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AEI-BROOKINGS JOINT CENTER FOR REGULATORY STUDIES

## **Developing a Framework for Sensible Regulation: Lessons from OSHA's Proposed Ergonomics Rule**

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## **Executive Summary**

Injuries caused by workplace activities that involve repetitive motion, known as musculoskeletal disorders (MSDs), increasingly concern workers, employers, and regulators because of their frequency and high treatment costs. The Occupational Safety and Health Administration (OSHA) recently proposed a national rule designed to reduce the workplace risk of MSDs. OSHA estimates there were about 626,000 MSDs in 1997, representing about one-third of all serious nonfatal workplace injuries and illnesses. OSHA estimates the proposed rule will cost \$4 billion per year and generate \$9 billion per year in benefits. Yet, OSHA does not provide sufficient evidence that private markets are failing to reduce MSD risk without government intervention and does not convincingly demonstrate that the rule will result in more good than harm.

Unless OSHA effectively addresses some of the more serious flaws in the proposed rule, OSHA should not proceed with the final regulation. OSHA should more carefully evaluate the nature and extent of MSDs in the workplace than it did in the proposed rule and use improved economic analysis to target serious MSDs that employers can reduce at low cost. Furthermore, OSHA should include new provisions to improve employer access to information about reducing workplace risk of MSDs. The rule's ergonomics program requirements should apply only to those MSDs which employers do not have sufficient incentive to reduce without government intervention.

## Recommendations

The Occupational Health and Safety Administration (OSHA) should redesign its proposed ergonomics rule: first, OSHA should more precisely evaluate the nature and extent of musculoskeletal disorders (MSDs) in the workplace than it did in the proposed rule; second, OSHA should use improved economic analysis to target serious MSDs that employers can reduce at low cost; third, OSHA should include new provisions to improve employer access to information about reducing workplace risk of MSDs. The rule's ergonomics program requirements should apply only to those MSDs that employers do not have sufficient incentive to reduce without government intervention.

- 1. Precisely Evaluate the Nature and Extent of MSDs in the Workplace.** OSHA cannot target serious MSDs without good information about the nature and extent of MSDs in the workplace. A more precise evaluation of workplace MSDs than OSHA provided in the proposed rule will help OSHA target severe and well-understood MSDs that employers can reduce at low cost, termed “target MSDs.”
  - a. Refine the Estimate of Workplace MSDs.** OSHA's estimate of workplace MSDs may include injuries that are not MSDs. OSHA should provide support for each type of injury included in the final estimate of workplace MSDs. All of the injuries in the category “sprains, strains, and tears” from “overexertion,” may be MSDs, for example, but OSHA did not demonstrate that these injuries are all caused by repetitive motion over time. OSHA should also discuss whether all low back injuries included in the estimate, which account for 55% of all MSDs, are caused by repetitive motion. OSHA should adjust the workplace MSD estimate if injuries that are not MSDs are included in the estimate.
  - b. Provide Data on MSD Trends.** The rule does not provide any information on trends in the frequency and severity of specific MSDs over time, so it is not clear the rule targets these injuries. To evaluate the frequency and severity of MSDs over time, OSHA should analyze the Bureau of Labor Statistics (BLS) data from 1992 to the present by injury, duration of injury, job type, and industry.
  - c. Estimate the Effects of Multiple Risk Factors on the MSD Estimate.** Some MSDs are clearly the result of a particular work activity, and others are the result of multiple risk factors. OSHA should adjust the workplace MSD estimate to account for multiple risk factors, such as non-work activities or the physical ability of a worker to tolerate repetitive stress. Ergonomics scholars use an “aetiological fraction” in their analyses of the number of workplace injuries, which is the proportion of injuries among workers exposed to the risk of injury that is attributable to the exposure. OSHA should use different aetiological fractions for different injuries and job types, as appropriate.
  - d. Classify Causal Relationship Studies by Injury and Job Type.** According to the proposed rule, enough evidence exists to suggest there is a strong causal relationship between workplace activities and MSDs. According to the National

Institute for Occupational Safety and Health, however, the nature and strength of such evidence varies significantly among injuries. OSHA should classify the causation evidence presented in the rule by MSD and job type, and discuss the association between workplace activities and specific MSDs. OSHA also should show, if possible, that the causes of specific MSDs in different job categories covered by the rule are well enough understood that it is feasible to design effective ergonomics programs.

2. **Use Economic Analysis to Identify Target MSDs.** Reducing the risk of target MSDs will, by definition, have high benefits and low costs. To identify target MSDs, OSHA should combine information on the nature and extent of workplace MSDs discussed in the previous section with information about the cost of interventions. OSHA then can estimate the aggregate costs and benefits of the rule. As a result of flaws in OSHA's economic analysis of the proposed rule, OSHA overestimated the benefits of the proposed ergonomics rule. The following recommendations, which address the flaws in OSHA's economic analysis, will help OSHA estimate the costs and benefits of reducing target MSDs.
  - a. **Base Analytical Assumptions on Peer-Reviewed Studies.** The economic analysis relies on assumptions based in part on studies not published in peer-reviewed journals. Where possible, OSHA should use peer-reviewed studies. OSHA should weigh the results of peer-reviewed studies more heavily than other studies, such as reports from company ergonomics program managers that estimate the average effectiveness of workplace interventions.
  - b. **Discuss the Uncertainty in Key Assumptions.** Despite the widely accepted difficulty of identifying and understanding workplace MSDs, the economic analysis relies on a number of assumptions that are point estimates. It also does not include a test of the sensitivity of its final estimates to these key assumptions. OSHA should identify probability distributions where possible. OSHA should conduct extensive sensitivity analysis. OSHA should, for example, use the National Institute for Occupational Safety and Health's estimate of the decline in MSDs resulting from a 50% reduction in workplace risk to estimate the benefits of the rule, in addition to its estimate of a 100% reduction in workplace risk.
  - c. **Adjust Baseline to Reflect Decline in MSDs Over Time.** OSHA assumed that the number of workplace MSDs would remain at 1996 levels for the next ten years. MSDs have declined every year since 1992. OSHA should adjust its baseline to reflect this decline, which will lower both the benefits and the costs of the regulation.
  - d. **Include Failed Ergonomics Programs in Effectiveness Estimate.** OSHA's assumption that ergonomics programs will reduce injuries by 50% is based on a review of successful programs, and does not include programs that failed to reduce risk. OSHA should revise the average effectiveness estimate to include

some failed programs, and provide information about failed programs to company managers to discourage investment in ergonomic programs with negligible benefits.

- e. **Link Cost and Benefit Estimates.** OSHA's cost estimate is based on a different set of studies than its benefit estimate. As a result, OSHA's benefit estimate relies on employers implementing ergonomics programs that are potentially more costly than the programs on which the cost estimate relies. The same is true of the effectiveness of ergonomics programs; the programs used to estimate the costs of the rule may be less effective than the programs used to estimate the benefits of the rule. OSHA should use the same ergonomics programs to estimate the costs and the benefits of the rule.
- 3. Improve Employer Access to Information about Reducing Workplace Risk.** The market has already shown that it will respond to better information about the risk of MSDs, as indicated by the 5% annual decline in MSDs since 1992. If the employer savings from ergonomics programs that OSHA cites in the proposed rule exist, such as increased worker productivity and worker compensation savings, improving access to useful information about the rewards of such programs should encourage employers to adopt them.
- a. **Provide On-line Information.** While information about ergonomics programs is available in the literature, there is no central, reliable on-line source of information about ergonomics programs. OSHA should provide on-line information to employers about risk, intervention costs, intervention effectiveness, and the causes of specific MSDs, including an assessment of the quality of the research findings. OSHA should rely primarily on peer-reviewed studies. OSHA further should design a web site that is easy to search by industry, job type, or injury, and provide additional information to industries with the highest MSD incidence rates.
  - b. **Fill Key Information Gaps.** There is a dearth of studies that synthesize existing information about MSDs, such as the study by the National Institute for Occupational Safety and Health that summarizes epidemiologic evidence for MSDs from over 600 studies. OSHA could commission reports to help employers identify the ergonomics programs that are most likely to reduce risk from workplace activities. OSHA should also evaluate the quality of any studies used to recommend specific actions

**Developing a Framework for Sensible Regulation: Lessons from  
OSHA's Proposed Ergonomics Rule**

## I. Introduction

There is increasing concern about injuries caused by workplace activities that involve repetitive motion, known as musculoskeletal disorders (MSDs).<sup>1</sup> The nature of these injuries varies widely, as do the associated workplace activities. One worker, for example, might injure his back after years of lifting doors on an assembly line while another might injure her wrist after years of typing on a keyboard. In response to growing concerns about such injuries, the Occupational Safety and Health Administration (OSHA) proposed a national rule designed to reduce workplace risk of MSDs in November 1999.<sup>2</sup> The rule requires workplaces that record at least one MSD in a given year to implement an ongoing program to reduce the risk of injury.

OSHA estimates that there were about 626,000 MSDs that required injured employees to miss at least one day of work in 1997, down from 784,000 in 1992. These MSDs represent approximately 34% of all nonfatal workplace injuries and illnesses.<sup>3,4</sup> OSHA's rule requires companies to implement risk reduction programs based on ergonomics, or "the applied science of equipment design intended to maximize productivity by reducing operator fatigue and discomfort."<sup>5</sup> The so-called ergonomics rule does not apply to all workplaces, but it covers 342 industries, almost six million establishments, and 31 million employees in manufacturing jobs, manual handling jobs,

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<sup>1</sup> MSDs are also referred to as cumulative trauma disorders or repetitive stress injuries.

<sup>2</sup> The terms rule and regulation are used interchangeably throughout this paper.

<sup>3</sup> Unless otherwise specified, references to MSDs and nonfatal workplace injuries and illnesses refer to those that required injured employees to miss at least one day of work.

<sup>4</sup> MSDs have remained approximately 34% of all nonfatal workplace injuries and illnesses since 1992.

<sup>5</sup> The American Heritage College Dictionary. 1997. Third Edition.



and jobs in workplaces for which at least one MSD has been reported.<sup>6,7</sup> It is not clear whether it covers home offices.<sup>8</sup>

The rule requires employers of workers in “high-risk” jobs, which include manual handling and manufacturing, to implement a “basic” ergonomics program before an employee experiences a MSD and a “full” program after one worker experiences a MSD. OSHA requires the full program, with the same single injury trigger, for employers of workers with other types of jobs covered by the rule.<sup>9</sup> OSHA’s basic ergonomics program requires the employer to report injuries and provide workers with information about MSDs.<sup>10</sup> The full program requires employers to eliminate or “materially reduce” the risk of MSDs using job controls and other measures.<sup>11</sup> The full program also requires employers to transfer injured workers to less risky activities at 100% of take-home pay, or to compensate workers for days away from work at 90% of pay if restricted work is not a viable option.<sup>12</sup>

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<sup>6</sup>The number of industries and establishments are from OSHA’s Table VIII-1 of industries by 3-digit SIC code. OSHA (1999a, p. 65987). The number of employees is from Table IV-2 of the RIA, representing those employees that are not already covered by an ergonomics program. OSHA (1999b).

<sup>7</sup> Such MSDs are termed “OSHA recordable” MSDs. These MSDs must meet one of the following criteria: a diagnosis by a certified health care provider, at least one positive physical finding, or a MSD symptom. The injury must be related to the physical tasks an employee performs and connected to the physical work activities at the core or significant part of the employee’s job. OSHA (1999a, p. 65777 and 65783).

<sup>8</sup> OSHA does not state in the proposed rule that it does not cover home offices. However, OSHA sent an advisory letter to CSC Credit Services on November 15, 1999, in response to an inquiry, stating that federal health and safety rules are applicable to home offices. A week later, OSHA published the ergonomics rule and on January 4, the *Washington Post* reported on the new policy and its applicability to the new rule. OSHA publicly withdrew the letter on January 27, and released a statement on February 25 clarifying that employers are not liable for the home offices of employees. The *Washington Post* (2000a) and The *Washington Post* (2000b).

<sup>9</sup> OSHA’s approach allows employers some flexibility. Employers can, for example, implement the “Quick Fix” option to reduce the risk of workplace MSDs, which allows employers 90 days to implement some controls to reduce risk instead of implementing the full program. They can also limit their efforts to the injured employee if they show that MSD hazards do not pose a problem for other employees in the same job. Employers can discontinue major parts of their ergonomics program if no MSDs are reported in a problem job within three years after the employer takes action to reduce the risk OSHA (1999a, p. 65792).

<sup>10</sup> Specifically, the firm must designate an ergonomics program manager, set up a MSD reporting system, and provide information to employees on MSD risk factors and symptoms.

<sup>11</sup> It requires employers to increase training, recordkeeping, program evaluation, and management efforts relative to the basic program.

<sup>12</sup> OSHA does not state explicitly that these benefits from the rule will be greater than the current level of benefits workers receive for MSDs, or if more injuries will be covered under the rule than at present. OSHA states only that “most cases requiring [worker restriction protection] will be covered by workers’ compensation.” OSHA (1999b, p. 23 of Chapter V). If the rule results in a significant increase in benefits and/or a broader definition of a MSD than the current definition, the incentive for workers to exaggerate or

OSHA estimates the proposed rule will cost \$4 billion per year and generate \$9 billion per year in benefits. Yet, OSHA did not fully evaluate the nature and extent of MSDs in the workplace, or demonstrate why private markets are failing to significantly reduce the risk of workplace MSDs. OSHA further based its economic analysis on a series of unrealistic assumptions, and failed to test the sensitivity of its benefit and cost estimates to alternative assumptions.

Before proceeding with the final regulation, OSHA should more precisely evaluate the nature and extent of MSDs than it did in the proposed rule and use this information to target serious MSDs that employers can reduce at low cost. To better target MSDs, OSHA must disaggregate information about MSDs by job type, industry, and injury and provide more information about the nature, severity, and cause of specific MSDs.<sup>13</sup> Direct OSHA regulation may not be warranted, even for serious MSDs, if alternative strategies can adequately address the alleged market failure, such as providing workers with more information.

Section II describes a framework for good regulatory decision making, based on widely accepted economic principles. Sections III and IV show that OSHA could improve the ergonomics rule by using this framework. Section III shows that OSHA could improve the rule by more fully evaluating the nature and extent of workplace MSDs than it did in the proposed rule. Section IV shows that OSHA could use improved economic analysis to target serious MSDs that employers can reduce at low cost. Section V concludes that OSHA should address the concerns described in Sections III and IV before proceeding with the final regulation, and also should improve employer access to information about MSDs.

## **II. A Framework for Regulatory Decision Making**

OSHA's ergonomics rule does not sufficiently address two basic economic issues fundamental to good regulatory decision-making. These two issues, which all agencies

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fake injuries increases. OSHA did not adequately address this issue in the proposed rule, but we do not pursue it further in this paper.

<sup>13</sup> OSHA states that the rule "focuses on jobs where problems are severe and solutions are well understood," but does not provide evidence to support this assertion. OSHA (1999a, p. 65787).

should address before regulating, are: first, whether the regulation addresses a "significant market failure"; and second, whether the regulatory intervention is likely to do more good than harm.<sup>14</sup> In spite of widespread recognition of the importance of these economic issues, agencies often ignore them.<sup>15</sup> Significant is not easily defined, but it generally means that the regulation could result in substantial improvements in economic efficiency.<sup>16</sup> In other words, the expected benefits of regulating far outweigh the expected costs.<sup>17</sup> Once an agency shows that a significant market failure exists, it should use economic analysis to show that the regulation will do more good than harm.

Generally, market failures can arise if information asymmetries exist, if certain goods are not priced appropriately, or if there is a natural monopoly.<sup>18</sup> A significant market failure is a necessary condition for regulation, rather than just a market failure, for two reasons. First, market failures are pervasive in all economies, even smoothly running capitalist economies. Second, if the government attempted to correct small market failures, the intervention could do more harm than good because regulation often has unintended consequences.<sup>19</sup> Regulators must demonstrate that a significant market failure exists because otherwise they would have too much latitude to regulate.

OSHA designed the ergonomics rule to address two sources of market failure: first, imperfect knowledge about workplace risk may prevent workers from demanding wages that fully compensate them for the risk of injury<sup>20</sup>; second, flaws in the workers'

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<sup>14</sup>Regulators are familiar with these issues. President Clinton, for example, requires agencies to conduct an economic analysis of proposed regulations in Executive Order 12866, and describes twelve "Principles of Regulation." The first principle states that "Each agency shall identify the problem that it intends to address (including, where applicable, the failures of private markets or public institutions that warrant new agency action) as well as assess the significance of that problem." Clinton (1993). § 1(b)(1) of Executive Order 12866. The sixth principle states that agencies "shall" show that the benefits of a regulation justify the costs. Clinton (1993). § 1(b)(6) of Executive Order 12866.

<sup>15</sup> See Hahn (1999a) and Hahn et al. (2000) for a discussion of agency failure to provide good analyses.

<sup>16</sup>Economic efficiency is often defined as the sum of producer and consumer surplus.

<sup>17</sup>In economist's terms, the regulation should pass a broadly defined benefit-cost test. See, e.g., Crandall et al. (1997). A reasonable lower bound for passing a benefit-cost test might be \$100 million to \$1 billion in net benefits for major federal regulations.

<sup>18</sup> See, e.g., Bator (1958) and Akerlof (1970).

<sup>19</sup> See, e.g., Viscusi (1984).

<sup>20</sup> If employers and workers have perfect information about the risk of workplace MSDs, and workers accept a wage that compensates them for that risk, there is no market failure. Evidence suggests, however, that workers do not have perfect information about the risk of MSDs. Smith (1992) and Viscusi (1992), for example, provide evidence that workers slowly learn of workplace hazards after they have been on the job. On the other hand, labor markets could work reasonably well even if some workers are not well informed about risk. Poorly informed workers may be protected, in part, if some workers have good information

compensation system prevent employers from taking appropriate safety measures to reduce risk.<sup>21</sup> OSHA identifies these market failures in the economic impact analysis of the proposed rule, but does not provide empirical support for their existence – in part because such evidence is limited. OSHA uses a proxy for proof of a market failure, information about the number of MSDs in the workplace, which is justified by the dearth of information about the actual market failure. OSHA does not, however, fully evaluate the nature and the extent of MSDs in the workplace in the proposed rule or account for ongoing employer efforts to reduce MSDs. OSHA therefore does not demonstrate in the proposed rule that a significant market failure exists.

OSHA could show that a significant market failure exists if OSHA more precisely evaluates the nature and extent of workplace MSDs than it did in the proposed rule, but the market failure is probably smaller than OSHA believes. If OSHA shows that the ergonomics rule addresses a significant market failure, then a second economic issue arises: whether the chosen regulatory intervention will do more good than harm. In the case of the ergonomics rule, OSHA can use economic techniques to show that the rule targets serious MSDs that employers can reduce at low cost.

## **II. The Nature and Extent of MSDs in the Workplace**

Given the difficulty of determining whether workers are fully compensated for workplace MSD risk, the existence of a market failure is legitimately controversial. OSHA does not precisely define a MSD, much less adequately account for employer

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about wages and risks and employers cannot easily discriminate between workers. If this is the case, poorly informed workers will benefit from the higher wages demanded by the workers with more information.

<sup>21</sup>The government-mandated workers' compensation system exists because the labor market often fails to provide workers with the optimal level of safety and income protection against work-related injuries. Private markets could fail to provide such protection, for example, because of transaction costs associated with negotiation, and asymmetric information about workplace risks. The workers' compensation system does not fully correct these market failures because it sometimes does not provide employers with perfect incentives to reduce workplace risk (Krueger, 1990a). The employer's incentive to invest in risk reduction measures increases as workers' compensation premiums increase. Workers' compensation premiums are based on "experience ratings," however, which are estimates of workplace risk based on an employer's history of recorded injuries. Experience rating is imperfect because injury rates have a random component to them and because often premiums are determined by averaging the risk across workplaces in an industry (Smith, 1992 and Krueger, 1990). The mechanism for determining the employer's workers' compensation premium, for example, frequently fails to reflect the real costs associated with an employer's record of injuries. OSHA (1999b, p. 9 of Chapter V).

efforts to reduce MSD or provide good information about the nature, severity, and cause of MSDs. Consequently, OSHA has not yet demonstrated that the ergonomics rule will result in significant efficiency gains.<sup>22</sup>

### **Definition of Workplace MSDs**

Workplace MSDs are difficult to define because it is not always clear that an injury is the result of workplace activities involving repetitive motion. A sprained back, for example, could result from repetitive motion or from a single traumatic event. Furthermore, a MSD could result from exposure to multiple risk factors, such as different job tasks, non-work activities, and the physical ability of a worker to tolerate repetitive motion. The definition of a MSD is important because it affects estimates of workplace MSDs, which in turn affects the public's perception of the problem.

The different definitions of MSDs used by OSHA and BLS illustrate some of the problems in measuring the magnitude of the potential problem. MSDs are generally defined in the ergonomics literature as injuries that occur after prolonged exposure to workplace activities that involve repetitive or forceful exertion, static or awkward postures, and vibration.<sup>23</sup> They are associated in many cases with swelling along with other symptoms, such as numbness, restriction of motion, and loss of dexterity.<sup>24</sup> OSHA defines MSDs as injuries that develop as a result of repeated exposure to ergonomic risk factors.<sup>25</sup> OSHA's definition includes injuries and disorders of soft tissues.<sup>26</sup> These injuries are characterized by sprains, strains, tears, back pain, soreness, or simply "pain," as long as these injuries were caused by specified bodily motions, such as bending.<sup>27</sup> The BLS definition of a MSD, on the other hand, excludes injuries from sprains, strains, and tears and traumatic injuries to soft tissues.<sup>28</sup>

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<sup>22</sup> The use of the number of MSDs as a proxy for the significance of the market failure is reasonable because information about worker compensation for workplace risk is limited. At the same time, these statistics should be interpreted carefully.

<sup>23</sup> Silverstein et al. (1997). According to the Silverstein et al. definition, MSDs primarily affect soft tissues.

<sup>24</sup> Sorock and Courtney (1996)

<sup>25</sup> OSHA (1999a, p. 65783).

<sup>26</sup> Soft tissues are muscles, nerves, tendons, ligaments, joints, cartilage, and spinal discs.

<sup>27</sup> OSHA's definition covers a number of different injuries, but does not include single event accidents.

<sup>28</sup> These soft tissues include tendons, ligaments, muscles, or joints. BLS includes arthropathies, dorsopathies, rheumatism, osteopathies, chondropathies, and acquired musculoskeletal deformities.

Figure 1 shows how the definition of a MSD affects estimates of the number of workplace MSDs. According to OSHA's definition, the number of workplace MSDs in 1997 was 626,000, or approximately 34% of all nonfatal occupational injuries and illnesses that required at least one day away from work. According to BLS, the number was 34,325, or 2% of all nonfatal injuries and illnesses.<sup>29</sup> Dudley and Rowen (1999) made a similar point about the definition of MSDs in its comment on OSHA's draft ergonomics rule, released in 1995.<sup>30</sup> Mercatus estimated that the number of MSDs experienced in 1994 ranged from 332,000 to 705,800, depending on which BLS data categories were included in the estimate.<sup>31,32</sup> OSHA states that it chose to include specific BLS categories after it consulted with a panel consisting of an occupational physician and two professional ergonomists, but did not offer further support for its definition in the proposed rule.<sup>33</sup>

There are additional problems with defining and identifying MSDs, which go beyond issues related to the data. MSDs are the result of a number of risk factors, such as non-work activities and the physical capacity of an individual to tolerate repetitive stress motion.<sup>34</sup> OSHA acknowledges such risk factors, but does not explain how they could affect the number of workplace MSDs the regulation will reduce or its original estimate of the number of MSDs.<sup>35</sup> For example, OSHA writes that most non-work activities are not performed with the duration or intensity characteristic of occupational exposures and that the physical capacity of an individual to tolerate repetitive stress motion influences the risk of injury, yet does not provide empirical evidence of these effects.<sup>36</sup>

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<sup>29</sup>Linda Garris, Bureau of Labor Statistics, U.S. Department of Labor, telephone interview by Tats Kanenari, AEI-Brookings Joint Center for Regulatory Studies, Washington, D.C., February 2000.

<sup>30</sup>Dudley and Rowen (1999).

<sup>31</sup> The estimate of 332,000 MSD is based on the number of repeated trauma illnesses while the 708,000 estimate includes repeated motion and overexertion illnesses in addition to repeated trauma illnesses.

<sup>32</sup> The OSHA MSD estimate is based on a cross-tabulation of four BLS data categories: nature of injury (i.e. strain, sprains, and tears), body part affected (i.e. the back), source of injury (i.e. machine operation), and event or exposure (i.e. overexertion).

<sup>33</sup> See OSHA (1999a, p. 65928).

<sup>34</sup> Non-work activities associated with upper extremity musculoskeletal disorders, for example, include gender-based hormonal factors, chronic diseases, and poor repair or healing of previous acute trauma injuries. The wrist size/shape and the body mass index also can increase upper extremity MSD risk.

<sup>35</sup> OSHA (1999a, p. 65868).

<sup>36</sup> Sorock and Courtney (1996).

OSHA's estimate could also underestimate workplace MSDs. Studies have shown, for example, that workers often do not report MSDs. The extent of underreporting could be as high as 50%, according to OSHA, although this estimate is controversial.<sup>37</sup> OSHA does not test this potential effect in the economic analysis of the proposed rule.

### **Employer Efforts to Reduce MSDs**

While some markets may fail to fully compensate workers for the risk of MSDs, evidence also suggests that markets are adjusting in response to an increased understanding of workplace risk. The number of workplace MSDs has decreased by an average of 5% a year since 1992, both according to the BLS estimate and the OSHA estimate of MSDs.<sup>38</sup> Although the cause of the decline is not clear, some suggested explanations include reform of state worker's compensation systems and risk reduction programs implemented by employers and insurance carriers.<sup>39</sup> Furthermore, it could be the result of improved information about the frequency of MSDs. BLS changed its data collection practices in 1992, for example, in part to provide better information about MSDs. The emergence of new data contributed to heightened awareness of the problem, which OSHA acknowledges.<sup>40</sup> OSHA efforts to reduce MSDs prior to the proposed rule, through inspections and enforcement of the General Duty clause, may also have contributed to the decline.<sup>41</sup> OSHA does not evaluate the extent to which the private

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<sup>37</sup> OSHA summarizes studies that attempt to estimate the extent of underreporting of occupational injuries and illnesses. The studies are not specific to MSDs, and the extent of estimated underreporting ranges from approximately 9% to 45%. OSHA does not critically evaluate these studies, or provide evidence that they are representative of all industries, so the true extent to which MSDs are underreported is unclear. OSHA (1999a, p.65980-65893).

<sup>38</sup> The estimate of the decline in all workplace MSDs could, however, conceal problems in specific industries or job types.

<sup>39</sup> Murphy and Volinn (1999).

<sup>40</sup> See OSHA (1999b, p. 4 of Chapter VIII).

<sup>41</sup> OSHA has been using the General Duty Clause of the Occupational Health and Safety Act of 1970, as well as other means, to reduce MSD risk since the mid-1980s. OSHA reached a corporate-wide agreement with the meatpacking industry regarding repetitive stress injuries in the late 1980s and early 1990s, for example, and a corporate-wide agreement with General Motors in 1990. Courtney and Maynard (1999) write that OSHA inspections of workplaces with a high risk of MSDs peaked in the late 1980s and early 1990s and have since declined, perhaps in anticipation of an ergonomics rule.

sector will continue to reduce MSDs without further government intervention, and therefore overestimates the number of MSDs the proposed regulation will reduce.<sup>42</sup>

### **The Nature, Severity, and Causes of MSDs**

Knowledge about the nature, severity, and causes of workplace MSDs is essential to the design of cost-effective ergonomics programs. Without such knowledge, companies could invest heavily in safety measures that produce negligible benefits. Alternatively, carefully targeted safety expenditures could reduce injuries and perhaps result in increases in worker morale and productivity. To illustrate the importance of understanding the nature, severity, and cause of MSDs, we analyzed data provided by the BLS that OSHA used to estimate the number of workplace MSDs. We found that OSHA probably included injuries in its MSD estimate which are not MSDs and that the causes of some MSDs are poorly understood. OSHA should use information about the nature, severity, and causes of MSDs to redesign the proposed regulation to target MSDs that are severe and well understood, and which employers can reduce at low cost.<sup>43</sup>

**Nature.** A significant number of injuries covered by the rule are not injuries typically recognized as MSDs. The popular press and OSHA focus on high-profile injuries like carpal tunnel syndrome when they discuss repetitive stress injuries. Yet, Table 1 shows that 65% of MSDs are “sprains, strains, and tears” from overexertion and only 5% are carpal tunnel syndrome caused by repetition, according to OSHA’s definition of a MSD.<sup>44</sup> OSHA did not explain its decision to include sprains, strains, and tears from overexertion in its estimate of MSDs. OSHA states instead that it relied on the recommendations of its expert panel of ergonomists.

Table 2 shows that approximately 55% of MSDs are back injuries, using OSHA’s definition.<sup>45</sup> Injuries affecting the trunk, excluding the back, are the next most prevalent

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<sup>42</sup> All nonfatal injuries and illnesses have also been falling since 1992, at approximately the same rate, however, so it is not clear the employers have made special efforts to reduce MSDs.

<sup>43</sup> OSHA has focused efforts to reduce MSDs in the automobile and meatpacking industries in the past, and plans to release separate ergonomics rules for other high-risk industries agriculture, construction, and maritime operations.

<sup>44</sup> We also analyzed data from 1992-1996, but the percentages did not change significantly in any year.

<sup>45</sup> Other authors’ findings support this conclusion. Daltroy et al. (1997) write that low back pain accounts for 15% to 25% of the injuries covered by workers’ compensation and accounts for 30% to 40% of



type of injury, followed by upper extremity injuries. If some of these back injuries are not caused by repetitive motion resulting from workplace activities, the rule should not cover them. Furthermore, a review of the literature on interventions to reduce back pain reveals that they are sometimes ineffective, in part because the causes of back injuries are often difficult to identify and in part because rest or restricted work activity is sometimes the most effective remedy.<sup>46</sup> OSHA did not show that the causes of back injuries are well enough understood to design effective ergonomics programs, or that back injuries can be traced to workplace activities.

Most back injuries are sprains, strains, or tears.<sup>47</sup> At least some of the injuries included in the sprains, strains, and tears category are probably not MSDs, both because they are back injuries or because of the nature of the injury. The BLS defines sprains, strains, and tears as “traumatic injuries to muscles, tendons, joints, and ligaments.”<sup>48</sup> In addition, sprains are generally defined as injuries resulting from a painful wrenching of a ligament or joint – not necessarily repetitive motion.<sup>49</sup> Strains, on the other hand, are generally considered the result of overuse or overexertion. Overexertion, according to the BLS, is excessive physical effort involving lifting, pulling, and other similar actions – repetitive motion is not mentioned in the definition.<sup>50</sup> The BLS further specifies to employers filling out its survey that all diseases and disorders affecting the musculoskeletal system should be included in the separate category for MSDs, not in the sprains, strains, and tears category. OSHA did not show that all the injuries in the sprains, strains, and tears category are MSDs, yet OSHA uses this MSD estimate to calculate the number of injuries the rule will reduce.

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workers’ compensation payments. The significance of back injuries as a percentage of total injuries may be decreasing, however. Murphy and Volinn (1999) estimate that workers’ compensation payments for low back pain decreased from 36% of total payments in 1987 to 23% in 1995.

<sup>46</sup> See Daltroy (1997).

<sup>47</sup> Author’s calculation based on BLS data. Daltroy et al. (1997) supports this finding, stating that 87% of back injuries are sprains, strains, and tears, and 72% of those are from overexertion.

<sup>48</sup> Definition from the BLS Survey of Occupational Injuries and Illnesses, 1992-1997. A standard dictionary definition of “trauma” is “serious injury or shock to the body, as from violence or an accident” or “injury (as a wound) to living tissue by an extrinsic agent.” American Heritage College Dictionary (1997) and Webster’s New Collegiate Dictionary (1977), respectively.

<sup>49</sup> American Heritage College Dictionary (1997). Third Edition.

<sup>50</sup> The definition of “bodily reaction” is “bending, climbing, crawling, reaching, or twisting.” Definitions from the BLS Survey of Occupational Injuries and Illnesses, 1992-1997.

**Severity.** In the absence of detailed information on the cost-effectiveness of interventions, OSHA’s proposed rule should consider targeting the most severe injuries because they also are the most costly. Such injuries require more long-term medical attention than less severe injuries, and require workers to take more time off work to recover.<sup>51</sup> While severity is difficult to define, OSHA could at least focus the ergonomics rule on those injuries that require workers to miss many days of work to recover. OSHA does not make any distinction between injuries based on severity, however, although OSHA emphasizes the consequences of severe injuries in its proposed rule.<sup>52</sup> OSHA’s annual MSD estimate includes injuries that require from one day to one year away from work. The regulation therefore could cover some injuries that are not severe enough to justify government intervention in the workplace.

**Causes.** The causes of many MSDs are poorly understood, often because there are multiple risk factors.<sup>53</sup> Understanding the causes of a MSD is essential to the design of an effective ergonomics program to reduce the risk of injury, and is therefore central to OSHA’s proposed rule.<sup>54</sup> OSHA recognizes the uncertainty associated with causation, and devotes seventy pages of the *Federal Register* notice to an exhaustive review of the results from hundreds of causation studies. OSHA concludes that the weight of the evidence presented in the *Federal Register* notice indicates a causal relationship between workplace risk factors and work-related musculoskeletal disorders.<sup>55</sup> While some studies demonstrate a causal relationship for some injuries and job types, however, they are usually specific to individual workplaces and injuries.

The causes of some MSD injuries are better understood than other MSD injuries. Demands of different jobs place various types of stress on a worker, and such stress is more easily evaluated and reduced in some jobs than others. Low back disorders, for

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<sup>51</sup> In a study of U.S. workers’ compensation claims for low back injuries, Hashemi et al. found that 12.4% of claims with a “length of disability” greater than three months accounted for 87.9% of the costs.

<sup>52</sup> OSHA states that workers with severe MSDs can face permanent disability that prevents them from returning to their jobs or handling simple, everyday tasks like combing their hair, picking up a baby, or pushing a shopping cart. OSHA (1999a, p. 65769).

<sup>53</sup> See Volinn (1999) for an analysis of whether workplace interventions prevent low-back disorders.

<sup>54</sup> Case studies of other injuries support the assertion that understanding the cause of the injury is essential to the design of effective programs. The National Institute of Occupational Safety and Health did a study of data entry staff at US West and found that, despite a reported increase in the number of MSDs in the years preceding the study, almost all workstations were of high ergonomic quality. Scalia (1994).

<sup>55</sup> See OSHA (1999a, p. 65926).

example, are the most prominent type of MSD according to OSHA's definition. Abenheim et al. (1995) and Deyo (1997) found that a definite diagnosis may be assigned to only a small minority of all low back disorder cases. Nachemson (1994) find that in 80-90% of low back disorder cases the true cause of the pain is unknown. Regarding upper extremity musculoskeletal disorders, Sorock and Courtney (1996) report that "Despite the substantial body of work, there has been relatively little progress towards a better scientific understanding of exposure-disease associations." The cause of some injuries, on the other hand, is more easily identified. Employers could, for example, reduce low back disorders among automobile assembly workers with a well-designed ergonomics program if research demonstrates a specific relationship between a specific automobile assembly task and the risk of injury.<sup>56</sup>

The lack of a clear understanding of the cause of some MSDs is primarily the result of multiple risk factors.<sup>57</sup> Sorock and Courtney assert, for example, that the lack of progress in understanding the cause of musculoskeletal upper extremity disorders is in part the result of poor study design and the inability to isolate individual risk factors. Even OSHA writes that a clear determination of whether these multiple risk factors act additively or synergistically within the workplace is not yet feasible.<sup>58</sup> Yet OSHA states that to be covered by the rule, a MSD must be "a OSHA-recordable injury," "directly related to the employee's job," and "specifically connected to activities that form the core or a significant part of the worker's job."<sup>59</sup> The lack of a clear causal relationship for many workplace MSDs will make it difficult to both determine whether the injury is directly related to the employee's job and to design effective ergonomics program to reduce risk.

#### **IV. Use Improved Economic Analysis to Identify Target MSDs**

If OSHA determines that a significant market failure exists after a more careful evaluation of the nature and extent of MSDs in the workplace than the evaluation

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<sup>56</sup> Punnett et al. (1991)

<sup>57</sup> Possible exceptions include some vibration-related disorders (i.e. low back pain from truck driving or operating construction equipment) and heavy lifting (i.e. injuries from frequent lifting of hospital patients).

<sup>58</sup> See OSHA (1999a, p. 65866).

<sup>59</sup> <http://www.osha.gov/ergonomics-standard/fs-over.html>

provided in the proposed rule, OSHA should use improved economic analysis to target serious MSDs that employers can reduce at low cost. OSHA should use the following description of the flaws in its analysis of the proposed rule to improve its future work.

## **Costs**

In its cost analysis, OSHA relied on information from a limited sample of experts and on assumptions that overestimate cost savings and underestimate the costs of ergonomics program implementation. OSHA also did not test the sensitivity of its final estimates to uncertain parameters in its analysis. OSHA estimates that the rule will cost \$3.4 billion annually over a ten-year period, and an additional \$.8 billion annually if the costs of additional work restriction provisions are included.<sup>60</sup> The costs include workers compensation benefits and the costs of the ergonomics programs. Approximately 54% of the total costs are related to implementation of ergonomics programs to reduce MSD risks. OSHA's cost estimate is low because OSHA overestimates likely labor savings and underestimates the cost of implementing ergonomics programs to reduce risk.

**Labor Cost Savings from Increases in Productivity.** OSHA overestimated the percentage increase in productivity resulting from interventions, which leads to significant labor cost savings according to OSHA's calculations.<sup>61</sup> OSHA created 170 scenarios of different workplace interventions designed to reduce workplace MSD risk, based on case studies, the ergonomics literature, and the expert opinion of one professional ergonomist.<sup>62</sup> For each scenario, OSHA calculated the cost of the intervention and the labor savings, if such savings exist, resulting from increased productivity. OSHA based its labor savings estimate on the wage rate, the hours per year the worker performed the task, and an estimated percentage increase in productivity. OSHA did not show that the case studies it used are reliable and representative of typical

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<sup>60</sup> The \$.8 billion is a transfer of costs from employees to employers.

<sup>61</sup> OSHA claims that many ergonomic interventions improve productivity, either because they reduce employee fatigue and relieve muscle pain or because they involve automating portions of jobs in ways that can be expected to improve productivity. See OSHA (1999a, p. 66010).

<sup>62</sup> OSHA developed the 170 scenarios with the help of a consulting firm, Auburn Engineers. The scenarios are based on published case studies and the experience of professional ergonomists. Each of the scenarios describes the industry, occupational group, job, reason the MSD arising from the job is covered by the regulation, physical work activities or work conditions, risk factors, and applied ergonomic controls.

ergonomic interventions, however. Reports of the success of ergonomics programs could be biased, for example, if the person reporting is responsible for implementation of the program. Also, OSHA could have overestimated labor cost savings if it relied primarily on case studies of voluntary programs rather than required programs because employers who have the most to gain from implementing ergonomics programs are more likely to implement them voluntarily.

OSHA further did not explain why, for 67 of the 170 scenarios, its estimate of labor savings from the intervention is greater than its estimate of the costs.<sup>63</sup> After calculating the labor savings for each of the 170 scenarios, OSHA subtracted the labor savings from the costs of the intervention to estimate the net costs of the intervention. Of the 170 scenarios, 96 did not result in productivity increases. Of the 74 scenarios that did result in productivity increases, 67 resulted in labor savings greater than the costs of the intervention. OSHA also did not explain why employers do not currently take advantage of the availability of such significant savings.

**Costs of Ergonomics Programs.** OSHA's calculation of the costs of the proposed rule is sufficiently convoluted that it is difficult to determine whether OSHA underestimated or overestimated the costs to modify jobs that cause MSDs. OSHA used average estimates of costs and labor savings from high cost, high technology interventions to estimate a cost ratio for each of 26 occupational groups.<sup>64</sup> To arrive at its estimate of the average cost of interventions for each of the 26 groups, OSHA multiplied the ratio for each group by the cost of interventions estimated by three ergonomics consultants.<sup>65</sup> The consultant estimates of the costs are based on low cost, low technology

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<sup>63</sup> In one scenario, for example, the gross cost of reducing MSD risk per worker is \$417 and the resulting labor savings are \$127,534 per worker.

<sup>64</sup> The ratio is total costs minus labor cost savings resulting from increases in productivity (termed net costs by OSHA) divided by total costs (termed gross costs by OSHA), and represents the percentage of total costs that are actual costs after accounting for labor cost savings.

<sup>65</sup> The discussion in the text skips over some of the details of OSHA's calculation to simplify the discussion for the reader. OSHA estimated intervention costs for 170 scenarios and subtracted labor savings. OSHA then used these cost estimates to calculate a ratio of average net costs to average gross costs, as described in the text, averaged the ratios from the 170 scenarios for 26 occupational groups, and asked the three consulting ergonomists to estimate the average costs of interventions for the 26 groups. OSHA then multiplied its ratios for the 26 occupational groups by the average cost for each group estimated by the consultants. The resulting cost estimates are presented in the proposed rule. On a related note, OSHA also did not explain why it chose the three ergonomists to estimate the costs, or explain the substantial variation between some of the estimates from different ergonomists for interventions in different occupational

interventions, which the consultants insist are standard workplace interventions.<sup>66</sup> More information is necessary to determine the nature of the bias in OSHA's calculations.<sup>67</sup>

Finally, OSHA estimates that employers can reduce MSD risk for 85% of all problem jobs without hiring outside experts.<sup>68</sup> This estimate is based on information provided by a single ergonomics consultant. OSHA did not, however, provide evidence that the information provided by a single consultant is sufficient to validate the 85% estimate, and did not test the sensitivity of the assumption. OSHA did not explain why 1,500 hours per year is a valid estimate of the number of hours per year the task is performed for approximately 1/3 of the scenarios for which no estimate was provided.<sup>69</sup> Given that 2,000 hours a year is a 40-hour, 50-week work year, this estimate assumes that the worker performed the same task almost all day. Since many workers are responsible for many tasks, such an assumption is probably not defensible.<sup>70</sup>

## **Benefits**

OSHA overestimated the benefits of the rule to employers, and did not estimate the benefits of the rule to workers. OSHA estimates that the rule will reduce workplace

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groups. The estimates varied from \$190 to \$900 in the "administrative support except clerical" occupational category, for example.

<sup>66</sup> These consultants were originally asked to develop cost estimates for OSHA's 170 scenarios. They refused in part because they thought OSHA interventions were not representative of standard interventions, and that costs estimates based on the scenarios would overestimate true costs. Instead, they developed average cost estimates for 26 occupational groups based on low cost, low technology interventions that they thought represented standard workplace interventions. OSHA used these estimates in their final cost calculation, explained further in footnote 64. See OSHA (1999b, p. 16 of Chapter V).

<sup>67</sup> OSHA's approach would tend to overestimate the savings from labor and overestimate the overall cost of interventions. The impact of the ratio OSHA uses to adjust the cost estimates of the ergonomists is ambiguous without further information. For example, OSHA assumed that the ratio of average net costs to average gross costs for high cost, high technology interventions is representative of the ratio of average net costs to average gross costs for low cost, low technology interventions. If these ratios are not equal, OSHA probably underestimated the costs.

<sup>68</sup> OSHA estimates that 50% of problem jobs can be fixed by someone with very little ergonomics training, and the other 35% will require a trained ergonomics program manager.

<sup>69</sup> According to OSHA, the 1,500 hours assumption is based on the average number of hours worked by employees in the other 2/3 of the scenarios.

<sup>70</sup> OSHA further assumes that the cost of evaluating job controls is the same in all industries, for all job types. Given that some industries have higher MSD risks than other industries and that the cause of some injuries is better understood than others, this assumption is not defensible. In addition, OSHA assumes that the MSD risk factors are identifiable and are work-related. As is clear from the discussion in the previous section on the cause of MSDs, this is not always the case.

MSDs by 26% relative to 1996 levels over a ten-year period. The decline in workplace injuries could both reduce worker pain and suffering and reduce the cost of medical, insurance, and worker compensation costs to employers and society. OSHA does not estimate a value for reduced worker pain and suffering.<sup>71</sup> OSHA does, however, estimate that the rule will save employers and the rest of society \$9 billion a year in injury-related costs.<sup>72</sup> While it is clear from an evaluation of OSHA's economic analysis of the rule that it overestimated employer benefits, the rule may still have significant worker benefits in terms of reduced pain and suffering. Given that OSHA did not provide a clear description of workplace MSDs, as described earlier in this paper, the potential magnitude of these benefits is unclear.

OSHA overestimated the benefits of the rule to employers because it based its estimate on five flawed assumptions: 1) that the programs implemented as a result of the rule will reduce workplace risk by 50%; 2) that programs to reduce risk are equally effective, regardless of injury or industry; 3) that the studies it used to estimate the benefits of the rule are comparable to the studies; 4) that the rule does not provide workers with the incentive to exaggerate or fake injuries; and 5) that the MSD rate will stay at 1996 levels for the ten-year duration of OSHA's economic analysis.<sup>73</sup> OSHA also did not test the sensitivity of its final estimates to uncertain parameters in its analysis.

**Effectiveness of Ergonomics Programs.** OSHA overestimates the average effectiveness of ergonomics programs, which overestimates the number of injuries OSHA expects the rule to reduce. OSHA assumes that ergonomics programs required by the rule will reduce workplace risk by 50%, and estimates the number of injuries the proposed regulation will reduce based on this assumption. The ergonomics literature suggests that there is serious debate about the effectiveness of various interventions to

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<sup>71</sup>Viscusi (1992), however, provides a widely accepted estimate for the value of an averted injury. Viscusi reviewed all existing labor market studies on the cost of a workplace injury, and determined that the value is between \$25,000 and \$50,000 per injury.

<sup>72</sup> OSHA estimates that employers pay more than \$15 to \$20 billion in workers' compensation costs each year for MSDs, and other associated expenses may increase this total to \$45 to \$54 billion a year. See OSHA (1999a, p. 65769).

<sup>73</sup> OSHA overestimated benefits only if workers are reporting the majority of workplace MSDs. If underreporting of MSDs is a significant problem, as OSHA suggests, then OSHA should recalculate the benefits of the rule to reflect the extent of estimated underreporting. As discussed earlier in this paper, however, OSHA did provide a defensible analysis of the extent of underreporting in its description of the proposed rule.

reduce MSD risk, however, and OSHA's does not provide sufficient support for its assumption in the proposed rule.<sup>74</sup>

OSHA bases its 50% effectiveness assumption on two separate reviews of intervention studies, neither of which provides sufficient evidence to justify OSHA's 50% assumption. OSHA cites the highest estimates of program effectiveness for different injuries from the first review, and ignores the low estimates of program effectiveness.<sup>75</sup> The high estimates are based on the assumption that programs reduce 100% of workplace MSD risk, which is doubtful given evidence that ergonomics programs are sometimes ineffective or fail to reduce all risk.<sup>76</sup> The low estimates of program effectiveness assume that the programs reduce only half of the risk of MSDs from workplace activities, perhaps a more plausible assumption. The low estimates of program effectiveness range from 38% to 47%, which suggests that OSHA's assumption of 50% effectiveness is not conservative, as OSHA claims.<sup>77</sup>

The second review of intervention effectiveness is based the studies in high-risk industries, which introduces selection bias.<sup>78</sup> Programs in these industries may be more effective because the injuries are more frequent, severe, and well understood.<sup>79</sup> Approximately 29% (30) of the studies are conducted in the twenty-one industries with the highest MSD incidence rates (greater than 600 MSDs per 10,000 workers), for example, yet these same high-risk industries represent only 6% of the 342 industries covered by the proposed rule.<sup>80</sup> OSHA also did not include any studies of ergonomics

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<sup>74</sup>Volinn (1999), for example, writes that both the media and the ergonomics literature express dissenting views about whether interventions to reduce the risk of a low-back disorder are effective. He cites a number of studies on both sides of the debate.

<sup>75</sup> The first review, conducted by the National Institute for Occupational Safety and Health, summarizes the results of 600 studies. The results of this review are discussed and presented in a summary table.

<sup>76</sup> See, e.g. Daltroy (1997).

<sup>77</sup> OSHA (1999b, p. 5-6 of Chapter IV).

<sup>78</sup> The second review, conducted by OSHA, summarizes the results of 104 studies. Each of the 104 studies is described in a table in the *Federal Register* notice of the proposed rule.

<sup>79</sup> According to BLS, nine industries, each having at least 100,000 injuries, accounted for about 1.7 million injuries, or 30% of the 5.7 million total injuries that resulted in lost worktime, medical treatment other than first aid, loss of consciousness, restriction of work or motion, or transfer to another job in 1997. See Bureau of Labor Statistics (1999).

<sup>80</sup> Only 22% of the studies OSHA reviewed are in industries with less than 300 MSDs, yet 65% of the industries covered by the proposed rule have MSD incidence rates less than 300 MSDs per 10,000 workers. Approximately 46% (48) studies are conducted in the 101 industries with less than 600 MSDs per 10,000 workers but more than 300 MSDs. Eighteen of the thirty studies are in the automobile industry,



programs for which there was no observed effect in this review.<sup>81</sup> Finally, the review contains a number of studies that were not peer-reviewed, and OSHA did not provide evidence that results of the studies are robust.<sup>82</sup>

**Program Effectiveness Varies.** Ergonomics program effectiveness is dependent on the type of injury and the nature of the industry, if not the specific job. OSHA did not show that the 50% effectiveness estimate applies to all MSDs, industries, and jobs. Even a cursory review of the ergonomics literature reveals that there are significant differences in the effectiveness of ergonomics programs between industries, as well as between programs designed to reduce different types of injuries. It is therefore inappropriate to apply one effectiveness estimate to all ergonomics programs.

**Link Between Cost and Benefit Estimates.** OSHA does not link the studies it used to estimate the benefits of the proposed rule to the costs of the rule. It reviewed over 100 studies as part of its benefits analysis, yet provides no evidence of costs based on these studies. The cost of achieving the level of risk reduction that OSHA estimates will result from the rule is therefore unclear. As discussed in the previous section, OSHA analyzed the costs of ergonomics programs by averaging estimates from three consultants for 26 different occupations. OSHA does not, however, describe whether the programs on which the consultants based their estimates are comparable to the programs on which OSHA based its estimates of the effectiveness of ergonomics program.

**Incentive to Exaggerate or Fake Injuries.** The rule could provide workers with an incentive to take more days off work, exaggerate the nature of their injury, or file

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which has a MSD incidence rate of 1,221 MSDs per 10,000 workers. Industries with less than 300 MSDs per 10,000 workers account for 73% of employees in all establishments, relative to 22% for industries with between 300 and 600 MSDs per 10,000 workers, and 5% for industries with over 600 MSDs per 10,000 workers. OSHA (1999a, Table VIII-1) and OSHA (1999a, p. 65986).

<sup>81</sup> See, e.g. Daltroy et al. (1997). This recent *New England Journal of Medicine* study showed, for example, that educational programs to reduce back injuries among postal workers sometimes have no effect.

<sup>82</sup> A number of the studies OSHA reviewed came from news sources that appear to rely on information provided by ergonomics program managers for estimates of the effectiveness of the ergonomics programs. These managers have the incentive to overestimate the effectiveness of the program because it is a measure of their personal success on the job. Furthermore, many of these programs, in addition to programs reported in the literature, are programs that companies adopted voluntarily and therefore may be more effective than required programs. OSHA also relied on some peer-reviewed studies with results that have been challenged elsewhere. OSHA included a study by Garg and Owen (1992), for example, that Volinn (1999) challenged in the ergonomics literature because it did not include a contemporaneous control group and did not randomize study subjects. Garg and Owen (1992) conducted a study of the effectiveness of patient handling devices nursing home workers. They found the reportable back injury rate declined 43%.

more fraudulent claims than they would in the absence of the rule. The rule provides workers diagnosed with a MSD with compensation at 90% of after tax wages and 100% compensation for restricted work. These benefits represent an unspecified increase in benefits relative to current benefits from workers' compensation programs. OSHA does not adequately address the impact the increase in benefits may have on the number and duration of claims, referred to as moral hazard.<sup>83</sup> OSHA further does not address why employers should compensate workers more for MSD injuries than for other workplace injuries, such as burns, broken limbs, or sprains.

**Validity of Assuming Continuous 1996 MSD Rate.** OSHA uses its 1996 estimate of workplace MSDs as the baseline for its analysis of the number of MSDs the proposed rule will reduce over a ten-year period. It assumes that MSDs will remain at this level. OSHA does not factor in the observed 5% annual decline in MSDs since 1992, discussed earlier in this paper. If OSHA factors some portion of this decline into its analysis, it would result in a lower estimate of the injuries reduced as a result of the rule. This would lower estimates of the costs of the rule as well as the benefits, although it will reduce the cost estimate more than the benefit estimate.

## **V. Improve Worker and Employer Access to Information about MSDs**

OSHA should generate better information about the nature, severity, and causes of MSDs. It and can use this information to target serious MSDs that employers can reduce at low cost. OSHA also should provide information to workers and employers about risk, intervention costs, intervention effectiveness, and the causes of specific MSDs. Improved access to information will allow workers, as well as employers, to take action to reduce the risk of injury. A worker, for example, could switch jobs or make lifestyle changes, such as an increasing exercise. If employer savings from ergonomics programs that OSHA cites in the proposed rule exist, such as increased worker

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<sup>83</sup> Increases in the number of claims and duration of claims as a result of an increase in benefits is well-documented. See Krueger (1990a), Krueger (1990b), Viscusi (1992), and Butler and Worrall (1991). To date, however, scholars have not been able to disassociate what part of the increase is a result of legitimate injuries that workers chose not to report, and what part is due to the effect of moral hazard. As a result, experts suggest that the empirical evidence now available is not sufficiently precise to determine how the response of workers will affect economic efficiency. See Viscusi (1992) and Krueger (1990a).

productivity and worker compensation savings, improving employer access to useful information about the rewards and effectiveness of such programs should encourage employers to adopt them.

OSHA should provide on-line information about MSDs and fill in key information gaps in the literature. While information on ergonomics programs is available, there is no central, reliable on-line source of information about ergonomics programs. OSHA should provide information specific to job types, industries, and injuries, as well as evaluate the quality of the research findings. If necessary, OSHA could commission studies to fill in key information gaps, such as practical information about program effectiveness by job type or information about the cause of back injuries by industry.

The number of MSDs in the workplace is declining without the ergonomics rule, and OSHA must carefully weigh the benefits and costs of government intervention to reduce risk. OSHA could play a useful role in providing information, and possibly targeting efforts to reduce serious MSDs that employers can reduce at low cost. Unless OSHA effectively addresses some of the more serious flaws in the proposed rule, however, OSHA should not proceed with the final regulation.

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