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Integrating Occupational Health Services and Occupational Prevention Services

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Background *Despite the human and monetary costs of occupational injury and illness, occupational health care has focused more on treatment than prevention, and prevention is not part of many clinical occupational health practices. This represents a failure of occupational health care to meet the health care needs of the working patients.*
Methods *MEDLINE searches were conducted for literature on occupational medical treatment and the prevention of occupational injury and illness were reviewed to for linkages between prevention and treatment. Policy discussions which identify examples of programs that integrated prevention and treatment were included.*
Results *Although examples of the integration of clinical and preventive occupational health services exist, there are challenges and barriers to such integration. These include inaction by clinicians who do not recognize their potential role in prevention; the absence of a relationship between the clinician and an employer willing to participate in prevention; economic disincentives against prevention; and the absence of tools that evaluate clinicians on their performance in prevention.*
Conclusions *Research is needed to improve and promote clinical occupational health preventive services.* Am. J. Ind. Med. 40:307–318, 2001. © *2001 Wiley-Liss, Inc*

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INTRODUCTION

Occupational injuries and illnesses arise from unsafe conditions or activities in the work environment; they are usually preventable. In general medical care, the health care provider typically advises patients about ways to reduce health risks such as diet or smoking. Similarly, the occupational medical provider has a role in addressing workplace risks. Indeed, the role of occupational medicine includes the recognition, assessment, and control of occupational hazards in the workplace in order to prevent injury and illness, as well as the treatment of injured or ill workers [Accreditation Council for Graduate Medical Education, 1996]. Despite the human and monetary costs of occupational injury, occupational health care has focused more on treatment than prevention. Although early legislation enacting workers' compensation systems explicitly linked prevention and the compensation system, occupational health and safety and workers' compensation have evolved into segregated sectors [Shor, 1995]. Spieler [1994] discusses the many ways in which the current workers' compensation paradigm may perpetuate risk rather than promote prevention. The no-fault system contributes to a belief that the root cause of workers' compensation claims lies outside of employer control; individual employee behavior is often viewed as a primary cause of increased costs and becomes a focus of cost-containment activity. Externalization of costs, pricing mechanisms, and risk

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spreading within workers' compensation dilute the deterrent effects of high costs [Spieler, 1994].

Additionally, there has been a functional separation and cultural divergence between the medical and public health sectors in general. The dominance of the biomedical paradigm has focused resources and physicians on individually-oriented fee-for-service curative medical services in the clinical environment [Lasker, 1997]. This limits the focus of medical care to curative actions performed in the clinic, contributing to the separation between workplace-based prevention and clinical care.

Recently, the ageing of the workforce, the emerging prevalence of cumulative injuries in workers' compensation, changes in the workers' compensation market, and the expanded role of managed care in workers' compensation have created new interest in the re-integration of prevention and treatment in occupational medicine. We briefly review basic aspects of prevention, summarize recent efforts to integrate prevention and clinical medical services in occupational and non-occupational health care, identify challenges to integrating prevention services with occupational medical care, and propose areas of research for enhancing that integration.

PREVENTION IN OCCUPATIONAL HEALTH

Prevention in occupational health can be characterized as primary, secondary, or tertiary. Primary prevention seeks to minimize exposure to workplace hazards that cause occupational injury or illness, requiring four basic components [Weeks et al., 1991]:

1. surveillance of exposures and of injuries or diseases;
2. analysis of surveillance data to assess risk and identify patterns which suggest the need for investigation or intervention;
3. control of workplace hazards and minimizing exposure through appropriate engineering controls; and
4. identification of individual workers with health conditions which place the worker or co-workers at substantial risk in a particular work environment.

Surveillance of exposures is accomplished through industrial hygiene and safety inspections to assess workplace hazards and the effectiveness of control measures. Examples of primary prevention strategies include guardrails to prevent fall injuries, or ventilation control of toxic gases. These primary prevention strategies in occupational health will be enacted in the workplace rather than the health clinic. The others, surveillance of injuries and identification of workers with predisposing conditions, may be conducted in an administrative office or clinic, respectively, but require collaboration with the workplace to act on the information.

Primary prevention failures require secondary and/or tertiary prevention efforts. Secondary prevention is the early detection of disease with interventions to reverse, prevent, or slow disease progression. An example is a workplace program to monitor blood lead levels. Tertiary prevention attempts to minimize the effects of injury or illness on the individual through education, rehabilitation, or accommodation. An example is disability management, which uses medical care, physical and occupational rehabilitation, job accommodation, and other strategies to prevent chronic disability and return the employee to the highest level of work possible [Shrey, 2000].

Cases of occupational illness or injury indicate failures of primary preventive measures [Rutstein et al., 1983; Matte et al., 1989]. Such cases, whether identified for secondary or tertiary prevention should stimulate efforts to correct the workplace exposure (primary prevention). For example, a worker needing chelation for lead poisoning also signals the need to reduce workplace lead exposures. For this reason, the three levels of occupational health prevention should be coordinated. Unfortunately, barriers often prevent the desired interaction.

One barrier is the failure to recognize the association between a worker's ailment and the exposure that caused it. This is more often true of diseases, especially chronic diseases which may be recognized years after the exposure. Without that association, the case is less likely to trigger implementation of workplace exposure controls.

Another barrier is the worker's lack of influence on workplace preventive measures. In general health, individuals make their own choices regarding prevention of illness due to lifestyle risk factors such as diet and exercise. In the workplace, in contrast, management has the greatest ability to control of workplace hazards. Workers lack the control over workplace exposures that they do over lifestyle risks.

A third barrier is the administrative and geographical separation between the workplace and the clinic. For most work-related injuries and illnesses, occupational prevention services cannot be effectively provided without attention to workplace risk factors. This can only be overcome by close working relationships between occupational health services providers and the workplace.

In occupational medicine, clinical treatment alone is often an inadequate response to disease. Wrist splints without control of workplace ergonomics simply invite recurrence of wrist pain. Thus, effective occupational preventive services require attention not only to the individual but also to the workplace and those responsible for workplace safety. Implementation of environmental preventive strategies rests with the employer, who holds the legal responsibility to furnish employment ''free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees'' [Occupational Safety and Health Act, 1980].

The American College of Occupational and Environmental Medicine's Code of Ethical Conduct recognizes distinct obligations of the occupational physician with reference to prevention [Teichman and Webster, 1994]. Although there has been some criticism of the weakness of the Code's prevention provisions [Brodkin et al., 1998], the ACOEM code calls for the physician to:

> "...accord the highest priority to the health and safety of individuals in both the workplace and the environment. The work environment—and its effect on humans–must be a major concern of occupational medicine professional."
>
> "...strive to acquire and maintain adequate knowledge and expertise upon which to render professional service. This requires the physician to be knowledgeable about the nature of the work and worksite."
>
> "... communicate to individuals and/or groups any significant observations and recommendations concerning their health and safety." Occupational physicians have an obligation to report observations about the health status of individuals or groups, associated risks, and appropriate recommendations [ACOEM Committee on Ethical Practice in Occupational Medicine, 1995].

The health care provider thus is expected to play several important roles in the prevention of occupational injury and illness:

1. recognition of work-related disease or risk factors, which can lead to initiation of prevention activities.
2. education of workers and employers about occupational illness, workplace exposures, and preventive measures.
3. advocacy for the patient, who may lack the knowledge or power to press for needed prevention activities.
4. recommendation of health and safety activities and additional resources to the employer.
5. identification of workers at higher risk and provision of screening to detect early or sub-clinical disease.
6. provision of tertiary prevention services to minimize disability arising from occupational injury.

EXAMPLES OF INTEGRATION OF PREVENTIVE AND CLINICAL SERVICES

Hulscher et al. [1999] recently reviewed efforts to better integrate preventive services into clinical practice in non-occupational health care. The interventions were categorized as professional (information transfer, learning through social influence, feedback, reminders), organizational, financial, or regulatory [Hulscher et al., 1999]. Strategies to improve delivery of preventive care in the general health sector include: health education materials for patients and providers; reminders to patients about the need for preventive services; reminders to providers in chart notes or computerized records; tracking systems; performance feedback to providers; financial incentives; use of additional staff (other than physicians) to provide information; standardized office procedures; and contract specifications to incorporate prevention services [Yano et al., 1995; Heiser and St Peter, 1997; CDC, 1997; Baker et al., 1998; Mandelson and Thompson, 1998; McAfee et al., 1998; Miller et al., 1998].

One challenge is to change physician practice behavior. There is increasing evidence that, in general, continuing medical education is not effective in changing physician practice [Davis et al., 1995; Oxman et al., 1995]. More effective strategies to change physician practice styles are multi-faceted, require organizational resources and planning, have good systems for collecting and using data, and include a monitoring and evaluation component.

Some managed care organizations have provided training and assistance to primary care clinics to develop prevention systems in the general health care sector. In one such effort, clinics that received training were found to be twice as likely to implement systems to ensure delivery of preventive services [Solberg et al., 1998]. Other successful managed care prevention projects are community based, including collaborative population health improvement efforts with public health agencies [CDC-MMWR, 1995; Molliconi and Zink, 1997].

Unfortunately, there are few similar examples of the integration of clinical and preventive services in occupational health and no rigorous evaluations of efforts to improve delivery of prevention services. There is, however, limited anecdotal evidence that occupational medicine providers are expanding their offerings of prevention services. Two surveys of managed care companies offering workers' compensation products found that over 60% of them claimed to offer some prevention services, including safety inspections, trend tracking, education programs, and employer financial incentives for safety [Dembe et al., 1998].

Additionally, there are several published reports of successful integration of clinical and preventive services in occupational health. At a New York union-supported clinic, direct clinical care is integrated with worker and employer education, screening for early disease, and workplace hazard abatement. A health and safety specialist coordinates education and prevention efforts, and every case of occupational disease is treated as a potential sentinel health event. Successful workplace follow-up of index cases of

rotator cuff tendonitis, lead poisoning, and formaldehyde overexposure has been documented; the authors estimate that follow-up of just three cases affected 150 workers [Herbert et al., 1997].

Another example of an effort to integrate prevention and clinical treatment is the publicly funded New York State Occupational Health Clinics Network, which uses an interdisciplinary staff with a public health orientation [Herbert et al., 2000]. Clinic staff perform prevention activities including evaluation of coworkers of clinic patients, recommendations for feasible workplace interventions, and workplace education about specific hazards.

A comprehensive safety and managed care initiative at a large self-insured medical center reported a dramatic 50% reduction in workers' compensation costs [Green-McKenzie et al., 1998]. The program featured on-site case management, a preferred provider network, and proactive safety and ergonomic programs to abate workplace hazards. The occupational physician/nurse case management team coordinated the entire process including prevention and facilitated return to work. Over two years lost-time cases fell from 22 per 1000 employees to 12–14 per 1000 employees [McGrail et al., 1995; Bernacki and Tsai, 1996]. Another program of prompt assessment, treatment, and modified work, an example of secondary and tertiary prevention linking to primary prevention, demonstrated a 23% reduction in hospital worker back injuries [Yassi et al., 1995].

Staff at Kaiser Northwest reported a comprehensive occupational medicine program that includes the different levels of prevention. A nurse-physician case-management team, trained in worksite assessment, is assigned to every contracted employer. The team communicates with risk management, safety, and human resources personnel, conducts worksite visits to identify prevention opportunities, reviews modified work policies and collects job descriptions to facilitate return to work. Primary prevention efforts include identification of risk factors and education of employers and workers. Kaiser has also developed aggressive programs to provide vaccinations at high-risk worksites. Secondary prevention is implemented through programs for early detection and screening, and trend analysis. Employers receive standardized reports on cases and trends, facilitating discussion regarding prevention opportunities. In order to improve tertiary prevention, the return-to-work experience of each physician is tracked and physicians receive counseling regarding disability prevention. Over a 4-year period, this program showed statistically significant decreases in lost work time for low back cases (from 17.8 to 15 days per case) and total claims cost reduction of 33% [Feldstein et al., 1998].

The Washington State Managed Care Pilot Project evaluation showed a significant reduction (21.5%) in medical costs in the pilot firms [Cheadle et al., 1999]. The pilot emphasized a model of care similar to the Kaiser model [Sparks and Feldstein, 1997]. Health care providers have also been used as educators in prevention efforts [Daltroy et al., 1997].

Several reports document methods for effectively using existing medical and workers' compensation data to target prevention efforts. In Alberta, high workers' compensation rates in certain industrial sectors led to an initiative which included employer-funded industry-specific safety associations and financial incentives for improved safety; five year injury rates showed significant improvement [Guidotti, 1998]. In Washington State, workers' compensation claims for skin disease were analyzed in order to identify industries with the highest risk. Additional information on cutaneous hazards was sought from employers in the highest categories. Although this report did not describe an intervention component, the workers' compensation data could be used to target prevention efforts [Kaufman et al., 1998]. The employee health service of a large hospital combined injury data from the hospital safety office's OSHA 200 log, cost data from the workers' compensation database, and data on hours worked from the hospital's personnel and payroll. These data were used to create summary statistics that compared work areas by injury rate and cost, providing indicators that could be used to target preventive intervention efforts [Jarrard et al., 1997].

Managed Care and Preventive Services

Managed care organizations (MCOs) increasingly are providing workers' compensation care [Eccleston and Victor, 1998]. The experience of preventive health care provided by managed care organizations in general health is extensive, and is reviewed here to provide perspectives on MCOs' potential role in prevention in occupational health.

MCOs often emphasize their commitment to prevention in general health care, and there is some evidence that managed care enrollees receive more preventive services than those in traditional indemnity plans [Miller and Luft, 1997; Potosky et al., 1998]. There is also evidence that receiving care from a group (versus IPA) model HMO and good continuity of care significantly increases the likelihood of receiving secondary prevention services in general health care [Gordon et al., 1998].

Some public health experts believe that organized delivery systems offer important opportunities for expanding prevention services and improving community health through increased focus on population health, improved information systems, and accountability for performance [Shortell et al., 1994; CDC-MMWR, 1995]. Public health experts have identified several characteristics of group health managed care organizations that may enhance the delivery of primary and clinical preventive services [Baker et al., 1994].

MCOs are responsible for a defined population. They are likely to have data systems useful for surveillance, monitoring, and research within a population of enrollees. They are accountable to purchasers and regulatory agencies for outcomes, which may include prevention outcomes. MCOs may have economic incentives to encourage prevention, and frequently include preventive services in quality measurement systems. Additionally, many MCOs support ancillary staff (e.g., health educators, nurse case managers) who may provide prevention services that busy physicians can not, including counseling, and the facilitation of referrals for social support services [Baker et al., 1994; Smith, 1998; Solberg et al., 1998]. Technical and administrative support, epidemiological analysis, or professional training may also be more readily available in the managed care setting.

Although favorable provider attitudes toward prevention may be helpful, it appears that preventive services rates are most effectively improved by shaping the clinical environment in which clinicians work [Solberg et al., 1997]. Putting prevention into practice is difficult and organizations must both enable and reinforce key members of the prevention team. The organizational infrastructure must provide adequate resources and skills for prevention activities, and reinforce the value of prevention [Thompson et al., 1996]. Several organizational characteristics of MCOs which may facilitate optimal prevention performance have been described: population health objectives should be delineated and linked to responsibilities and performance measurement; information systems should support outcomes evaluation and population health assessment; provider and patient prevention education resources should be available; and financial incentives and performance measures must be aligned with prevention objectives [Welton et al., 1997].

This experience in MCO general health care suggests MCO characteristics that facilitate preventive health care and will likely be relevant to the improved delivery of occupational health preventive services (OHPS). These include: improved information systems which enhance surveillance, identification, and monitoring of high risk workers; financial arrangements with incentives for prevention services (for both employer and provider); increased case management, education, and counseling staff; increased access to occupational medicine expertise and health and safety expertise; and performance measurement/quality improvement processes which incorporate OHPS.

These basic strategies for improved prevention services may also be used by smaller group practices [Weiss, 1998]. In occupational medicine, insurers and employers may also play a key role in developing the organizational support structures for improved preventive services delivery. For example, existing software for use by employers allows collection of workplace health information for surveillance and risk detection [Maizlish, 1997].

CHALLENGES IN THE PROVISION OF PREVENTIVE SERVICES

Unfortunately, preventive services in general health care continue to be underutilized and physicians perform clinical preventive services less frequently than published guidelines recommend [Schauffler and Rodriguez, 1993; Ahmed and Thompson, 1998; Thrall et al., 1998]. One reason is lack of insurance coverage for preventive care; the services most likely to be covered are cancer screening and immunization, not counseling and education [Schauffler and Rodriguez, 1993]. Similar barriers exist to the delivery of occupational health preventive services. Employers are required to pay only for services specifically required by OSHA. Workers' compensation only covers costs related to injury once it has occurred, while most group health policies specifically exclude payment for services related to work-related illness. The impact of coverage gaps on OHPS delivery is unknown.

Preventive services may not be sought when needed, due to lack of awareness, fear of the results, or lack of time [Schauffler and Rodriguez, 1993]. In occupational health, many workers and employers remain ignorant of workplace hazards or appropriate prevention. Some employers fear that screening and education will increase the incidence of workers' compensation claims, although a prospective cohort study demonstrated no increase claims incidence after a screening and education program on musculoskeletal pain [Melhorn, 1999]. Some employers also fear that being informed about sentinel events may make them more vulnerable to citation for a willful violation if they fail to act on the information.

Employers may not provide education or screening legally required by OSHA, which could identify workplaces and workers in need of additional preventive services. In one study, employer self-reporting indicated few potentially lead-exposed workers had participated in monitoring; less than 3% of facilities had environmental or biological monitoring programs [Rudolph et al., 1990]. Government agencies may lack data that could be used to effectively target consultative or enforcement-based OHPS for other reasons (e.g., under-reporting of occupational illness by employers in the BLS survey) [Windau et al., 1991].

Even physicians may not recognize the need for OHPS. Physicians who are not trained to recognize occupational disease may overlook occupational etiologies of disease [Landrigan and Baker, 1991]. In a recent study of asthma in HMO members, 21% of new-onset or reactivated asthma cases had evidence for an occupational cause, but none were formally diagnosed as occupational asthma or reported as workers' compensation cases [Milton et al., 1998]. This

problem has proved difficult to remedy. For example, the use of a structured Occupational Intake questionnaire for family practitioners did not significantly improve the recognition of work-related disorders [Thompson et al., 2000]. If physicians do not recognize that a disease is caused by work, they cannot participate in its prevention.

Treating physicians often fail to appropriately report occupational injuries and illnesses, even when recognized and reporting is legally required. In one California survey, physicians reported that they had treated over 3,400 cases of work-related carpal tunnel syndrome in a given year, although only 71 cases had been reported through California's mandatory physician report of occupational injury [Cummings et al., 1989]. In a related study, less than a third of workers with diagnosed work-related carpal tunnel syndrome filed workers' compensation claims [Maizlish et al., 1995]. The unreported cases are lost opportunities to identify the need to reduce exposures in those workplaces and thereby prevent cases in other workers.

The acute care orientation of medical practice may create barriers to the effective delivery of preventive services in clinical settings: prioritization of medical problems on the basis of urgency; a problem-oriented medical record without an occupational history or documentation of prevention needs; lack of consensus guidelines (or in some cases conflicting guidelines); and lack of method for identifying individuals who should be targeted for specific services [Mandelson and Thompson, 1998]. Physician time pressures may also hinder effective delivery of preventive services, if, for example, financial productivity incentives lead physicians to see more patients and therefore spend less time on prevention [Wee et al., 2001].

Much of the initial care for occupational injuries is provided by physicians without training or certification in occupational medicine (e.g., orthopedists, chiropractors, emergency medicine specialists). They often lack expertise in the identification of job risk factors or risk reduction, and are unfamiliar with a population-based approach to health [Division on Health Promotion and Disease Prevention, 1988]. As a result, they focus on caring for the injured worker but do not make the link to preventing similar injuries among others at the same workplace.

Treating physicians need information about prevention [Weingarten, 1999]. The recently published ACOEM treatment guidelines incorporate prevention recommendations [Harris, 1998], but many State workers' compensation agency, specialty society, and commercially available treatment guidelines for occupational injuries fail to do so. Technological advances may increase opportunities to inform treating physicians about prevention; a computer-based medical record could include prompts to help the clinician identify occupational risks, flag occupational sentinel health events, and identify occupation-specific clinical prevention strategies. Prevention guidelines in other medical disciplines, coupled with efforts to promote them to physicians and remind them during their patient encounters, have influenced physicians to increase their use of recommended prevention strategies in areas such as perinatal HIV transmission and intrapartum Group B streptococcal disease [Hulscher et al., 2001; Wortley et al., 2001]. Similar strategies could be used to promote prevention in clinical occupational medicine.

Under-Developed Provider Relationships With Employers and Claims Administrators

Effective OHPS delivery requires a working relationship with the employer. Occupational medicine physicians often have difficulty getting exposure information, job duty descriptions, or information about the availability of modified work. Employers play a primary role in the mitigation of workplace risk factors, without which clinician efforts may fail (e.g., an employer's refusal to provide modified work may thwart a provider's tertiary prevention plans). The provider who fears losing customers in a highly competitive environment may hesitate to push an employer on prevention issues. Claims administrators or employers, often focused on short-term costs, may not welcome provider recommendations for preventive services. In a competitive environment, providers may hesitate to push clients on prevention issues. Ironically, these tensions may reinforce the patient's concerns about whether the allegiance of the occupational medicine provider is to the patient or of the employer. Patient concerns may be compounded by recent fears about managed care [Feldman et al., 1998].

Lack of Economic Incentives for Prevention

The proper alignment of provider and employer economic incentives to encourage prevention services is critical. CPT codes exist for preventive services, but obtaining reimbursement for these services may be difficult. Counseling is least likely to be covered by insurance companies [Parkinson, 1996]. Occupational physicians are frequently not reimbursed for worksite visits, time coordinating modified work, or counseling workers or employers about worksite risks. Without greater equity in payment for preventive and curative services, significant improvement in preventive services delivery is unlikely [Gellert and Dillenberg, 1993].

New reimbursement structures, such as capitation, may create incentives for providing preventive services because the provider picks up the costs of medical treatment if prevention efforts fail [Rosnick, 1998]. However, these incentives work best for those preventive services with a

short lead-time between prevention failure and medical cost impact (e.g., pre-natal care). There may be less interest in providing preventive interventions where the benefits accrue after decades [Schauffler and Rodriguez, 1996]. Thus, in OHPS, the economic incentives of capitation may promote more interest in preventing acute conditions such as traumatic injury than in preventing occupational illnesses from chronic exposures.

Some purchasers of workers' compensation care have developed contracts with MCOs that stipulate specific provisions for care, including the delivery of certain prevention services [Dembe et al., 1998]. However, these services should be evaluated based on performance measures that include processes and outcomes. Performance measures based upon return to work, for example, should assess sustained return to work and incorporate assessment of clinical and functional outcomes, lest they otherwise encourage overly aggressive return-to-work and risk poor healing or injury aggravation. Careful evaluation of ''prevention incentives'' is thus warranted.

Improved OHPS may require increased employer incentives, whether financial or legal. For example, one study showed that fall injury rates might decrease significantly if more employers received OSHA inspections, which would serve as an incentive to implement primary preventive services [Nelson et al., 1997]. Some MCOs provide discounts to employers with return-to-work programs. Further research is needed regarding the efficacy financial incentives in improving delivery of OHPS.

One study has found a significant association between patient satisfaction and preventive services, and another has evaluated the correlation between preventive services and financial performance [Weingarten et al., 1995; Born and Geckler, 1998]. Analogous studies could be of value in encouraging improvement in the delivery of OHPS.

Lack of Evaluation Tools

If the delivery of preventive health services is encouraged, evaluation criteria are needed to judge whether, or how well, those services are provided. In general health care, the National Council on Quality Assurance created the Health Employer Data Information System (HEDIS) to allow purchasers to assess managed care organization performance [Committee on Performance Measurement, 1997]. HEDIS includes measures of clinical preventive services. Standardized performance measures allow assessment of preventive services delivery to various populations across employers and providers. They can be the basis for internal quality improvement measures or for healthcare purchasing decisions.

In contrast, there are currently no agreed upon methodologies for measuring performance in the delivery of OHPS. The Association for Accreditation of Health Care (AAHC/URAC) has proposed a set of performance measures for workers' compensation medical care that includes several measures of OHPS. U.S. Department of Health and Human Services occupational disease prevention objectives could also be used as standardized outcome measures [U.S. Department of Health and Human Services, 1991].

Risk adjustment is critically important in constructing performance measures for preventive services, and in implementing financial incentives based on those measures. Risk adjustment reduces the effects of confounding factors (e.g., pre-injury health status, patient demographics) that are causally related to outcomes in assessing the effectiveness of health services [Iezzoni, 1994]. Performance measures must adjust for factors which influence outcome but over which the entity being evaluated has little control. Severity of injury, for example, impacts disability prognosis; risk adjustment for severity of injury is key in any evaluation of tertiary prevention services. However, there are no widely accepted methods for severity adjustment for musculoskeletal injuries that are of primary interest in workers' compensation. Further methodological development of risk adjustment is a critical adjunct to the expansion of performance measurement in workers' compensation health care.

Given the primacy of the employer in worksite based prevention, the evaluation of health care providers' preventive services must also take into account the employers and workplaces for whom preventive services are being provided. Capturing the information on employer practices which impact prevention efforts may prove difficult. But failure to adequately ''risk adjust'' for employer and employment factors could create perverse incentives for providers and MCOs, similar to adverse selection incentives described in the health care literature [Schauffler and Chapman, 1996].

A RESEARCH AGENDA FOR OCCUPATIONAL HEALTH PREVENTIVE SERVICES

Clearly, there are significant gaps in our knowledge about occupational health preventive services (OHPS), and research could help improve both the delivery and effectiveness of these services. McGinnis defines prevention research as ''research designed to yield results that are directly applicable to impeding the occurrence, or progression from an asymptomatic stage, of disease, injury, or impairment, or to promoting an enhanced level of function and sense of well-being'' [McGinnis, 1994]. He includes etiologic research, intervention research, and methodological research to improve measurement of health status and data and information management. All these areas are ripe for occupational health prevention services research.

In OHPS, research is needed in the following broad areas (examples are illustrative only).

Prevalence, Distribution, and Trends in the Delivery of Preventive Services in Occupational Health

What proportion of workers who should receive specified OHPS actually receive them? How often are OSHA-mandated services such as medical surveillance provided, and how well? (e.g., how many lead-exposed workers get blood lead monitoring using accredited laboratories; how often do the results stimulate appropriate medical removal and control of exposures? what percent of exposed health care workers are vaccinated for Hepatitis B?). Which OSHA-mandated OHPS are effective?

What proportion of exposed workers receives non-mandated OHSP (e.g., rabies vaccinations for animal control workers, ergonomic intervention after diagnosis of work-related RSI)? Workplace OHPS include clinical preventive services, occupational hygiene, safety, and ergonomics. In what proportion of workplaces are OHPS delivered, and what services are provided? Who provides OHPS? How are clinical and workplace preventive services best coordinated.

Are there significant differences in the prevalence or availability of OHPS between geographic areas? between industries? based on employer characteristics? based on workforce characteristics? What are the trends in delivery of OHPS over time.

Additionally, the impact of different organizational structures, provider characteristics, reimbursement systems, etc. on occupational health and medical services is unknown. Development and evaluation of techniques found to be effective for promoting prevention in other areas of health care (e.g., reminders, feedback to providers) is also necessary.

Evaluating the Efficacy and Cost-Effectiveness of Primary, Secondary, and Tertiary Prevention Techniques and Strategies

It is essential that the cost-effectiveness of various prevention strategies be evaluated. What are the costs and effectiveness of alternative prevention strategies vs. none at all [Gorsky and Teutsch, 1995].

However, before cost-effectiveness can be assessed and one strategy compared with other options, there must be evidence that a prevention strategy is effective [Farnham and Haddix, 1996]. Many occupational health professionals fervently believe that primary prevention is the most cost effective way to reduce the impact of occupational injuries, but there is little supporting data. A limited number of occupational health preventive techniques have been demonstrated to be effective (e.g., immunizations for infectious diseases). However, for many common techniques, few studies are available; for others (e.g., back belts, back schools), available efficacy studies are poorly designed, or suggest a lack of efficacy [Back Belt Working Group, 1994; Wassell et al., 2000]. Evaluation of the effectiveness of prevention techniques must be a high priority for research; dissemination of the results of well-designed evaluation studies is also critical.

For strategies with demonstrated effectiveness, cost-effectiveness analysis (CEA) can be used to identify the most cost-effective choice among a range of options. The economic burden of occupational injury and illness is distributed among support and insurance systems across society [Leigh et al., 1997]. Therefore, cost-effectiveness analysis initially should be performed using methods that account for the total societal costs associated with preventive interventions or the lack thereof [Mandelblatt et al., 1997]. Additional perspectives can be used when appropriate for the particular study question [Farnham and Haddix, 1996]. CEA should assess both the relative societal costs associated with different preventive strategies, and the impact of the failure to implement prevention activities. For example, what are the total costs and benefits of increasing staff versus installing lifting aids to reduce back injury in a nursing home setting? In other arenas, such analyses have utility for prioritizing and selecting prevention efforts and for supporting the expansion of preventive services when appropriate [Das, 1999; Goldie et al., 1999]. The analysis of effectiveness of tractor rollover protection provides an example of such research in occupational health [Centers for Disease Control, 1993].

Evaluation research could also assess the impact of various organizational factors on prevention effectiveness; e.g., what are the hallmark characteristics of effective prevention collaboration between employers and health care providers? Are some employers' management organization structures more effective than others for reducing injury and disability?

Clinical Aspects of Secondary and Tertiary Prevention

Little research is available to guide physicians and other health care providers in the provision of secondary and tertiary preventive services for patients with work-related conditions, particularly for those with musculoskeletal disorders. For example, what specific lifting restrictions are appropriate for patients with various types of low back injuries, and for how long? Is complete avoidance of repetitive tasks necessary for a patient with repetitive strain injuries, or can the patient return to a job with a reduced repetition rate?

Physicians often have difficulty measuring progress in recovery; they would greatly benefit from additional research and development of tools for the consistent assessment of pain and functional capacity [Matheson et al., 1995]. Can objective measures be used to determine when work restrictions can be lifted (either incrementally or completely), and how? Such measures would contribute to the success of tertiary prevention for the injured worker.

Development of methods for risk adjustment for severity of injury would be extremely beneficial.

Psychosocial Aspects of Prevention in Occupational Medicine

There is increasing evidence that psychosocial factors (both work and non-work) play an important role in both the etiology and prognosis of many types of illness, including common occupational disorders such as low back pain [Stansfeld et al., 1994]. Yet little is known about the psychosocial aspects of prevention in occupational medicine. How do work and non-work stressors and moderators influence prevention efforts, and how can the provider address these issues during treatment of the injured worker? What changes in work organization impact the incidence of work-related injury and illness, or the worker's recovery, and what is the role of the provider vis a vis work organization? Are there behavioral strategies that effectively increase employer and/or employee responsiveness to health care provider recommendations regarding prevention of injury or of work disability?

Medicaid providers are paying close attention to issues of language and culture in delivery of health services, and some research suggests ethnicity and culture play an important role in response to pain [Bates, 1996]. However, there is little research to guide providers in developing cultural competence in the delivery of primary and tertiary occupational preventive services.

Policy and Economic Research

Health services research may demonstrate the effectiveness of particular practices, but often policy is needed to promote the adoption of those practices. Does health services research change the opinion of health care providers, purchasers, consumers, or policy makers regarding prevention?

When policy has been changed, research is needed to assess the impact of policy changes on the integration of prevention and clinical services. Have the enacted policies achieved their goals? For example, 34 OSHA standards include regulations for medical surveillance of affected workers. What proportion of affected workers actually receive this surveillance, how effectively is it done, and does the practice improve worker health? Is compliance better for some standards than others, and if so, what factors lead to improved compliance? Oregon maintains a program with incentives for employers to provide modified work to injured workers; is it working?

Do enforcement incentives (increased fines and inspections) change employer response to prevention recommendations? Do state-promulgated treatment guidelines influence physician behavior? What financial incentives are effective in increasing the provision and utilization of OHPS (e.g., premium pricing mechanisms, provider reimbursement strategies)? Do policies of non-governmental organizations (for example, professional or trade society guidelines, or requirements imposed by liability insurance carriers) influence employer or health provider practice? Are these more or less effective than government regulation? There is little available research to guide the design of financial incentives (for providers or employers) to encourage the integration of clinical and preventive services. What are the existing incentive mechanisms, and what impact do they have on OHPS? What options for defining service scope encourage collaboration; how do performance measurement and risk adjustment interact with payment incentives [Glied, 1998].

CONCLUSION

Occupational medicine is a preventive medicine specialty, and occupational injuries and illnesses are largely preventable. Yet there is frequently a divide between the worlds of occupational health and safety practitioners and the medical care professionals who provide clinical and rehabilitative services for injured workers. Better integration of these two aspects of occupational health could serve to improve the delivery of preventive services, reduce the incidence of occupational injury and illness, and improve the care and outcomes for injured workers.

Improved delivery of OHPS will require: improved recognition and reporting of work-related illness; better training of physicians who treat occupational injury about preventive strategies; identification and implementation of organizational and financial structures which encourage employer-physician communication and provision of OHPS; and more research on the efficacy and delivery of OHPS.

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