Barriers to Implementation of Workplace Health Interventions: An Economic Perspective

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Objective: To identify insurance related, structural, and workplace cultural barriers to the implementation of effective preventive and upstream clinical interventions in the working age adult population. **Methods:** Analysis of avoided costs from perspective of health economics theory and from empiric observations from large studies; presentation of data from our own cost-plus model on integrating health promotion and ergonomics. **Results:** We identify key avoided costs issues as a misalignment of interests between employers, insurers, service institutions, and government. Conceptual limitations of neoclassical economics are attributable to work culture and supply-driven nature of health care. **Discussion:** Effective valuation of avoided costs is a necessary condition for redirecting allocations and incentives. Key content for valuation models is discussed.

This economic evaluation of disease prevention and upstream interventions administered at the workplace is intended to facilitate broader implementation of preventive initiatives and to encourage favorable health outcomes through the valuation of intervention effectiveness. The underlying premise is that modifications of chronic diseases are a function of individual behavior, amenable to interventions in the forum of the workplace but are also sociobiological consequences of work organization, work demand, compensation, and job security and mobility. Emphasizing the interplay of work life, home life, and individual risk reflects our own affiliation with the Center for Promoting Health in the New England Workplace, one of three National Work life Centers funded by the National Institute for Occupational Safety and Health.

This work life concept considers biological, socioeconomic, and psychosocial pathways of disease in combination. The content includes ergonomics and aging-associated musculoskeletal diseases, work organization and cardiovascular diseases, and work-family interactions and mental health. The accent on prevention and early chronic disease management (CDM) diverges from customary articulation of the working life concept in Northern Europe, where the emphasis has been on working conditions, protection of leave, and salary replacement for disease or pregnancy.[1]

Considerable evidence supports the effectiveness of prevention directed to working cohorts,[2] but the divorce of workforce oriented preventive initiatives from conventional group health insurance and financing attenuates available resources. There are nationally idiosyncratic problems of valuing and sustaining investment in preventive programs for working adults in the United States because of the bifurcation of the worker's compensation and group health systems. Insurance companies and the government, the main third party payers, often mediate between and monitor different stakeholders: patients, employers, individual physicians, large group practices, and hospitals. Third party payers have commanding roles in the misaligned incentives identified by critics of American health care.[3] Accordingly, resource allocation and depletion among adults in their workplaces is a special case of more general health care financing problems. The challenge is to create a viable systems-based incentives approach with an emphasis on the consolidating role of the workplace. Such an approach would use principles from traditional neoclassical and behavioral economics to facilitate participation and successful adoption of health interventions. This redirection of insurance reimbursement procedures includes public policies such as government tax credits and subsidies for prevention and Workplace Health Promotion (WHP) and broader facilitation of workplace organizational change to promote positive effects on health outcomes.

Three types of barriers to more effective and sustainable workplace interventions are as follows.

1. Misplaced allocations and incentives.
2. Organizational and cultural barriers to implementing efficient interventions.
3. Systemic flaws: supply-driven medical care versus demand-driven health.

Misplaced Allocations and Incentives: Problems With the Concepts of Return on Investment and Discounting

Defining the Issues

The primary barrier to implementing preventive and upstream interventions is the misaligned interests of individuals, employers, insurers, service institutions, and government. Consequently, avoided costs from effective workplace oriented prevention cannot be valued in a uniform way. We use avoided costs in the conventional sense, ie, health care costs that are avoided by an occupational safety and health (OSH), WHP, or CDM intervention. Conventional return on investment (ROI) analyses at the company level may characterize insufficiently structural conflicts that separate interests of individuals, firm, insurer, and state (public interest). Measuring cost from the appropriate stakeholder's perspective is a critical component for intervention-oriented economic evaluation.

The ROI Problem

Reported successful ROI models[4,5] for WHP and CDM appear to be insufficiently convincing for many companies, especially the smaller and midsized firms that may not be fully self-insured. Even larger companies exclude working conditions from the characterization of individualized risk in a manner that expunges the influence of economic security and work culture on health. Moreover, benefits from deferred chronic disease costs seem overstated, unless turnover is low, because cost savings would accrue to a subsequent employers or to the government, through lower Medicare costs. Using a standard business case or ROI analysis, these deferred disease costs vitiate favorably calculated benefit to cost ratios for WHP. If chronic disease avoided costs are subtracted, and calculated return is based on worker's compensa-

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tion claims incidence and costs or ephemeral productivity measures such as lost work time, major capital investments in workplace health are problematic. Furthermore, general trends in improved workplace safety and in process efficiencies have reduced historical occupational hazards. On simple a priori grounds, traditional ROI analysis that includes different stakeholders benefits in one equation, while useful from a societal perspective, is misleading from a company's perspective. For example, the effort to reduce hand injury in electronics assembly may produce a convincing ROI in terms medical costs from the perspective of the worker's compensation carrier or from the human resources department. From a production manager's perspective, the benefit is less convincing and may be better realized by automating out the employee or outsourcing the process.

Even where self-insurance and bargaining power affect some control, there are additional barriers. Employee diffidence reflects work life concomitants, such as pay and job insecurity, over direct workplace exposure. The worker's compensation carrier recognizes that CDM involves long-term investment, possible compensation for disability, and significant insurance tails. The cycle of worker's compensation insurance involves a highly discounted up front approach to ROI, although capacity for long-term cost sharing between carriers exists. When chronic disease prevention becomes the object of WHP, conceptualizing hazard reduction as an opportunity introduces less straightforward trade-offs. Future costs are routinely approximated through reserves and incidence requires quasi-public reporting and some enforcement, and diseases such as coronary heart disease (CHD) or hypertension exceed these worker's compensation parameters. In most manufacturing and service sectors, group health vastly outweighs worker's compensation utilization and costs, and a distribution of medical treatment obligations between group health and worker's compensation carriers for chronic diseases would impose large cost accelerators. Hence, the vigorous defense of carriers against work-related mental health, stress, or heart disease claims. The relationships and varied interests of key stakeholders are summarized in Table 1. This table is meant to elucidate why an alignment of interests is so difficult to realize under current conditions. Employers have to make large capital expenditures without capturing the full financial benefits, because most of the avoidable cost gains go to the third party payers. Premium is not necessarily adjusted that leads to price inelasticity of premiums. To mitigate these effects, the insurance reimbursements should be geared toward prevention and identify conditions for success, eg, participation. Employees face large occupational hazards, experience negative health outcomes, and are not always aware of the risks due to asymmetric information. They incur out of pocket expenses and wage loss.

Reimbursement for lifestyle changes and incentives to enhance the success of interventions may be required. The third party insurer (workers' compensation) who faces rising downstream payments for insured companies may navigate between the poles of increased workers compensation and more disciplined management of workplace risks through engineering interventions. When options require large investments, companies face the paradox of competing costs from safety investments or rising premium costs, and these may be resolved only temporarily by pursuing new vendors. Here, a reimbursement mechanism through cost sharing would offer an alternative. Because of their inability to control risks, group health insurers tend to shift financial risks to health care providers under fixed-payment reimbursement. Here, the use of outcomes analysis to reimburse utilization would help providers to couple medical services to results and deliver superior output.

In Fig. 1, the differing ROI perspectives of major interest groups and their potentially mismatched interests are presented using a demonstration disease, asthma. For employers, disease reduction through controls may not justify ROI if the employee changes employment. Figure 1 illustrates how benefits to an employer or an insurer based on a preventive ROI model can conflict with the capital investment initiatives of hospitals and large group practices whose influence may border on regional oligopoly. From a societal perspective, all significant costs and benefits flowing from health interventions share a common weight, regardless of interest group. However, the time horizons of employers and insurers do not coincide. Employers will often pose productivity gains against current prevention expenditures. The worker's compensation carrier's prevention effort is directed to avoiding disability costs that may extend longitudinally, whereas chronic disease can be stipulated. The guardian of long-term social costs, the federal government, is modestly engaged as a leveling stakeholder, but ROI analysis remains important because government can direct tax credits and subsidies for WHP interventions to companies if successful health outcomes elude market forces.

The Discounting Problem

Upstream interventions that engage the active workforce may also upend general assumptions on discounting. Cost discounting presumes that the value of a unit of consumption decreases over time both to individual and society. There are three well-known explanations: 1) individuals discount based on their future mortality; 2) individuals and society prefer not to delay consumption; and 3) marginal gains will decrease in the future due to increases in wealth. Even without aggregating individual and social discount rates, these presumptions are problematic.

The problems of discounting were recognized by Murray and Acharya[6] who argued against discounting health benefits, although not costs. Workplace health and safety programs may involve deep discounting, because benefits are expected to be frontloaded, and marginal gains are consistently devalued after "low hanging fruit" have been culled. Contrary to presumption, active members of the workforce cite deferred high function in later working life and retirement as justifying current interventions. The vigorous efforts of working age populations to defend retirement benefits; to balance income, child and elder care responsibilities; to maintain health benefits during retirement; and to participate in union and health and safety activities all indicate that descriptive terms like "myopia and egoism" poorly characterize behavior. Contrarily, managers may attenuate an original high-level investment when effective programs have realized decreased morbidity and costs. Discounting may be understated for managerial decisions but overstated for workforce decisions.

Application of discounting to interventions in working populations requires contextualizing the organizationally distinct and sometimes conflicting directions of group health, health and safety, and disability managers within the firm and with brokers, and account representatives outside of the firm. Both operating costs and insurance-related cost burdens are diversely segregated by firm sector and size, insurance product, and assumed risk. It makes little sense to regard avoided costs as an encumbered social benefit. Coercion, strategy, and fundamentally different values locate health issues beyond simple marginality and require extra-market considerations.

Organizational and Cultural Barriers to Implementing Efficient Interventions: Idiosyncrasies of Insurance, Chronic Disease Attribution, and the Measurement of Productivity

The Group Health Carrier and Incentivization

Group health carriers share an interest in outcomes research and in transferring costs to physicians and oligopolistic regional providers. Such information may reduce regional practice differences and capital intensive treatments without encouraging upstream prevention. Moreover, when insurers provide administrative services only, avoiding risk, there is little incentive to reduce capital

TABLE 1. Understanding Stakeholders Interests: Shifts in the Reimbursement of Prevention

	Employers	Employees	Insurer (WC)	Insurer (GH)	Hospitals, Laboratories, Capital Intensive Med	Primary Care Medicine	Government
Key barriers: workplace prevention	Large capital expenses	Occupational hazards	Limited work-site control	Shift risk to physicians	Decreased utilization	Loss on variable reimbursement payments	↑ Share healthcare costs
	Unrealized financial benefits	Negative health outcomes	↑ Premiums inhibit performance	Loss on fixed reimbursement payments	↓ procedure intensive TX	Incentive skew to treatment over prevention	
	Inelastic premiums	Inadequate interventions	↑ Claims costs		Funds transfer to community-based resources		
	Delayed benefit	Asymmetric hazard info			↑ Capital intensive screening and prevention		
	Limited productivity gains	Out of pocket wage and medical costs					
		↑ wage ¹ gain productivity					
Mechanisms for cost sharing	Reimburse intervention programs	Program reimbursement for lifestyle change	Introduce cost sharing mechanisms	Use outcomes analysis to reimburse utilization	Public health, safety, medical management practice stds	Programs to reimburse preventive practices	Direct investment prevention and promotion
	Identify and target conditions for intervention	Develop measures of effectiveness		Economic/econometric linking costs to outcomes	Shift from procedures to prevention	Enhance role of primary care physicians	Create outcomes and small area data bases for working population
				Translate risk reduction to rates			Reimbursement based on CUA or other outcomes models

WC, workers' compensation; TX, treatment.

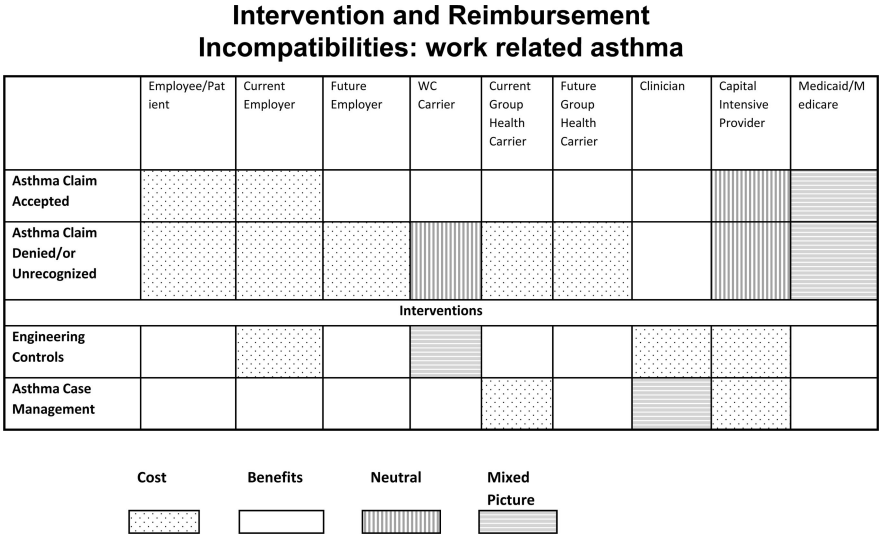

FIG. 1. Competing interests and cost allocation.

intensive medical practices. Because costs are generated at the clinical services level, and employers periodically bring their insurances to bid, a fixed reimbursement from the insurer for preventive services is potentially noncompetitive.[7] For hospitals and capital intensive specialized practice groups, investments in preventive programs represent potential cost challenges. Horizontally administered services and capital intensive therapeutics are potentially undermined by more participatory and "educational" approaches that engage different types of service personnel. Incentive realignment modestly influences primary care physicians, although potentially leading to more generous reimbursement. As insurer of last resort and ultimate insurer of the aging workforce, the government's role is complex. Deferring serious illnesses into later life may raise federal health costs, whereas lowering disability costs in younger individuals. The alignment of stakeholder interests based on outcomes research and well-structured cost-effectiveness analyses, perhaps, can proceed only within government programs. Furthermore, cost effectiveness analysis (CEA) assumes nonlinearity, ie, the benefit to cost ratio declines as the slope of the relationship is extended. In avoided costs interventions, assumptions of nonlinearity may be incorrect, because in working age populations, risks are distributed nonuniformly, unlike the classic health economics demonstrations for infectious diseases, where risks are individually uniform.

Relationship of the Workplace to Chronic Disease and Aging

Preventive intervention is encouraged by the aging workforce, increased recognition of links between work status and chronic diseases, particularly CHD, and recognition that health status affects performance.[8,9] An emerging literature links work conditions to individual health behaviors such as smoking, alcohol consumption, and exercise and energy balance.[10,11] Effective WHP programs are expected to address organizational conditions for their effect on individual behaviors.[12,13] This is a perspective that goes beyond the typical orientation of the group health insurer, where health promotion, if it exists at all, is limited to narrow individually centered interventions, such as weight loss and exercise, or compliance with drug regimens. The conditions of work are defaulted to company management.

Upstream worksite interventions suggest several considerations: 1) the continuous improvement ethos seen in product control may provide more successful adaptations than cost-driven downstream utilization; 2) attributing work-relatedness of chronic diseases is too often conjectural and conflict-driven; and 3) mechanisms are needed for translating improved health into cost reductions.

The Spectrum of Workplace-Related Diseases

That disease categories are not respectful of insurance delineations can be appreciated from Table 2. The example of asthma—a chronic disease that may be induced or aggravated by work, or may interfere with performance at work—illustrates the potential problems of misallocation of preventive resources. Although nerve entrapment disorders and shoulder disease are usually recognized by worker's compensation carriers, musculoskeletal conditions, such as sarcopenia, metabolic syndrome, and reduced metabolic efficiency are nemeses to the current health care reimbursement system. Work-related inputs such as job stress, sleep disorders, extended hours, and lack of recuperative time, or leisure exercise are addressable at the firm level through WHP but not within group health and worker's compensation plans. Finally, CDM may align with the workplace for managing existing disease and disease risk: workers congregate; they are accessible during prime hours; and health information can be centrally communicated. Some companies and health insurers offer CDM services, but mitigations include separation from the clinical health care system and confidentiality and quality considerations. There is, moreover, no simple mechanism exists for valuation on and reimbursement through the premium structure.

Individuation Versus Group or Participatory Activity

The conventional marginal utility approach of calculating distributive effects at the individual level appears limited, even obsolete, when adapted to working populations at the group level. Intervention research introduces the importance of participatory group consciousness and activity in effecting health risk reduction in communities[14] and in workplaces.[15,16] Egoism and altruism, applied to the avatar of "economic man," overlooks the important role of participatory organization in effecting workplace change and potential change in individual health behavior. The logic of calculating distributive effects at the individual level is dispersed by health self-efficacy research evidence that changes in health behavior in a single domain becomes generalized and that demands are likely to be collective or social not individual.[17]

There are historical and current alternatives to the individually based models for assessing working populations. The argument of "moral hazard" presumes that cost is driven at the individual

TABLE 2. The Spectrum of Work-Associated Disorders

Exposure Specific Disorders—Mixed or Etiology Specific		Chronic Conditions of Working Life		Conditions Suitable for Workplace Disease Management	
Disease	**Workplace Exposure**	**Condition**	**Workplace Intervention**	**Disease**	**Management**
Asthma	Intrinsic and multiple extrinsic agents	Hip and Knee Arthritis	Job design and age- adjusted work	Diabetes Mellitus	Glycemic and treatment monitoring
Bladder Cancer*	Dyes, ingested carcinogens	Obesity	Workplace design/diet and exercise	Colon cancer screening	Colonoscopy screening
CTS	Biomechanical factors, vibration	Metabolic syndrome	*See above* and disease management	Hypertension	Ambulatory and static BP monitoring
Chronic	Dusts and fumes, smoking	Sarcopenia	Job design and age- adjusted work	Mental illness	EAP services
Contact Dermatitis	Multiple irritants and sensitizers	Coronary heart disease	Organizational and workplace redesign	Skin cancer	Dermatologic screening
Hearing Loss	Noise, co-factors	Stroke	See above	Hyperlipidemia	Blood tests and health promotion
Parkinson's*	Heavy metals, host factors	Dysthymia/depression	Work organization and time flexibility	These interventions presume the usefulness of the workplace as a setting for disease screening and monitoring	
Low back pain	Biomechanical strain, host factors	Reduced cognitive performance	Work organization, noise-repetition control		
MCS	Multiple agents	Loss of trunk stability/coordination	Job design and age-adjusted work		
AML	Benzene, ionizing radiation	Rotator cuff/impingement	Conditioning, job redesign, retraining		
Lung Cancer	Smoking, radon, workplace carcinogens*	Entrapment Neuropathy	Diet and exercise, job redesign		
		Sleep disorders	Work organization		
		Soft tissue disorders	Job design and age- adjusted work		

*Rare disease or decreasing exposure risk.

level by an informed or irrational search for intensive life sustaining technology. However, for serious diseases, intensiveness and cost of care are often unrelated or inversely related to health outcomes.[18,19] Weinstein et al[20] have documented that the historical surgical pattern in Medicare regions, not morbidity, drive increased rates of spinal fusions and associated increases in discectomies and laminectomies. Effective workplace conservative programs featuring ergonomic job redesign and accommodation to chronic disability[21] seem to occur in a different universe.

Workers do not select expensive and ineffective treatments because of "gold-plated" benefits and "Cadillac plans." It is a misconstrued model that places decision-making and cost burden on the patient. The alternatives are not prevention versus intensive interventions. Reducing ineffective intensive interventions occur largely outside of effective prevention. Stated another way, we can assume counterfactual partial nulls.

Productivity and WHP

In an often articulated view, preventive health investment can be rationalized at the level of the firm through increased productivity.[22] The argument that more effectively utilized human capital comes from improved health status has sometimes lead to highlighting short-term gains in productivity, rather than longer term impacts on chronic disease reduction.[23,24] Cost-effectiveness information on OSH and WHP interventions feature inconsistent and/or noncomparable definitions of effectiveness.[25] Traditional measures of productivity—lost work time, medical and worker's compensation claims, unit output—are useful but approach health status and chronic disease indirectly. Effective valuation of avoided costs with respect to each stakeholder and appropriate measurement of productivity improvements in conjunction with appropriate public policies relating to insurance reimbursement and incentives for prevention (in terms of workplace tax credits and subsidies) are necessary conditions for redirecting allocations and incentives. Although measurement of productivity gain in the manufacturing sector is possible, there exists a critical gap in the measurement of service sector productivity and quality improvements.[26,27] Productivity arguments and the supposition that improved health status lowers medical costs are undercut by evidence that medical costs in this system of contesting interest groups have supply-driven escalators that operate independently of health status.

Still, many of the cost-effectiveness arguments for WHP seem to show advantages for program participants.[25] Chapman[5] performed meta-analysis on 42 epidemiological studies, combining 537,319 employees, averaging for 3.6 years follow-up. In 20 of the 42 studies, absenteeism decreased by an average of 30%. Health care costs decreased on average by 21.8%. Sixteen studies with cost benefit analyses reported positive ROI: every $1 spent returned $5.67—range, $3.40 to $7.88). Controlling selection and short-term efficacy are problematic; positive effects appear more modest when economic metrics, such as reduced group health costs, are weighed.

Systemic Flaws: Supply-Driven Medical Care Versus Demand-Driven Health

Discordance Between Improved Health and Reduced Health Care Costs

Arguments about misplaced incentives are illustrated by CHD where there are recognized effective preventive interventions: dietary change, exercise, control of blood pressure, and lipids.[28] The Framingham study confirms a significant long-term downward trend in CHD mortality.[29] Nevertheless, during the past two decades, the growth of invasive procedures has been geometric, despite limited evidence for improved survival.[30] Ryan et al[31] documented how substitution for surgery by less costly stenting escalated health care costs due to volume appreciation.

In a supply-driven system, a concave demand curve would be anticipated. The output of procedures should be reduced under conditions of imperfect competition, even accepting that there are regional health care oligopolies, hospitals, and medical groups, sustained by insurers. Almost the opposite has occurred, with growth in invasive procedures and extensive regional variations unsupported by outcomes evidence.[32] If utilization is detached from clinical severity or demand, any resource reallocation resulting from effective upstream workplace interventions is unlikely to reduce costs, and a preventive infrastructure has built-in competitive disadvantages. This conflict is unlikely to be resolved by mutual efforts limited to employees and labor organizations, business groups, and worker's compensation carriers.

The valuation problem has additional workplace ramifications that include productivity measures and time allocation for staff indirectly providing preventive health care. Valuing avoided costs from successful interventions is essential for determining ROI but is insufficient to control costs under current conditions. It is necessary but not sufficient for successful work life interventions.

Future Research Directions for Valuing Avoided Costs

Some comprehensive multicomponent health promotion programs and other relevant wellness interventions have produced positive health and financial outcomes, particularly for comprehensive multilevel interventions.[5,25,33–35] As noted, improved methods for determining ROI/cost effectiveness (CE) are required. The current paucity of "accurate" data on intervention effectiveness, outcome variables and assumptions, differences in study designs, and intervention costs complicate interstudy comparisons and hinder development of standardized methods for appropriate ROI or CE models.[35,36]

The workplace is not a homogenous entity. Differences between large and small and medium-sized enterprises that employ 50% of the working population and between sectors must be addressed in any research design and analysis of interventions. Economic evaluation models require specification to these size and sector characteristics, as well as to workplace culture.

Particularization of cost evaluation to each stakeholder is a critical step in an economic evaluative for aligning incentives. Table 3 delineates some alternative cost estimates for each stakeholder.[35,36] This choice model necessarily reduces to several key questions:

Who is affected?
On whose behalf decisions are made?
Whose health would gain and who would be paying for it?

The answers determine relevant health outcomes, allocated resources, and measurement tools. Economic characterization of intervention effectiveness requires tracking several major outcomes groups.

These include:

Health outcomes: intermediate endpoints such as biomarkers, case-defined incidence reduction, and modulation of severity or disease natural history accounting.
Economic outcomes: productivity losses; absenteeism and diminished performance, productivity improvements; turnover rates; labor replacement costs.
Insurance impacts: group health care costs, workers compensation medical and indemnity costs, and disability payments.
Time profile of disease costs: immediate versus lagged effects.

Identifying mitigations that effectively align incentives to different stakeholders requires a determination of impacts, beneficial as well as adverse, on each of the stakeholders, further stratified by the type of intervention. Mitigations include insurance reim-

TABLE 3. Cost Perspective

Employer Cost	Employee Cost	WC Insurer Costs	GH Insurer Costs	Disability Insurer Costs	Government Costs	Social Costs
Equipment and labor costs for interventions	Out of pocket costs	Medical claims (nonindemnity)	Insured medical care	Short and long-term claims costs	Medicare and Medicaid	Above costs excluding double counting and transfer payments (taxes and subsidies)
Changes in productivity	Uncompensated lost work time	Lost work time claims (indemnity)				
Absenteeism and ↓ health related performance	Opportunity cost of care giver					
Employee turnover	Return to work conflicts					
WC claims (self-insured)						
GH costs (self-insured)						
Short and long-term disability (self insured)						
Premiums to insurer (not self-insured)						
Tax incentives for capital purchases						

WC, workers' compensation.

bursement procedures, and government WHP tax credits or subsidies to employers. A valuation model must algorithmically create a pay-off matrix for all stakeholders for each intervention. Absence of such constructs undermines statutory prevention efforts based on health insurance, either in wellness or upstream administrative articulation.

From the employer's perspective, policy making requires ROI or cost-benefit ratios that convert outcome variables into monetary units. From a societal, governmental, or insurance company perspective, CEA or cost utility analysis is the relevant measure for resource allocation.[37–39] Metrics coming from these approaches would help prioritize allocation of systematically scarce resources for prevention and WHP. The ROI business model may not work for very small firms and for OSH interventions that do not significantly enhance productivity. Changing workplace practices that improve OSH will require legislation, perhaps as government subsidy to smaller firms. The types of productivity growth expected in some nonmanufacturing sectors may also vitiate the argument for direct investment in OSH.

To effectively tailor interventions, economic and noneconomic variables that explain efficacy variation from interventions require analysis and granular data tracking at the individual level. Introduction and refinement of a surveillance component at the facility level presupposes relevant outcome and economic data collection.

This type of facility-oriented surveillance is an implicit aim of National Institute for Occupational Safety and Health's National Work life Initiative. In a Center for Promoting Health in the New England Workplace intervention research study of nursing homes, a net-cost model was applied to a series of WHP and OSH interventions[40] A key ergonomic intervention was a no-lift program (NLP). Economic analysis was used to supply valuation of efficacy to several important intervention components. The goal was to identify program features and organizational and management changes, deemed essential for improving outcomes. Some conventional WHP activities seemed to enhance injury and disease reduction components of the NLP. Despite site variability, net savings from the NLP intervention were greater when the NLP and WHP were combined.[40] Because the NLP intervention entails capital investment with organizational and training elements, adding more individualized WHP involves a different type of cost, whose inclusion is central to valuing intervention effectiveness. Both the microlevel basis for a "business case model" for OSH interventions and the macrolevel basis for reducing health care costs and improving prevention are served by recognizing appropriate organizational determinants and employee characteristics.

Steering people toward more effective choices (eg, increasing participation rate) shares natural affinities with behavioral economics. Aligning incentives for different stakeholders by getting "prices right" follows the reasoning of neoclassical economics, the presumption being that markets efficiently allocate resources without government interventions, and that consumers make utility maximizing rational (appropriate) choices. Without resort to dynamic or instability contingencies, neoclassical models fail to account sufficiently for cost and performance in the health care sector. Choice and transparency, alone, will not sufficiently empower the public. Behavioral economics challenges the assumption of rationality and supplements the traditional financial incentives of "prices" with principles from behavioral sciences.[41] Thaler and Sunstein, the authors of "Nudge," describe how people can be gently maneuvered into doing the right thing by organizing decision context through services of "Choice architects."[41] Small, seemingly insignificant detail can impact individual behaviors. Because, there are systematic biases in patterns of thinking, targeting those biases can enhance intervention effectiveness.

Limited data on intervention effectiveness and costs for WHP and CDM programs not only hinders prevention but also solicits interdisciplinary collaborative interventions that integrate economics research with prospective studies at company or institutional levels. The steps include

1. Develop a model in a structured format based on a systems approach with appropriate study design to ensure internal validity.
2. Enumerate the variables and drivers or functions of effectiveness (eg, participation rates).
3. Induce behavioral change with respect to the different stakeholders, based on the principles of consumer economics/behavioral economics, health economics, industrial organization, etc.

Summary: A Call for Interdisciplinary Research Collaboration

The demand for evidence-based outcomes from workplace prevention and upstream health interventions invites rigorous research and an appropriate framework. Intervention and outcomes research will be insufficient, if divorced from valuation mechanisms, and if structural barriers are not dismantled. The reallocation of current incentives cannot be accomplished without imposition on insurers and public payer prerogatives. Resolution at the firm level is unfeasible. Without alterations in tax and tax credit structures, sufficient capital investment in work design is improbable. Although insurers may impose some expectations for workforce health in the fully or partially insured firm, their approach is contingent and excludes the largest corporations that often set trends and dominate consensus business health groups. Moreover, implications for hospitals and capital intensive group practices are adverse: disease reduction would put upward pressures on unit costs. The federal government, large health systems, or large purchasing groups could alter these relationships but not in the current environment. Direct investment by employers in long-term maintenance of workforce and chronic disease prevention is essential but not sufficient. For now, the linking of intervention research with valuation models seems a necessary precondition for fundamental resource reallocation.

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