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The IAIABC Journal is published two times per year by the International Association of Industrial Accident Boards and Commissions, 5610 Medical Circle, Suite 24, Madison, WI, 53719. It publishes twice a year in conjunction with the major events of the IAIABC. Spring issues of the Journal publish at the time of the All Committee Conference, and Fall issues publish at the time of the Annual Convention.

Each IAIABC member will receive one print copy as a benefit of membership, for library use. Subscriptions for additional print copies can also be obtained:

IAIABC Members: $20 per single issue or $30 per year
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We’ve all become accustomed to statutory law, decisional law and the administrative rules that are generated in response to them. Most of us are less familiar with the possibility that a non-governmental entity will change the environment in which we work, and in which the rights of claimants are adjudicated. Yet, that seems to have occurred, at least for some jurisdictions, in December 2007, when the American Medical Association (AMA) released the Sixth Edition of its Guidelines to the Evaluation of Permanent Impairment (Guides).

There are 15 states that “automatically” adopt the new Guides, by virtue of the wording of their statutes. Other states will consider adoption, because the Guides are the newest and best effort of the AMA to provide guidance in this important area. Without passing any judgment on the existence, extent, or impact of any of these issues, there are a number of potential areas of discontinuity between existing state law or policy and the Sixth Edition of which regulators ought to be aware. The areas are discussed in detail by the authors of the first article featured this issue, and outlined below with their corresponding article page numbers.
• The Sixth Edition of the Guides is a substantial departure from earlier editions, both in approach and philosophy – pages 27, 52. Specifically, the new edition “provides greater weight to functional assessment than do prior Editions” – page 26.

• Some impairment ratings will be lower than in previous editions, while some will be higher, but the overall ratings between the Fifth and Sixth Editions appear to be similar – pages 52-53, 41, 44, and 47.

• The empirical validity of the impairment percentages provided in the Sixth Edition awaits “empirical testing” – page 26.

• According to the authors, it is probable that there will be corrections that will appear subsequently in a published “Errata.” Users of the initial printing on the Guides will need to also reference the Errata, which may complicate the adjudication of some cases rated in this initial phase.

• There are significant differences in the way that impairment ratings for pain are derived, as compared to the Fifth Edition – page 36.

• Impairment rating is based on the outcomes of treatment rather than the treatment itself. Therefore, surgeries do not alter impairment unless they affect the patient’s function (as in a spinal fusion affecting spinal motion segment integrity) – page 45. It is possible that treatment patterns will be affected.

• Mental and behavioral disorders are handled differently than in previous editions, and quantitative (numeric) impairment values are now provided. The impact and reliability of this feature has not yet been determined – pages 49-51.

• The emphasis on diagnosis as the basis for assignment of a condition to an impairment rating class may give rise to increased incidence of disputes concerning the correct diagnosis – pages 27, 31. Similarly, the Sixth Edition relies heavily on a causal analysis of the physical condition and does not rate common degenerative findings or other findings that are not causally related to the occupational disease or injury – pages 24, 46. This feature may give rise to disputes concerning causality.
• The Guides are still not to be used for direct measurement of work participation restrictions – page 24. However, they attempt to make greater use of assessments of functionality than previous editions – page 25. This leads to the potential for discontinuity with state law schemes that already attempt to factor in functional ability as part of a conversion formula to derive “disability” from “impairment.” This potential for discontinuity should be carefully assessed – page 19. However, the adjustment for function for musculoskeletal injuries is a “non-key” adjustment, limiting the possibility of “double dipping” between the state formulas and the Guides – page 25.

• The Sixth Edition may conflict with state law, rules or precedent concerning the administration of medical care, including impairment rating, and may also impact the cost of impairment ratings:
  • The utilization of chiropractors for impairment ratings is restricted to the spine, which may conflict with local law, rule or practice – page 34 (note footnote on recent ruling).
  • According to the authors, the utilization of treating physicians as raters of impairment is somewhat discouraged on the grounds of potential bias, and the ratings given by treating physicians are subject to “greater scrutiny” – page 35. This observation in the article does not reflect a restriction in the Guides themselves that would cause a potential direct legal conflict.
  • Non-physician evaluators may analyze impairment ratings and offer opinion as to the appropriateness of the rating procedure – page 34.
  • Physicians will need significant training to utilize the new Guides. The training may delay adjudications of early cases in states where automatic adoption is mandated, chill the open choice of raters that is a feature of some state laws, and be passed on as an additional cost driver for impairment ratings – page 35.
• Assessment under the *Guides* will require rater utilization of assessment tools to evaluate patient self-reports, questionnaires and empirical validation for the collection of functional assessment data – pages 26-27, 36-37, 38, 42-44, 50, and 52.

In the next issue of the *Journal* we will feature a series of articles bringing important issues about the new *Guides* to your attention. **We invite any and all potential commentators to contact the *Journal*, and discuss potential articles with us.** Particularly welcome are:

• Physicians and other health care professionals that may wish to comment on perceived strengths and weaknesses of the new *Guides* or raise questions about their application or effect.

• Policymakers and regulators that have questions about how the new *Guides* interact with other features of state laws and regulations.

• Claims administrators, risk managers and insurance industry personnel that wish to comment on the costs and benefits of implementation of the new *Guides*.

• Researchers interested in studying aspects of the impact of the new *Guides*.

• Attorneys/judges that wish to comment on issues relating to how the *Guides* may change the frequency, subject matter, and relative intractability of benefit disputes.

It is the intent of the *Journal* to provide the workers’ compensation industry with up-to-date information concerning the Sixth Edition of the *Guides* and a neutral forum in which their impact on the industry can be intelligently, dispassionately, and openly assessed. All potential contributors to this discussion are urged to contact the *Journal* to discuss their participation.
AMA Guides Sixth Edition: New Concepts, Challenges and Opportunities

Christopher R. Brigham*
Elizabeth Genovese**
Craig Uejo***

Introduction

The American Medical Association (AMA) Guides to the Evaluation of Permanent Impairment (Guides) serves as the standard for defining impairment in most workers’ compensation cases. The Guides Sixth Edition, published in December 2007, introduces new approaches to rating impairment based on a modification of the conceptual framework of the

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History and use of the Guides

The AMA Guides is the basis for defining impairment in the vast majority of workers’ compensation jurisdictions, and the use of the most recent edition will be required immediately by certain state jurisdictions and for the Federal Employees Compensation Act program (FECA), Energy Employees Occupational Injury Compensation Program Act (EEOICPA) and Longshore and Harbor Workers’ Compensation Act (LSHWCA) cases.

The Guides started in 1958 with publication of the article, “A Guide to the Evaluation of Permanent Impairment of the Extremities and Back” (American Medical Association, 1958); this was followed by additional guides published in the Journal of the American Medical Association. In 1971 a compendium of 13 guides became the First Edition. The Second Edition was published thirteen years later in 1984, with publication of the Third Edition in 1988. The Third Edition was the first to use the Swanson (1964) methodology, which assigned discreet impairment ratings to specific range of motion (ROM) deficits of the upper extremities. The Third Edition was replaced two years later by the Third Edition, Revised (AMA, 1990), which is still used by the State of Colorado for workers’ compensation cases.

The Fourth Edition, published in 1993, provided many refinements, including the Diagnosis-Related Estimates (DRE) or “injury” model to the evaluation of spinal injuries, alternative approaches to assessing lower extremity impairment, and a pain chapter. The DRE model was unique in allowing for assignment of an impairment rating based solely on the diagnosis, even if maximum medical improvement (MMI) had not yet been reached. The Fourth Edition is still used for assessing workers’ compen-

Many states are legislatively required the use of the “most recent edition” of the Guides either by statute or code; therefore, states that are expected to implement the Sixth Edition immediately include Alaska, Hawaii, Kentucky, Louisiana, Mississippi, Montana, New Hampshire, New Mexico, Ohio, Oklahoma, Pennsylvania, Rhode Island, Tennessee, Vermont, and Wyoming.¹ The most recent edition is also expected to remain the standard for automobile casualty and personal injury cases, both domestically and internationally. Some of the countries abroad that use the Guides include Australia, Canada, Hong Kong, Korea, New Zealand, and South Africa. The probable use of the Sixth Edition in US state workers’ compensation cases is depicted in Figure 1. The Sixth Edition will be the immediate new standard for all federal cases.

Challenges and criticisms of prior editions

There are many challenges associated with the use of the Guides, including criticisms of the Guides themselves, the use of impairment rating numbers, and a high error rate (Burd, 1980; Clark et al., 1988; Hinderer, Rondinelli, & Katz, 2000; Pryor, 1990; Rondinelli et al., 1997; Rondinelli & Duncan, 2000; Rondinelli & Katz, 2002; Spieler, Barth, Burton, Himmelstein, & Rudolph, 2002). Previous criticisms include:

- Failure to provide a comprehensive, valid, reliable, unbiased, and evidence-based rating system.
- Impairment ratings did not adequately or accurately reflect loss of function.
- Numerical ratings were more the representation of “legal fiction than medical reality.”
Therefore, the following changes were recommended:

- Standardize assessment of Activities of Daily Living (ADL) limitations associated with physical impairments.
- Apply functional assessment tools to validate impairment rating scales.
- Include measures of functional loss in the impairment rating.
- Improve overall intra-rater and inter-rater reliability and internal consistency.

Studies of the Fifth Edition have demonstrated poor inter-rater reliability and revealed that most impairment ratings are incorrect, more often rated significantly higher than appropriate (Brigham, Uejo, Dilbeck, & Walker, 2006). While treating physicians, who by definition are advocates for their patients, have been particularly prone to overrate impairment, physicians who have not been adequately trained in the use of the Guides also commonly provide erroneous ratings, and it is more common for rating errors to increase rather than decrease ratings.

**Sixth Edition approaches and developmental process**

The Guides defines the process for evaluating impairment. Clinical discussions among physician colleagues regarding potential severity of an illness or injury typically involve four basic points of consideration:

1. What is the problem (diagnosis)?
2. What symptoms and resulting functional difficulty does the patient report?
3. What are the physical findings pertaining to the problem?
4. What are the results of clinical studies?

In a similar manner, these same basic considerations are used by the physicians to evaluate and communicate about impairment. The Sixth Edition expands the spectrum of diagnoses recognized in impairment rating,
considers functional consequences of the impairment as a part of each physician's detailed history, refines the physical examination, and clarifies appropriate clinical testing.

**International Classification of Functioning, Disability and Health**

The Sixth Edition uses the framework based upon the International Classification of Functioning, Disability and Health (ICF), a comprehensive model of disablement developed by the World Health Organization. This framework, illustrated in Figure 2, is intended for describing and measuring health and disability at the individual and population levels. The ICF is a classification of health and health related domains that describe body functions and structures, activities and participation. The domains are classified from body, individual and societal perspectives. The ICF systematically groups different domains for a person in a given health condition (e.g. what a person with a disease or disorder does do or can do). Functioning is an umbrella term encompassing all body functions, activities and participation; similarly, disability serves as an umbrella term for impairments, activity limitations or participation restrictions. Since an individual's functioning and disability occurs in a context, the ICF also includes a list of environmental factors.

The following definitions are used in the ICF to facilitate communications and standardization:

- **Body functions**: Physiological functions of body systems (including psychological functions).
- **Body structures**: Anatomic parts of the body such as organs, limbs, and their components.
- **Activity**: Execution of a task or action by an individual.
- **Participation**: Involvement in a life situation.
- **Impairments**: Problems in body function or structure such as a significant deviation or loss.
• **Activity limitations**: Difficulties an individual may have in executing activities.

• **Participation restrictions**: Problems an individual may experience in involvement in life situations.

**FIGURE 2**
ICF Model of Disablement

The ICF model reflects the dynamic interactions between an individual with a given health condition, the environment, and personal factors. Impairment, activity limitations, and limitations in participation are not synonymous; an individual may have impairment and significant limitations in most activities but be able to participate in a specific life situation of relevance, minor impairment and activity limitations with inability to participate in a specific life situation, or any other permutation of these three factors. An example used in the *Guides* is that of Christopher Reeve who suffered a traumatic spinal cord injury with associated high
impairment, however he remained exceptional in his accomplishments. In contrast, other patients may portray themselves as being disabled and ill when there are no objective findings that support such a conviction.

Use of the ICF model does not indicate that the Guides will now be assessing disability rather than impairment. Rather, the incorporation of certain aspects of the ICF model into the impairment rating process reflects efforts to place the impairment rating into a structure that promotes integration with the ICF constructs for activity limitations and limitations in participation, ultimately enhancing its applicability to situations in which the impairment rating is one component of the “disability evaluation process.” The potential impact of the changes with the Sixth Edition in these formulas needs to be carefully assessed. If functional deficits are adequately considered in a Sixth Edition rating, than it may no longer be necessary to modify the rating to incorporate functional loss.

**Impairment classes and diagnosis-based grids**

The ICF classification uses five impairment classes, which permits rating of patients who range from having no problems to having significant problems. In the Sixth Edition “diagnosis-based grids” were developed for each organ system. These grids use commonly accepted consensus-based criteria to classify most diagnoses relevant to a particular organ or body part into five classes of impairment severity, ranging from Class 0 (normal) to Class 5 (very severe). The final impairment is determined by adjusting the initial impairment rating given by factors that may include physical findings, the results of clinical tests, and functional reports by the patient. The basic template of the diagnosis-based grid is common to most organ systems and chapters, creating greater internal consistency between chapters than was seen formerly.

The Preface to the Sixth Edition (AMA, 2008, p. iii) states that the features of the new edition include:

- A standardized approach across organ systems and chapters.
- The most contemporary evidence-based concepts and terminology of disablement from the ICF.
• The latest scientific research and evolving medical opinions provided by nationally and internationally recognized experts.
• Unified methodology that helps physicians calculate impairment ratings through a grid construct and promotes consistent scoring of impairment ratings.
• A more comprehensive and expanded diagnostic approach.
• Precise documentation of functional outcomes, physical findings, and clinical test results, as modifiers of impairment severity.
• Increased transparency and precision of the impairment ratings.
• Improved physician inter-rater reliability.

The Sixth Edition reflects movement toward these goals; however, such change is not immediately achieved. Thus it should be considered a step in the evolution of the Guides rather than as an end point in and of itself. Many of the new approaches provided in the Guides are novel and the full extent of the strengths and weaknesses are not yet known.

Development process

The Sixth Edition process involved many participants – including physicians who use the Guides and the staff of the AMA, all of whom were tasked to develop the Sixth Edition in the context of the aforementioned principles. The process was guided by an Editorial Panel and an Advisory Committee, and features an open, well-defined, and tiered peer review process. A Delphi panel approach was used to achieve consensus. When there was not a compelling rationale to alter impairment ratings from what they had been previously, consistency of the ratings with those provided in prior editions was the default. The Section Editors led a group of 53 specialty-specific, expert contributors in developing the chapters and in conjunction with the Senior Contributing Editor wrote considerable portions of the revised chapters. The review process involved over 140 physicians, attorneys, and other professionals.
Sixth Edition structure

The Sixth Edition is 634 pages in length (the Fifth Edition is 613 pages) and is comprised of 17 chapters. Chapter 1, Conceptual Foundations and Philosophy, and Chapter 2, Practical Applications of the Guides, define the overall approaches to assessing impairment. Most impairment ratings are performed for musculoskeletal painful conditions; therefore, the most commonly used chapters will be Chapter 15, The Upper Extremities, Chapter 16, The Lower Extremities, and Chapter 17, The Spine and Pelvis. Chapter 3, Pain-Related Impairment, Chapter 13, The Central and Peripheral Nervous System, and Chapter 14, Mental and Behavioral Disorders, will also be frequently referenced. Chapters 4 to 12 focus on other organ systems and structures. To understand the Sixth Edition it is useful to review some of the content by examining the chapters.

Chapter 1 – Conceptual Foundations and Philosophy

The Sixth Edition commences with Section 1.1 - History of the Guides (pp. 1-2), describing a history of compensation for personal injury and disability that dates to antiquity. Section 1.2 - New Direction for the Sixth Edition (p. 3), presents previous criticisms of the Guides and five new axioms of the Sixth Edition. The five new axioms of the Sixth Edition (p. 2) are:

1. The Guides adopts the terminology and conceptual framework of disablement as put forward by the International Classification of Functioning, Disability, and Health.
2. The Guides becomes more diagnosis based with these diagnoses being evidence-based when possible.
3. Simplicity, ease-of-application, and following precedent, where applicable, are given high priority, with the goal of optimizing inter-rater and intra-rater reliability.
4. Rating percentages derived according to the Guides are functionally based, to the fullest practical extent possible.
The Guides stresses conceptual and methodological congruency within and between organ system ratings.

The contemporary model of disablement adopted by the Sixth Edition is the International Classification of Functioning, Disability, and Health (ICF), as explained in Section 1.3 (pp. 3-6). “Disablement” is now reflecting the process of disability. The traditional model of disablement previously relied upon, the International Classification of Impairments, Disabilities, and Handicaps (ICIDH), presented by the World Health Organization more than a quarter century ago, is characterized as a simplistic model providing a unidirectional depiction of the relationship among pathology, impairment, disability, and handicap, without recognizing the dynamic relationships among these factors nor the role of important personal and environmental modifiers. Personal factors such as empowerment and motivation have profound impact on the experience of disability, as do environmental factors, such as influences by other people and ability to accommodate the individual.

There are revisions to definitions for impairment and disability. The Sixth Edition defines impairment as “a significant deviation, loss, or loss of use of any body structure or body function in an individual with a health condition, disorder, or disease” (AMA, 2008, p. 5). This is more refined than the definition in the Fifth Edition which was “a loss, lose of use, or derangement of any body part, organ system, or organ function” (AMA, 2001, p. 601); the Sixth Edition includes the term “significant” and then adds the phrase “in an individual with a health condition, disorder, or disease.” Disability is defined as “activity limitations and/or participation restrictions in an individual with a health condition, disorder, or disease,” reflective of the ICF terminology (AMA, 2008, p. 5). The Fifth Edition definition of disability was “alteration of an individual’s capacity to meet personal, social or occupational demands, or statutory or regulatory requirements because of an impairment” (AMA, 2001, p. 600).

Impairment rating is defined as a physician-provided process that attempts to link impairment with functional loss and continues to be defined as a “consensus-derived percentage estimate of loss of activity re-
flecting severity for a given health condition, and the degree of associated limitations in terms of activities of daily living (ADLs)” (AMA, 2008, p. 5). The Sixth Edition differs in stressing the importance of causation assessment in performing a rating, as it is first necessary to determine if the health condition is related to an allegedly causal event or exposure. This represents a concerted attempt to prevent, or at least reduce, the common error of including factors that are not causally related to an injury in the rating (for example rating spinal degenerative disease not caused by an injury).

Since impairment ratings may be used inappropriately as a direct correlate of disability, the Sixth Edition addresses this issue by explaining:

The relationship between impairment and disability remains both complex and difficult, if not impossible, to predict. In some conditions there is a strong association between level of injury and the degree of functional loss expected in one’s personal sphere of activity (mobility and ADLs). The same level of injury is in no way predictive of an affected individual’s ability to participate in major life functions (including work) when appropriate motivation, technology, and sufficient accommodations are available. Disability may be influenced by physical, psychological, and psychosocial factors that can change over time (Ibid., pp. 5-6).

The Sixth Edition specifically states, as did prior editions, that “the Guides is not intended to be used for direct estimates of work participation restrictions. Impairment percentages derived according to the Guides’ criteria do not directly measure work participation restrictions” (Ibid., p. 6). It stresses that “the intent of the Guides is to develop standardized impairment ratings which involves defining the diagnosis and associated loss at maximum medical improvement, enabling a patient with an impairment rating to exit from a system of temporary disablement, and provide diagnosis and taxonomic classification of impairment as a segue into other systems of long-term disability” (Id.).
In other words, the process of assigning an impairment rating requires the evaluator to clearly delineate the diagnostic criteria (based on the history, including prior clinical course), physical examination findings, current and prior diagnostic test results, and functional status that places the patient in a given impairment class and warrants assignment of a specific number within the options for that class, with the understanding the provision of an impairment rating does not directly equate to a permanent disability rating. However, with the rating having more of a functional basis, this may impact the ratings and have consequences for how they are used.

Impairment is to reflect interference in activities of daily living; this consideration is expanded in the Sixth Edition by defining two domains of human personal function: mobility and self-care (illustrated in Figure 3).

Mobility involves transfer (movement of one’s body position while remaining at the same point in space) and ambulation (movement of one’s body from one point in space to another). The Sixth Edition differentiates activities of daily living that relate to self-care performed in one personal sphere (e.g., bathing and showering, bowel and bladder management, dressing, eating, feeding, functional mobility, personal device care, personal hygiene and grooming, sexual activity, sleep/rest, toilet hygiene) and “instrumental” ADLs that are complex self-care activities (e.g., financial management, medications, meal preparation) which may be delegated to others. Mobility and self-care activities may be performed independently or may require adaptive aids or helper assistance. The highest level of independence with which a given activity is consistently and safely performed is considered the functional level for that individual. This concept is critically important since function is a modifier of impairment in the Sixth Edition, and it is therefore important that raters be more precise in asking questions (or using questionnaires) in order to assess the ability to perform activities relevant to an overall assessment of function. In the Sixth Edition, adjustment for function is a “non-key” factor for musculoskeletal injuries, and therefore typically results in minor adjustment, if any, to the final impairment number. The full impact of functional considerations will be revealed in time.
Measurement issues are important factors in defining impairment and are discussed in Section 1.4 (pp. 6-8). Previous studies examining the validity of musculoskeletal impairment ratings have revealed equivocal results between impairment rating and functional losses. The Guides attempt to balance science and clinical judgment, as explained in Section 1.5 (pp. 8-9). Impairment ratings continue to be based largely on consensus and expert opinion since there is not yet adequate methodology or data to relate these ratings to functional loss. The validity of impairment percentages defined in the Sixth Edition must await further empirical testing. As much as possible the approaches in the Sixth Edition focused on simplicity and brevity (Section 1.6, p. 9), though it remains difficult to find an appropriate balance between these goals and providing the information (often complex) required in order to increase accuracy and reliability.

The Sixth Edition provides greater weight to functional assessment than do prior editions. The full impact of this approach is yet to be determined. Section 1.7 (pp. 9-11) discusses earlier approaches that have worked well (such as the New York Heart Association classification). Guidance is then provided on the use of self-report assessment tools and...
the need for empirical validation through in-office applications. The rating physician is to consider all available information; however, there is a clear mandate to evaluate the reliability of the information presented, as it is noted that patients may under-report or over-report their difficulties. As the Guides are often used in workers’ compensation cases and other litigation settings as the basis for monetary awards, over-reporting severity of problems is a common challenge. Therefore the Sixth Edition states that “examiners must exercise their ability to observe the patient perform certain functional tasks to help determine if self-report is accurate” (AMA, 2008, p. 10). In other words, if the examinee reports loss of certain abilities on a questionnaire or during the clinical interview, the examiner should observe the patient to see if these losses are consistent with the physical examination, diagnostic tests, and/or functional limitations that are “usually” associated with a given disorder; inconsistent and invalid data should not be used to define impairment. The use of functional assessment tools varies by chapter.

Section 1.8, The Need for Internal Consistency and a Uniform Template (pp. 11-16), explains the process used to develop a generic template for impairment grids that could be used across various organ systems to enhance uniformity and consistency. The Five Scale ICF Taxonomy used by the ICF and adopted by the Guides results in Classes 0 to 4:

1. No problem
2. Mild problem
3. Moderate problem
4. Severe problem

Impairment percentage ranges are provided for each class; the impairment values are dependent on the organ system and structure. Diagnosis and other historical or clinical information typically serve as the key factor used to place a patient within a specific class, although there are some exceptions. Each class is associated with a corresponding range of available impairment ratings, typically defined into five impairment grades.
(A to E), with the mid-range grade (C) serving as the default value. The grade may be modified by non-key findings which may include functional history, physical examination findings, and the results of clinical studies, although whether this occurs depends upon whether these factors fall into the same class as did the initial key factor.

The structure of a typical diagnosis-based grid is presented in Figure 4. The grid used for the extremities (which differs in several ways) is presented in Figure 5. Not all chapters use the same key factors, and some chapters use information other than the physical examination, test results, and functional limitations in assigning a specific rating (e.g., the endocrine chapter considers burden of treatment compliance). Nonetheless, the system used in the Sixth Edition represents a dramatic change from prior editions, especially with regards to the non-musculoskeletal chapters, as the classes previously were listed as ranges of impairment ratings with little or no specific guidance given regarding how to choose a discreet numerical value to reflect a patient’s impairment. This significantly contributed to the lack of inter-rater (and even intra-rater) reliability seen with use of prior editions, which should be considerably reduced. The generic system was used as the basis for most of the non-musculoskeletal chapters (with the exception of the nervous system chapter), and was modified for use in rating the extremities and spine (see Figure 4).
### FIGURE 4
Diagnosis-Based Grid Template

<table>
<thead>
<tr>
<th>Diagnostic Criteria</th>
<th>Class 0</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANGES</td>
<td>0%</td>
<td>Minimal%</td>
<td>Moderate%</td>
<td>Severe%</td>
<td>Very Severe%</td>
</tr>
<tr>
<td>GRADE</td>
<td>A B C D E</td>
<td>A B C D E</td>
<td>A B C D E</td>
<td>A B C D E</td>
<td></td>
</tr>
<tr>
<td>History</td>
<td>No problem</td>
<td>Mild problem</td>
<td>Moderate problem</td>
<td>Severe problem</td>
<td>Very severe problem</td>
</tr>
<tr>
<td>Physical Findings</td>
<td>No problem</td>
<td>Mild problem</td>
<td>Moderate problem</td>
<td>Severe problem</td>
<td>Very severe problem</td>
</tr>
<tr>
<td>Test Results</td>
<td>No problem</td>
<td>Mild problem</td>
<td>Moderate problem</td>
<td>Severe problem</td>
<td>Very severe problem</td>
</tr>
</tbody>
</table>

Once the history is used to place a patient into a given impairment class (at the default level of Grade C), the class ratings for other relevant factors (which will differ between body parts and/or organ systems) will be used to shift the rating to a higher or lower grade. The degree to which this occurs will ordinarily be based on the number of classes by which the additional factor is classified as representing a higher or lower impairment than the key factor. For example, if the history is the key factor and places an individual in Class 2, Class 1 physical findings (one below the originally assigned class) will shift the rating down to grade B, and then with Class 4 test results (two above the original class), a net change of +1 (-1 + 2) results in a final rating in Class 2 – Grade D.

**Spine and extremity rating**

The system used for the spine and extremities differs in that initial placement in the grid used to refine the impairment rating is based upon the diagnosis alone, and then modified based upon the results obtained from matching the patient’s clinical presentation to information in additional adjustment grids.
FIGURE 5
Diagnosis-Based Grid Structure for Extremities

<table>
<thead>
<tr>
<th>Diagnostic Criteria</th>
<th>Class 0</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RANGES</strong></td>
<td>0%</td>
<td>1%-13%</td>
<td>14%-25%</td>
<td>26%-49%</td>
<td>50%-100%</td>
</tr>
<tr>
<td><strong>GRADE</strong></td>
<td>A B C D E</td>
<td>A B C D E</td>
<td>A B C D E</td>
<td>A B C D E</td>
<td></td>
</tr>
</tbody>
</table>

**Soft Tissue**

<table>
<thead>
<tr>
<th>(Diagnosis description – general)</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
</tr>
</tbody>
</table>

**Muscle / Tendon**

<table>
<thead>
<tr>
<th>(Diagnosis description – general)</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
</tr>
</tbody>
</table>

**Ligament / Bone / Joint**

<table>
<thead>
<tr>
<th>(Diagnosis description – general)</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
<th>No significant objective findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
<td># # # # (Diagnosis – specific definition)</td>
</tr>
</tbody>
</table>

For each of the non-key factors there are definitions of the severity of the findings, which translate to the grade modifier (class equivalent) of these findings. This is reflected in the Adjustment Grid: Summary (Figure 6) and tables providing specific definitions for defining the grade modifier values for functional history, physical examination and clinical findings.
If the grade modifier number of the non-key factors is the same as the class number assigned by diagnosis, the default impairment value associated with grade C is used to define the impairment. The grade may be adjusted by comparing the relative difference between the class assigned by the key factor and the classes assigned by the non-key factors. Unreliable non-key factors are not used to modify the rating, and in the musculoskeletal chapters only the most significant diagnosis for an extremity or spine is modified by functional history.

It is possible that some workers’ compensation jurisdictions will modify the approach to functional adjustment, either requiring all diagnoses to be modified or prohibiting functional adjustments. For example, some jurisdictions may want to permit functional adjustments for all diagnoses to provide more of an approximation of the functional loss with an injury; other jurisdictions may prefer to retain an approach more consistent with a prior impairment assessment model. Data analysis and modeling of cases may provide more insight to the impact of functional adjustments.
Since class assignment is made solely by the diagnosis and associated clinical information, and that non-key factors will not result in impairment lower or higher than the values associated with that condition, appropriate class assignment is the most critical factor. With the Fourth and Fifth Editions it appears that some patients and raters attempt to inflate rating by reporting findings that result in higher ratable impairment, such as demonstrating less joint motion or less strength than actually exists. With the Sixth Edition it is more likely that controversies will result from the interpretation of diagnoses and clinical information that results in class assignment since this will have more dramatic impact on the impairment values. For example, with spinal impairment assessments it will be important to determine if there are objective findings of disk herniations and radiculopathy, two of the critical factors that define the impairment class. Thus, it is anticipated that physicians may attempt to utilize certain diagnoses that will result in higher or lower ratings. Although for a specific region typically only the most significant diagnosis is rated, it is anticipated that some physicians may want to rate using multiple diagnoses with resultant inflation of the rating. Challenges may also occur with differing opinions of the adjustment factors.

Chapter 2 – Practical Application of the Guides

Chapter 2 outlines the key concepts, principles, and rationale underlying the application of the Guides; therefore it is essential that all participants understand this content. With prior editions, erroneous ratings often occur as a result of physicians failing to follow rules defined in Chapter 2. Fourteen fundamental principles are defined and many of these principles have significant impact on the rating process. These principles, as presented in the first printing, are summarized in Table 1.
TABLE 1
Summary of Fundamental Principles*

1. Chapter 2 preempts everything in subsequent chapters that conflicts with or compromises the principles.

2. No impairment may exceed 100% whole person permanent impairment nor may impairment extend the maximum assigned to an organ or extremity.

3. All regional impairments are combined at the same level first and then regional impairments are combined at the whole person level.

4. Impairments must be rated per the chapter relevant to the organ or system where the injury primarily arose or where the greatest dysfunction remains.

5. Only permanent impairment may be rated and only after maximum medical improvement is certified.

6. A licensed physician must perform impairment evaluations and chiropractic doctors should restrict ratings to the spine.**

7. A valid impairment evaluation report must contain the three step approach of clinical evaluation, analysis of findings, and discussion of how the impairment rating was calculated.

8. The evaluating physician must use knowledge, skill, and ability generally accepted by the medical scientific community when evaluating an individual, to arrive at the correct impairment rating.

9. The *Guides* are based on objective criteria and if findings conflict with established medical principles they cannot be used to justify an impairment rating.

10. Motion and strength determinations should be assessed carefully for self-inhibition.

11. Ratings of future impairment are not provided.

12. If there is more than one method to define impairment, the method producing the higher rating must be used.

13. Subjective complaints alone are generally not ratable.

14. Impairment ratings are rounded to the nearest whole number.

* Based on AMA Guides Sixth Edition, Table 2-1, p. 20

**Note this has been revised, as explained in the article.
The principles in Table 1 were developed to improve inter-rater reliability. The statement that “chiropractic doctors should restrict ratings to the spine” has resulted in controversy and item 6 has been revised, removing that restriction.²

Section 2.2 (pp. 21-23) explains the concept of the whole body approach to impairment ratings. Although most ratings are provided as whole person permanent impairments, some jurisdictions require regional impairment values, and these continue to be supplied in order to serve the needs of these jurisdictions. The hierarchical relationship of extremity ratings to whole person ratings remains, with total loss of an upper extremity equaling 60% whole person permanent impairment and total loss of the lower extremity equaling 40% whole person permanent impairment. The approach to combining impairment values using the Combined Values Chart remains the same; however, specific guidance is now provided for circumstances where multiple impairments are combined, with it stated that the largest values must be combined first. This is consistent with the approach used in the California Permanent Disability Rating Schedule, but represents a change from directives provided in the Fifth Edition in Chapter 16.

The use of the Guides is explained in Section 2.3 (pp. 23-24). Particularly with this new edition the most important element is the physician’s accurate diagnosis since this defines the class of impairment. Diagnosis by analogy is only permitted if there is no other method for rating objectively identifiable impairment. Although impairment ratings are performed by physicians, non-physician evaluators may analyze an impairment evaluation to determine if it was performed appropriately. Expert review of all ratings is becoming common practice and is based on the recognition that many erroneous ratings were not previously being recognized and corrected. Although one of the intents of the Sixth Edition was to reduce the high error rate, it is probable that significant errors will occur while physicians and others become familiar with the appropriate use of the new edition.

The physician’s role in providing an impairment assessment is to be independent and unbiased. This is particularly challenging for treating physicians since by definition they have an advocacy role for their patients. This advocacy role may result in inflated ratings. Treating physicians also may not necessarily have received adequate training in the use of the Guides nor perform ratings with enough frequency to develop the needed skills. Therefore, assessments by treating physicians may be subject to greater scrutiny than those provided by independent medical evaluators and those with extensive training and experience in the use of the Guides.

The rules of application for the Guides presented in Section 2.4 (pp. 24-25) are similar to those in prior editions. Section 2.5 (pp. 25-27) presents concepts important to the independent medical examiner including definitions of medical possibility vs. probability, causation, exacerbation, aggravation and apportionment. The process of apportionment is the same as previous editions in which the examiner determines the current total impairment rating (all-inclusive) and subtracts the baseline rating reflecting pre-existing impairment. Apportionment requires careful analysis of the alleged causative factors and may be challenging when ratings have been performed using different editions. This may be particularly challenging with the Sixth Edition since the approaches used to define impairment may differ from earlier editions. If impairment was defined previously and there has been further injury of the same region, it may be appropriate to subtract that previous impairment number from the current rating by the Sixth Edition. In most circumstances the most appropriate method is to rate both the current total impairment and the pre-existing impairment (using clinical information about that condition prior to the more recent injury) by the Sixth Edition.

The concept of maximum medical improvement (MMI) has been clarified and refers to “a status where patients are as good as they are going to be from the medical and surgical treatment available to them. It can also be conceptualized as a date from which further recovery or deterioration is not anticipated, although over time (beyond 12 months) there may be some expected change” (AMA, 2008, p. 26). With prior conditions, typically the factors that result in potentially ratable impairment decrease
over time as the patient heals. Therefore rating prematurely typically inflates ratings; this is a problem commonly seen. With the Sixth Edition diagnoses may be modified by the time the patient is at MMI; therefore it is again necessary to assure the patient is at MMI prior to rating. The Guides does not permit the rating of future impairment. This edition presents a brief new discussion of the significance of cultural differences that may impact the evaluation process.

An impairment evaluation is a form of expert testimony, as explained in Section 2.6, Impairment Evaluation and the Law (pp. 27-28). Therefore, ratings must be fully supportable. If findings or impairment estimates based on these findings conflict with established medical principles they cannot be used to justify an impairment rating. An impairment rating is unacceptable unless it is the result of an assessment performed following the standards defined in the Guides. The standards for reports are provided in Section 2.7 (pp. 28-29), including clinical evaluation, analysis of findings, and discussion of how the impairment rating was calculated. This continues to serve as an excellent basis to determine the quality of an impairment evaluation report.

Chapter 3 – Pain-Related Impairment

Chapter 3 (pp. 31-46) discusses the challenges and controversies associated with assessing pain. If pain accompanies objective findings of injury or illness that permits rating using another chapter in the Guides, then pain-related impairments are not permitted to serve as add-ons. The clear language to this effect should reduce a common problem of “double-dipping” seen with the Fifth Edition (i.e. rating for a musculoskeletal condition and then providing further impairment for pain). Therefore, it is probable that impairment ratings for pain will be less frequent with the Sixth Edition.

Pain not accompanied by objective ratable findings may be ratable resulting in a maximum of 3% whole person permanent impairment, the same limit assigned in the Fifth Edition. The actual impairment is based on the patient’s self-reports on a Pain Disability Questionnaire (PDQ)
with a lowering of the impairment if the examiner questions the credibility of the patient. Due to the subjective nature of pain and differing philosophies, this chapter was one of the most controversial. Although there was discussion of modifying the magnitude of the impairment due to pain, lacking compelling information to change from the precedence established in the Fifth Edition, the maximum rating of 3% remains. It is probable that the approach to pain-related impairment will continue to evolve with the Seventh Edition.

Chapters 15–17: Musculoskeletal chapters

The vast majority of impairment ratings are performed for musculoskeletal injuries; therefore, Chapters 15 to 17 will be used most frequently. Chapter 16, The Lower Extremities, was the first chapter that incorporated the Diagnosis-Based Impairment Estimates approach and served as the model for Chapters 15 and 17. Since the methodology is similar among each of these chapters, once the user becomes familiar with the use of one chapter it is relatively easy to use the other two chapters. In contrast, the Fourth and Fifth Editions used different approaches for the upper extremities (primarily anatomically based impairments), lower extremities (thirteen different approaches), and spine (diagnosis-based or range of motion impairments). Adding or combining ratings from Chapter 3, Pain, and musculoskeletal chapters is not permissible.

Chapter 15 – The Upper Extremities

Chapter 15, The Upper Extremities (pp. 383-492), is the longest and most complex chapter, reflective of the complexities involved functionally with the upper limb and the type of injuries encountered. The principles of assessment are provided in Section 15.1 (pp. 385-386), and this defines the critical standards for interpreting symptoms and signs, functional history, physical examination and clinical studies. It is imperative that both evaluating physicians and those impacted by these ratings fully understand what is required.
Functional history is obtained to determine the impact of a given condition on the basis of functioning of the limb for activities of daily living (ADL) and results in assignment in to one of five grade modifiers (0 to 4):

0. None demonstrable.
1. Vigorous or extreme use of the limb only.
2. Regular use of the limb for ADLs but helper assistance (i.e., assistance of another person) is not required.
3. Minimal use of the limb for ADLs and some helper assistance (i.e., assistance of another person) is required.
4. All use of the limb precludes activity or requires total assistance for some or all ADLs.

The use of functional assessment is new to the Sixth Edition; although it is optional for most ratings it is required for the rating of entrapment disorders. The QuickDASH is the functional assessment tool that may be used to further evaluate this parameter (Beaton, Wright, & Katz, 2005). It is important to cross-validate reports of functional ability by observing the patient perform simple routine tasks, such as writing, opening a jar, buttoning a shirt, and tying shoes. The inclusion of functional history as an adjustment factor is controversial; however, it less likely to be as problematic as some may envision since its use in musculoskeletal assessment is limited to a single adjustment factor.

Standards for the physical examination are provided to assure more reliable ratings and to avoid some of the problems occurring with ratings performed by earlier editions. For example, the opposite extremity must be used to define normal for that individual if it is uninvolved and uninjured. More objective findings, such as atrophy, are given preference over findings that are under the control of the examinee, such as reports of tenderness and motion. The Grade Modifier for physical examination findings is defined by the most significant finding. It is probable that there will be disagreements about the significance of findings. However, since this serves as a non-key factor adjustment, this disagreement will
have less impact on the final rating compared to previous editions of the Guides.

Most upper extremity impairments are based on Diagnosis-Based Impairments, as explained in Section 15.2 (pp. 387-404). The upper extremity is divided into four regions: digits/hand, wrist, elbow, and shoulder. Diagnoses are defined in three major categories: soft tissue, muscle/tendon, and ligament/bone/joint. The definition of impairment classes and corresponding ranges of impairment for upper extremities and lower extremities are provided in Table 2.

**TABLE 2**
Extremities Impairment Classes

<table>
<thead>
<tr>
<th>Class</th>
<th>Problem</th>
<th>Extremity Impairment Range</th>
<th>Upper Extremity Conversion to Whole Person</th>
<th>Lower Extremity Conversion to Whole Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No objective findings</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Mild</td>
<td>1%-13%</td>
<td>1%-8% WPI</td>
<td>1%-5% WPI</td>
</tr>
<tr>
<td>2</td>
<td>Moderate</td>
<td>14%-25%</td>
<td>8%-15% WPI</td>
<td>6%-10% WPI</td>
</tr>
<tr>
<td>3</td>
<td>Severe</td>
<td>26%-49%</td>
<td>16%-29% WPI</td>
<td>11%-19% WPI</td>
</tr>
<tr>
<td>4</td>
<td>Very severe</td>
<td>50%-100%</td>
<td>30%-60% WPI</td>
<td>20%-40% WPI</td>
</tr>
</tbody>
</table>

The results of the evaluation should be recorded in Figure 15-2, Upper Extremity Impairment Evaluation Record (p. 388). The consistent use of the report forms will improve reliability of ratings. Each impairment rating involves the use of a regional grid (Table 15-2 Digit, pp. 391-394;
15-3 Wrist, pp. 395-397; 15-4 Elbow, pp. 398-400; or 15-5 Shoulder, pp. 401-405) and adjustment grids (Tables 15-6 to 15-9, pp. 406-411). The use of the Adjustment Grid and grade modifiers (non-key factors) is explained in Section 15.3 (pp. 405-419). Surgery typically does not define impairment; rather the impairment is based on the resulting diagnosis, modified by the findings at maximum medical improvement.

In prior editions, range of motion assessments were problematic: there is inadequate support for correlation between motion findings and function (Rondinelli et al., 1997) and motion assessments were often unreliable. In this edition, joint motion is used primarily as a physical examination adjustment factor and only to determine actual impairment values in the rare case when it is not possible to otherwise do so. Another very significant change is omission of strength measurements as a basis to rate impairment due to serious problems with lack of reliability; they are only used in assessing the motor deficit of a nerve injury. The inappropriate inclusion of grip strength loss in Fourth and Fifth Edition ratings as an ancillary factor in rating impairment no longer appears as a criterion.

Case examples are useful in learning how to rate per Diagnosis-Based Impairments. An example of a rating of a wrist injury is provided in Figure 7.

Several rating examples are provided in the Section 15.3e Upper Extremity Diagnosis-Based Impairment Examples (pp. 413-418); re-rating these examples using the previous Fifth Edition revealed both averaged 4% whole person permanent impairment.

The approach to entrapment neuropathy (i.e. focal neuropathy syndromes such as carpal tunnel, cubital tunnel syndrome) is separate of the process of rating other peripheral nerves and is a very significant change from prior editions. Only electrodiagnostically confirmed entrapment cases are ratable and the maximum impairment is 9% upper extremity impairment (5% whole person permanent impairment).
A patient sustains a wrist injury resulting in a triangular fibrocartilage tear, which is surgically treated. The patient reports improvement, however, continues to complain of localized tenderness. At maximum medical improvement the patient reports symptoms with strenuous activity and the ability to perform self-care activities independently. Specific physical testing is consistent. Physical examination is unremarkable except for reported localized tenderness. An MRI confirmed the diagnosis and reflected mild pathology.

The diagnosis of “triangular fibrocartilage complex (TFCC) tear” is found in Table 15-3 Wrist Regional Grid: Upper Extremity Impairments (6th ed., p. 396) and the specific criteria of “documented TFCC injury +/- surgery with residual findings” results in assignment to Class 1 with associated impairment values of 6%, 7%, 8%, 9% and 10% upper extremity impairment. Grade C, the default mid-range impairment value, is 8% upper extremity impairment. The functional history and the physical testing are consistent with a Grade Modifier 1 per Table 15-7 Functional History Adjustment: Upper Extremities (6th ed., p. 406); the physical examination is consistent with Grade Modifier 1 on the basis of “minimal palpatory findings, consistently documented, without observed abnormalities” per Table 15-8 Physical Examination Adjustment: Upper Extremities (6th ed., p. 408), and the clinical studies are also consistent with Grade Modifier 1 on the basis of “clinical studies confirm diagnosis, mild pathology” per Table 15-9 Clinical Studies Adjustment: Upper Extremities (6th ed., p. 410). All the non-key factor adjustment factors are Grade Modifier 1, which is consistent with the Class 1 designation for the diagnosis; therefore the impairment value remains at the default of Grade C with an associated 8% whole person permanent impairment.

If hypothetically the patient had reported functional difficulties consistent with Grade Modifier 2 (i.e. “pain/symptoms with normal activity” and “able to perform self-care activities with modification but unassisted”) and the other adjustment modifiers remained as Grade Modifier 1, then the net adjustment would be one grade higher with the assignment of grade D and 9% upper extremity impairment.
Complex regional pain syndrome (CRPS) is a challenging and controversial concept that is dealt with in Section 15.5 (pp. 450-454). CRPS is difficult to diagnose accurately, and epidemiological studies indicate that most such diagnoses are made within a workers’ compensation context; therefore, this is a particularly challenging diagnosis to rate. CRPS is only rated when the diagnosis is confirmed by defined objective parameters (present at the time of the rating), the diagnosis has been present for at least one year and verified by more than one physician, and other etiologies (physical and psychological) have been excluded. If these criteria are met, then adjustment factors (functional history, physical examination findings, and clinical studies are defined) and the number of “objective diagnostic criteria points” (Table 15-25, p. 453) are used in Table 15-26 (p. 454) to define the class and magnitude of impairment. This same approach is used in the lower extremity chapter.

Amputation impairment, presented in Section 15.6 (pp. 454-459), may be based on traditional definitions of amputation level or Table 15-29 Amputation Impairment (p. 460). Table 15-29 defines classes of impairment with an associated range of impairments; the final impairment is modified, as are Diagnosis-Based Impairments, by non-key factors of functional history, physical examination (proximal findings) and clinical studies.

Range of motion determination has a strong historical perspective and continues to be an essential component of upper extremity assessment; however its role is primarily as a physical examination adjustment factor. It is used as a stand-alone rating when the diagnosis-based impairment is not applicable and certain less common situations, as explained in Section 15.7 Range of Motion Impairment (pp. 460-478). The ICF model of impairment is also applied to Range of Motion with grade modifier severity based on reductions of motion from normal for that individual (by comparing the injured extremity to the uninvolved, uninjured opposite side).
Chapter 16 – Lower Extremities

The approaches in Chapter 16 (pp. 493-556) are consistent with Chapter 15 – Upper Extremities; however, there is a smaller spectrum of diagnoses with the lower extremities and therefore the chapter is less complex and shorter. The purpose of the lower extremity is transfer and mobility, and in comparison to the upper extremity more importance is given to stability than flexibility. The changes listed in the introduction to the chapter are the same as appear in Chapter 15.

Section 16.1 (pp. 494-496) defines the standards for interpreting symptoms and signs, functional history, physical examination and clinical studies. The American Academy of Orthopaedic Surgery Lower Limb Instrument (AAOS, 2005)\(^3\) may be used as an adjunct to defining functional ability; however, values are not provided to define a specific grade modifier.

Most lower extremity impairments are based on Diagnosis-Based Impairments, as explained in Section 16.2 (pp. 497-515). The lower extremity is divided into three regions: foot/ankle, knee and hip. Diagnoses are defined in three major categories: soft tissue, muscle/tendon, and ligament/bone/joint. The results of the evaluation are recorded in Figure 16-2 Lower Extremity Impairment Evaluation Record (p. 498). Each impairment rating involves the use of a regional grid (Foot and Ankle, Table 16-2, pp. 501-508; Knee, Table 16-3, pp. 509-511, and Hip, Table 16-4, pp. 512-515). The use of the Adjustment Grid and grade modifiers (non-key factors) is explained in Section 16.3 (pp. 515-531). The Functional History adjustment is based primarily on gait derangement, as illustrated in Table 16-6 (pp. 516). As with the upper extremity, the impairment is based on the diagnosis and final outcome rather than treatment performed, motion is primarily used as a physical examination adjustment factor, and strength is not used for ratings with the exception of grading the motor deficit of a nerve injury.

\(^3\) The questionnaire can be downloaded at: http://www.aaos.org/research/outcomes/Lower_Limb.pdf and scoring is available at: http://www.aaos.org/research/outcomes/Lower_LimbScoring.xls
Table 16-10, Impairment Values Calculated From Lower Extremity Impairment (pp. 530-531) provides conversion of lower extremity impairments to foot/ankle and toes.

Examples are useful in learning how to rate per Diagnosis-Based Impairments. An example of a rating of a knee injury is provided in Figure 8.

Fifteen rating examples are provided in the Section 16.3e Lower Extremity Diagnosis-Based Impairment Examples (pp. 522-529); the average Sixth Edition rating was 7% whole person permanent impairment and the Fifth Edition rating was 6% whole person permanent impairment.

**FIGURE 8**  
Lower Extremity Diagnosis-Based Impairment Example

A patient sustains a knee injury, resulting in a partial medial meniscus tear, confirmed by MRI. He declines surgery and is treated conservatively. The patient reports improvement and no significant interference with activities of daily living, including no problems with gait. Physical examination is normal.

The diagnosis of “meniscus injury” is found in Table 16-3 Knee Regional Grid (6th ed., p. 509) and the specific criteria of “partial (medial or lateral) meniscectomy, meniscal tear, or meniscal repair” results in assignment to Class 1 with associated impairment values of 1%, 2%, 2%, 2% and 3% lower extremity impairment, with Grade C default mid-range impairment value of 2% lower extremity impairment. The functional history is Grade Modifier 0 per Table 16-6 Functional History Adjustment: Lower Extremities (6th ed., p. 516); the physical examination is also consistent with Grade Modifier 0 per Table 16-7 Physical Examination Adjustment: Lower Extremities (6th ed., p. 517), and the clinical studies are also consistent with Grade Modifier 1 on the basis of “clinical studies confirm diagnosis, mild pathology” per Table 16-8 Clinical Studies Adjustment: Lower Extremities (6th ed., p. 519). Therefore, two non-key Adjustment Factors are Grade Modifier 0 one less than the Class 1 assignment for the diagnosis. Therefore, the final Grade assignment is two less than the default assignment of Grade C. Therefore, the rating associated with a Grade C at 1% lower extremity impairment is assigned.
Chapter 17 – Spine and Pelvis

Chapter 17 (pp. 557-601) provides impairments for the cervical spine, thoracic spine, lumbar spine, and pelvis, based on identification of a specific diagnosis or diagnoses. This method is, to some degree, an expansion of the diagnosis-related estimate (DRE) method used in the Fifth Edition of the Guides. The criteria for placement are modified and the impairment value within a class is further refined by considering information related to functional status, physical examination findings, and the results of clinical testing. In the Fourth and Fifth Editions, the choice of Diagnosis-Related Estimates method versus Range of Motion method often resulted in controversy – and often motion findings were questionable.

Current evidence does not support range of motion as a reliable indicator of specific pathology or permanent functional status; therefore motion is no longer used as a basis for defining impairment. The rationale for changes from previous rating methods is to standardize and simplify the rating process, to improve content validity, and to provide a more uniform methodology that promotes greater inter-rater reliability and agreement.

Section 17.1 (pp. 558-560) defines the standards for interpreting symptoms and signs, functional history, and ratable findings obtained from the physical examination and review of clinical studies. The Pain Disability Questionnaire (PDQ) may be used as a functional assessment tool (Anagnostis, Gatchel, & Mayer, 2004).

Spine and pelvis impairments are based solely on Diagnosis-Based Impairments, as explained in Section 17.2 (pp. 560-566). The spine is divided into three regions: cervical, thoracic, and lumbar, and diagnoses are divided into categories including non-specific spinal pain (soft tissues or strain/sprain), disk herniations and alteration of motion segment integrity (AOMSI), spinal stenosis, fractures, and fracture – dislocations. Treatment, if based on findings at the time of impairment assessment and surgery, does not alter the impairment, unless it creates a ratable diagno-
sis such as fusions that result in alteration of motion segment integrity. The results of the evaluation are recorded in Figure 17-2 Spine and Pelvis Impairment Evaluation Record (p. 561). Each impairment rating involves the use of a regional grid (Table 17-2 Cervical Spine, pp. 564-566; Table 17-3 Thoracic Spine, pp. 567-568; Table 17-4 Lumbar Spine, pp. 570-572.) The use of the Adjustment Grid and grade modifiers (non-key factors) is explained in Section 17.3 (pp. 566-592).

Common degenerative findings, such as abnormalities identified on imaging studies such as annular tears, facet arthropathy, and disk degeneration, do not correlate well with symptoms, clinical findings, or causation analysis and are not ratable according to the Guides.

Objective corticospinal injuries are rated by Chapter 13, The Central and Peripheral Nervous System, and combined. Subjective complaints such as sexual or sleep dysfunction that are not of a neurogenic origin are considered in the Functional History as a component of activities of daily living and are not otherwise rated.

An example of a rating of a spinal injury is provided in Figure 9.

Fifteen rating examples are provided in the Section 17.3g Spine Impairment Case Examples (pp. 583-592); the average rating was 8 person whole person permanent impairment, the same rating that occurs if each is rated using the Fifth Edition.
A 38-year-old man develops back pain while lifting and twisting, and studies confirm a lumbar disk herniation, L4-5, left posterolateral, with left L5 radiculopathy. He underwent surgical diskectomy with improvement, but continued to complain of back pain with activity. His physical examination revealed decreased dorsiflexion strength of the left ankle and normal sensory function with SLR test positive at 60 degrees.

The diagnosis of “intervertebral disc herniation” is found in Table 17-4 Lumbar Spine Regional Grid (6th ed., p. 570) and the specific criteria of “intervertebral disk herniation and/or AOMSI at a single level with medically documented findings; with or without surgery and with documented radiculopathy at the clinically appropriate level present at the time of examination” results in assignment to Class 2 with associated impairment values of 10%, 11%, 12%, 13% and 14% whole person impairment, with the Grade C default mid-range impairment value of 12% whole person impairment. The functional history per Table 17-6 Functional History Adjustment: Spine based on report of pain normal activity is Grade Modifier 2 (p. 575); the physical examination per Table 17-7 Physical Examination Adjustment: Spine (p. 576); based on report of positive SLR is Grade Modifier 2; and the clinical studies per Table 17-9 Clinical Studies Adjustment: Spine (p. 581) are also consistent with Grade Modifier 2. With the Grade Modifiers being consistent with the diagnosis Class, the impairment remains at the default assignment of Grade C with a default impairment of 12% whole person permanent impairment.
Chapter 13 – Central and Peripheral Nervous System

Chapter 13, The Central and Peripheral Nervous System (pp. 321-345), continues to use Fifth Edition methodology and does not follow the ICF methodology used by the other chapters.

The primary application of this chapter in previous editions has been for the rating of traumatic brain injuries and spinal cord injuries. This edition comments that “in contrast to previously held belief, the symptoms of mild traumatic brain injury generally resolve in days to weeks, and leaves the patient with no impairment” (AMA, 2008, p. 330).

The Fifth Edition was criticized for having duplication of materials in the Central and Peripheral Nervous System chapter that was presented in other chapters, with some differences between the ratings assigned. Thus, stated goals for the Sixth Edition included a collaborative decision of the Editorial Board of the Sixth Edition to maintain most ratings related to limbs in the upper and lower extremity chapters (Chapters 15 and 16, respectively), to refer visual disorder ratings to the visual disorders chapter (Chapter 12), and to provide most ratings of nerves of the head and neck in the ear, nose, and throat (ENT) chapter (Chapter 11), with Complex Regional Pain Syndrome (CRPS) rated only in the upper extremities and lower extremities chapters. Attention was also paid to maintaining consistency between this chapter on neurology (Chapter 13) and mental and behavioral disorders (Chapter 14) in terms of ratings of higher cortical function, the digestive system (Chapter 6) in terms of loss of bowel control, and the urinary and reproductive systems (Chapter 7) in terms of bladder and sexual function.

The approaches to assessing central nervous system and spinal cord impairment are very similar to the Fifth Edition, however the following changes are noteworthy:

- Alteration in Mental Status, Cognition, and Highest Integrative Function (MSCHIF) now results in maximum impairment
of 50% whole person permanent impairment; previously it was 70%.

- Emotional or behavioral impairment due to an objective central nervous system lesion uses Table 13-10, the Global Assessment of Functioning (GAF) Impairment Score (p. 334), and maximum impairment is now 50% whole person permanent impairment; previously it was 90%.

- Adjustments in values assigned for spinal cord injuries have also been modified, i.e. bladder maximum of 30% whole person permanent impairment (previously 60% whole person permanent impairment), sexual 15% (previously 20%), and respiratory 65% (previously 90% +).

Criteria for rating impairments related to chronic pain (5th ed., Section 13.8, pp. 343-344) have been replaced by Table 13-17 Dysesthetic Pain Secondary to Peripheral Neuropathy or Spinal Cord Injury (Sixth ed., p. 339). The maximum impairment for dysesthetic pain (pain of a neurogenic basis often described as “burning” sensation) is 10% whole person permanent impairment (Class 3, “severe dysesthetic pain”); the maximum impairment from the Fifth Edition for Table 13-22 Criteria for Rating Impairment Related to Chronic Pain in One Upper Extremity was 60% whole person permanent impairment (Class 4, dominant extremity, “individual cannot use the involved extremity for self-care or daily activities”).

Chapter 14 – Mental and Behavioral Disorders

Chapter 14, Mental and Behavioral Disorders (pp. 347-382), discusses impairments due to mental disorders and considers mental and behavioral impairments that may result from them. The emphasis is on evaluating brain function and its effect on behavior in the absence of evident traumatic or disease-related objective CNS damage. The most significant change is the provision of numeric ratings.
The importance of following the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV), and strictly adhering to the DSM-IV criteria for diagnosis, is emphasized in Section 14.1b (p. 348). The introduction to the chapter states that only impairments for selected well-validated major mental illnesses are considered, and Section 14.1c (pp. 348-349) elaborates, stating that the purpose of the chapter is not to rate impairment in all persons who may fit a DSM-IV diagnosis since many conditions are common in the general population and do not require an impairment rating. Given the use of the Guides in medicolegal settings, impairment rating in the Sixth Edition is specifically limited to mood disorders (including major depressive disorder and bipolar affective disorder), anxiety disorders, and psychotic disorders (including schizophrenia). Section 14.1c further provides a list of disorders that are not ratable in this chapter, including psychiatric reaction to pain, somatoform disorders, dissociative disorders, personality disorders, psychosexual disorders, factitious disorders, substance use disorders, sleep disorders, dementia and delirium, mental retardation, and psychiatric manifestations of traumatic brain injury. Section 14.1 Principles of Assessment (pp. 348-349) provides rules including the following:

- In the event of a mental and behavioral disorder that is judged independently compensable by the jurisdiction involved, the mental and behavioral disorder impairment is combined with the physical impairment.
- In most cases of a mental and behavioral disorder accompanying a physical impairment, the psychological issues are encompassed within the rating for the physical impairment, and the mental and behavioral disorder chapter should not be used.

The impairment rating is based on consideration of three scales: the Brief Psychiatric Rating Scale (BPRS), the Global Assessment of Function (GAF), and the Psychiatric Impairment Rating Scale (PIRS), as explained in Section 14.5 Concepts for Impairment Ratings (pp. 355-356) and Section 14.6 Methods of Impairment Rating (pp. 356-360). The stated purpose of including all three scales is “to provide a broad assessment of the patient,” as the BPRS focuses solely on symptoms and the
PIRS on role function, whereas the GAF is a blend of the two. The goal is to “arrive at a strongly supportable impairment rating.” This chapter is a dramatic departure from what was used previously (especially since numerical psychiatric ratings have not been used since the Second Edition); the impact and reliability is yet to be determined. While this chapter provides a methodology that will increase the reliability of impairment ratings, it faces major challenges as it currently exists in terms of its validity and usefulness in medicolegal settings.

**Medical and surgical chapters**

Chapters 4 to 12 provide approaches to assessing other organ systems. Chapter 4 – The Cardiovascular System, and Chapter 5 – The Pulmonary System, are unique – the chapters use the generic rating system described in Chapter 1, but use objective test results as the key factor in determining the impairment class. The maximum rating for cardiovascular disease, including vascular diseases of the extremities, has decreased from 100% to 65% (excluding thrombotic disease, which is discussed in chapter 9). Table 5-4 Criteria for Rating Permanent Impairment due to Pulmonary Dysfunction (p. 88) adds information about the history and physical examination to objective test results to modify the class assignment reflected by the latter. Table 5-5 Criteria for Rating Permanent Impairment Due to Asthma (p. 90) has been modified to fit into the generic rating system, incorporating the parameters from the American Thoracic Society (ATS) “Guidelines” rather than using the point system relied upon previously.

Chapter 6 – The Digestive System, Chapter 7 – The Urinary and Reproductive Systems, Chapter 8 – The Skin, Chapter 9 – The Hematopoietic System, Chapter 10 – The Endocrine System, and Chapter 11 – Ear, Nose, Throat and Related Structures, use the “generic” format described in Chapter 1 as the basis for calculating impairment ratings, and generally, but not always, use the history (which includes the diagnosis and all of the prior clinical data that substantiated the diagnosis) as the key factor. The rating criteria and impairment values in these chapters were
revised. There has been a decrease in the overall ratings, especially in Class 4, where the maximum rating for sign is usually no higher than 65 to 75% (less if the organ involved is not required for multiple ADLs). The maximum impairment rating for skin disorders is 58% whole person permanent impairment, as compared to 95% in the Fifth Edition. In prior editions of the Guides, the ratings for diseases in these chapters generally encompassed both organ-system specific pathology and the affect it has on other organ systems. The rater is encouraged to rate secondary disease processes separately and combine with the rating for the primary condition.

The assessment of Burden of Treatment Compliance (BOTC) was added to the rating process in Chapters 6 to 10 to reflect the impairment as the result of complying with treatment regimens associated with a given medical condition. Those who comply with these regimens often exhibit lesser degrees of impairment from the disease itself than would be present had they chosen to be noncompliant. However, the medications and interventions themselves either lead to side effects or require modifications of the individual’s activities of daily living that would have not otherwise been present.

Chapter 12 – The Visual System is a refinement of the process used in the Fifth Edition.

**Impairment rating values**

The Sixth Edition reflects very substantial change, more significant than any prior edition change. With the Sixth Edition, the impairment values for the most frequently used impairments and diagnoses are similar to the Fifth Edition. However, some adjustments were required, with certain ratings being lower and others higher. There are conditions that did not receive ratable impairment in the past (such as lateral epicondylitis and non-specific spinal pain), which in certain circumstances may now be ratable as Class 1 (mild) impairments. Sixth Edition ratings are based more on the end-result and the impact on the patient, rather than
what types of treatments or surgeries have been performed. Therefore, other ratings (such as spinal fusions) will receive significantly lower ratings since the focus is functional results and not the treatment provided. Although in the past surgery often resulted in an increase in the impairment rating, the goal of surgery and all treatment is to improve function and ideally to resolve impairment; therefore, the Sixth Edition resolved this contradiction.

In assessing the impact of the Sixth Edition it is important to consider whether original or expert ratings are being considered as the baseline. Most impairment ratings performed by the Fourth and Fifth Editions have been shown to be erroneous when these original ratings are reviewed by experts in the use of the AMA Guides. Therefore, in comparing differences, it is important to determine the relative change from observed ratings and those that are consistent with the Guides.

The full impact of changes in ratings will not be available until a large number of cases have been rated, or comparative studies are performed where cases are rated by both the Fifth and Sixth Editions. It is critically important to understand this impact on the systems that make use of the Guides. Comparative studies of ratings performed by the Third Edition, Revised, Fourth Edition, and Fifth Edition concluded that the Fourth and Fifth Editions are more complex than the Third Edition, Revised, and, in general, require more effort by rating physicians and result in lower ratings (Brigham, Mueller, Van Zet, Northrup, Whitney, & McReynolds, 2004).

Erroneous ratings with prior editions often occurred because unreliable examination findings were used to define impairment. With the Sixth Edition, it is probable that the errors will result more from inaccurate diagnoses and misclassification of the class of impairment. The definition of the class of impairment is the most significant factor in defining the extent of impairment.

Typographical errors are anticipated with the first printing and it is probable that these will result in some initial confusion and rating errors. The AMA has a process in place to identify and correct these errors.
Conclusion

It is probable that it will be several months before physicians, claims professionals, attorneys, and fact-finders are familiar with the significant differences in assessing impairment. Given the significant changes with the new edition it is probable that it will be difficult to successfully evaluate impairment without training. It is hoped that the Sixth Edition will benefit all stakeholders by minimizing conflict and improving decision making; however, whether this will occur is not yet known. The process of defining impairment and the complexities of human function is not perfect; however, the Sixth Edition should simplify the rating process, improve accuracy, and provide a solid basis for future editions of the Guides.

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References


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WorkSafeBC is proud to host the BC in 2008 Conference, a unique event combining the IAIABC’s 94th Annual Convention with the annual AWCBC Learning Symposium, which brings approximately 400 delegates together to discuss topics relating to workers’ compensation in Canada, the U.S., and around the world.

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Is There a Doctor in the House? California Workers’ Compensation System Medical Reform and Access to Medical Care

Alex Swedlow*
John Ireland**

Abstract

Between 2002 and 2004, California’s legislature and regulators enacted significant workers’ compensation medical care reforms with the intent to raise the quality of care delivered to injured workers and control excessive medical cost inflation. Since then, some system stakeholders assert that workers’ compensation managed care reforms such as fee schedules and utilization review discourage providers from treating workers’ com-
pensation patients, thereby restricting patient access to needed medical care. This study reports new findings on post-reform changes in medical utilization, provider network use, medical cost containment expenses and access to workers’ compensation providers.

Introduction

For the last fifteen years, health care delivery to California’s injured workers has been a contentious and volatile issue. Between 1992 and 2003, the California workers’ compensation system experienced unprecedented cost increases for medical care delivered to injured workers. In 2003 the California Workers’ Compensation Insurance Rating Bureau (WCIRB) estimated that between 1992 and 2002 the average ultimate medical cost per workers’ compensation indemnity claim increased from $8,693 to $31,767, a 265 percent increase.\(^1\) Several pre-reform studies documented significant increases in medical utilization between 1993 and 2002 as measured by the average number of visits and procedures per claim as well as the duration of treatment (Swedlow, 2003; Victor, 2003).

Several public policy studies have documented the factors associated with the significant increases in medical utilization and price between 1993 and 2003. Johnson (2002; see also Victor, 2003) and Gardner and Swedlow (2002) found that the increasing medical costs and utilization were only marginally the result of changes in the case-mix of injuries over this time. A much greater association was observed with concurrent legislative and regulatory changes, including the enhanced role of the primary treating physician (PTP), which began with the passage of 1993 legislation. Kominsky and Gardner (2001) reported an association between the lack of current and complete medical fee schedules for ambulatory surgery facilities and significantly higher ambulatory surgery facility fees. Harris and Swedlow (2004) suggested that subjective treatment plans,\(^2\)

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1 Estimated ultimate costs relate to the projected future total benefit claim cost.

2 WCIRB Estimated Ultimate Medical Costs for Indemnity Claims as of September 2002; released March 2003.
which are the norm when there is a lack of widely accepted treatment guidelines, were associated with highly variable claim outcomes, a textbook indicator of poor quality of care at the population level. Dr. Doug Benner, head of Occupational Health for Kaiser Permanente, points out that in terms of the frequent incongruity between diagnosis and choice of medical treatment, “a good outcome following treatment based on an incorrect diagnosis is a testament not to the skill of the doctor, but to the body’s ability to recover in spite of the doctor” (Benner, 2004).

How did this situation come to exist? In 1993, California lawmakers passed legislation that attached a rebuttable presumption of correctness to the opinion of the injured worker’s primary treating physician for the purposes of calculating permanent disability. Subsequently, the 1996 Minniear decision expanded the application of this presumption to all medical issues, including the use of any given medical treatment. The practical effect of the Minniear decision was to limit a payer’s ability to challenge medical treatment choices, unless it could be proved that the provider’s recommendation was not supported by the medical literature. This standard was rarely overcome in the appeals process.

Between 2002 and 2004, the California Legislature enacted a series of bills that included fundamental changes to the workers’ compensation system. Assembly Bill 749 (2002) and Senate Bills 228 (2003) and 899 (2004) eliminated the treating physician’s rebuttable presumption of correctness, thus striking down the Minniear decision. Senate Bill 228 was an effort to control medical unit costs and utilization and improve quality of care. This legislation required the use of medical utilization guidelines that incorporated scientific, evidence-based, peer-reviewed, nationally recognized standards of medical care, and also placed a 24-visit cap on physical therapy and chiropractic care. Senate Bills 228 and 899 also sought to update and tighten fee schedule loopholes related to reimbursement for certain provider services as well as durable medical equipment, ambulance services, pharmacy costs and inpatient hospital and outpatient surgery facility fees. In addition, SB 899 was intended to enhance the ability of medical provider networks to manage medical treatment costs by expanding networks’ control over injured workers’ medical care from just the first 30 days post-injury to the life of the claim.
Between 2004 and 2006, average claim costs in the California workers’ compensation system declined sharply relative to pre-reform levels. Prior to the reforms, the WCIRB estimated that the average ultimate medical cost for an accident year 2002 indemnity claim would total $31,767.3 With implementation of the medical reforms, the WCIRB currently projects that the average ultimate medical cost for an accident year 2002 indemnity claim will be $25,174, down 21 percent from the pre-reform estimate. The latest studies have reported an association between the recent legislative and regulatory reforms and significant changes in medical utilization and use of network providers (Swedlow, September-December 2005; Swedlow & Ireland, December 2006-August 2007).

The political debate has also shifted. Some stakeholders have claimed that the greater use of objective, scientific medical treatment guidelines, up-to-date fee schedules and the emphasis on return to work has improved quality of care, increased productivity, and reduced record high premiums for California employers. Other stakeholders have asserted that the medical reforms have adversely affected the medical delivery environment with overly restrictive treatment guidelines, use of physician networks, and expensive oversight requirements that cause some physicians to refuse to treat workers’ compensation patients, thereby limiting access to quality medical care.

The following study was performed to address these areas of the debate. The analyses supplement and expand prior research on California’s post-reform environment using new data on medical utilization, use of physician and the costs of medical management. The authors also evaluated measures of access to primary and specialist physicians who actively treat injured workers in the California workers’ compensation system.

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3 WCIRB Estimated Ultimate Medical Costs for Indemnity Claims as of March 2007; released June 2007.
Is There a Doctor in the House?

Post reform changes in medical delivery

Medical utilization

How has medical care for injured workers changed since the implementation of the 2002-2004 reforms? The authors compiled data for the study from the California Workers’ Compensation Institute’s Industry Claims Information System (ICIS) database into a special data set measuring medical utilization and payments. The authors analyzed paid medical services data on 993,644 claims with dates of injury between January 2002 and June 2006, for six of the most common areas of medical provider services:

- Evaluation & management
- Surgery
- Radiology
- Medicine
- Physical therapy
- Chiropractic services

The ICIS is a voluntary database system with more than 2.5 million California workers’ compensation claims and over 200 million policy and benefit transaction level payments and medical procedures for dates of injury dating back to January, 1993. CWCI receives medical services data from a significant number of national and regional payors operating in the California market who collectively represent a significant share of the workers’ compensation market.
### Table 1
Average Visits and Payments by Fee Schedule Section as of 12 Months Post Date of Injury* (Pre-Reform vs. Post-Reform)

<table>
<thead>
<tr>
<th>Fee Schedule Section</th>
<th>Average Visits</th>
<th>Average Paid</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Reform (1st Qtr 02)</td>
<td>Post-Reform (1st Qtr 05)</td>
<td>Pcnt Change</td>
<td>Pre-Reform (1st Qtr 02)</td>
<td>Post-Reform (1st Qtr 05)</td>
<td>Pcnt Change</td>
</tr>
<tr>
<td>Evaluation &amp; Management</td>
<td>5.2</td>
<td>4.5</td>
<td>-13.8%</td>
<td>$419</td>
<td>$380</td>
<td>-9.3%</td>
</tr>
<tr>
<td>Surgery</td>
<td>1.8</td>
<td>1.7</td>
<td>-4.9%</td>
<td>$677</td>
<td>$819</td>
<td>21.0%</td>
</tr>
<tr>
<td>Radiology</td>
<td>2.0</td>
<td>1.8</td>
<td>-8.7%</td>
<td>$374</td>
<td>$274</td>
<td>-26.8%</td>
</tr>
<tr>
<td>Medicine Section Services</td>
<td>1.6</td>
<td>1.5</td>
<td>-5.3%</td>
<td>$418</td>
<td>$194</td>
<td>-53.6%</td>
</tr>
<tr>
<td>Physical Therapy</td>
<td>23.2</td>
<td>9.2</td>
<td>-60.2%</td>
<td>$1,522</td>
<td>$634</td>
<td>-58.3%</td>
</tr>
<tr>
<td>Chiropractic Manipulation</td>
<td>28.2</td>
<td>9.0</td>
<td>-68.0%</td>
<td>$1,151</td>
<td>$328</td>
<td>-71.5%</td>
</tr>
</tbody>
</table>

*Averages based only on claims involving at least one visit within a treatment category.

Table 1 displays the changes in the average number of visits and the average amounts paid per claim in the first 12 months after injury for each of the six categories of treatment. Reductions in average visits were most notable for physical therapy and chiropractic services, with 60 and 68 percent fewer visits per claim, respectively, resulting in reductions in average amounts paid per claim of 58 and 72 percent, respectively. The results also found significant reductions in the average amounts paid per claim for evaluation and management (-9.3%), radiology (-26.8%) and
Medicine Section services (-53.6%), while the average amount paid per claim for surgery services increased 21 percent between the pre- and post-reform valuation points.5

Medical provider networks

The significant changes in medical costs noted above were accomplished not only through the medical utilization schedule, but also through statutory changes in the form and function of medical provider networks (MPNs). Provider networks have been a staple of the California workers’ compensation system since the mid-1980s. Prior to 2005, employers in California usually were able to direct their injured workers’ medical care to a designated provider during the first 30 days after the date of injury,6 typically accomplished by referring the injured worker to a member of a preferred provider organization (PPO). SB 899 reinvigorated provider networks for treatment on or after January 1, 2005, by enabling employers and insurers to establish MPNs (Labor Code section 4616) which are different from PPOs because they have to meet specific access standards to ensure that injured workers have a choice of both primary care and specialist physicians within a reasonable distance from their homes or worksites.7 In addition, all care provided by network physicians must be consistent with the Medical Treatment Utilization Schedule adopted by the Administrative Director of the Division of Workers’ Compensation.

5 The increase in the average cost of a surgical “procedure” reflects a disproportionate post-reform reduction in relatively high-volume but low-cost surgical procedures such as trigger point injections and venipunctures, coupled with relatively smaller changes for lower-volume, higher-cost procedures such as shoulder or knee arthroscopies.

6 There were exceptions. First, an employee had the right to predesignate a personal physician any time prior to an injury. Also, an employer or insurance carrier could establish a Health Care Organization which extended the period of medical control to up to 180 days after an injury and limited care to a prespecified panel of medical providers.

7 An injured worker receiving treatment by a member of a Medical Provider Network is allowed to change to a different treating physician an unlimited number of times but must remain within the approved network of providers.
For employers offering MPNs, the legislation extended the employer’s medical control from 30 days to the life of the claim.

Since January 2005, the California Division of Workers’ Compensation has approved more than 1,100 Medical Provider Networks. These MPNs range in size from the boutique (fewer than 500 physicians) to very large (more than 50,000 physicians).

Table 2 displays changes in network utilization between the PPO (pre-reform) era and the MPN (post-reform) era. Medical visit data were compiled for 828,635 pre- and post-reform claims with almost 13 million medical treatment visits. This analysis measured the proportion of visits to a network provider by timeframe and type of medical service.

### TABLE 2
Proportion of Medical Visits Made to Network Physicians in the first 12 months after Date of Injury, by Fee Schedule Section

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Evaluation &amp; Management</td>
<td>57.2%</td>
<td>57.0%</td>
<td>62.1%</td>
<td>72.6%</td>
<td>26.9%</td>
</tr>
<tr>
<td>Surgery</td>
<td>52.5%</td>
<td>53.7%</td>
<td>56.4%</td>
<td>66.7%</td>
<td>27.0%</td>
</tr>
<tr>
<td>Radiology</td>
<td>47.8%</td>
<td>48.2%</td>
<td>49.7%</td>
<td>57.1%</td>
<td>19.5%</td>
</tr>
<tr>
<td>Medicine</td>
<td>41.1%</td>
<td>42.0%</td>
<td>50.6%</td>
<td>63.2%</td>
<td>53.8%</td>
</tr>
<tr>
<td>Physical Therapy</td>
<td>25.0%</td>
<td>25.8%</td>
<td>39.1%</td>
<td>50.1%</td>
<td>100.4%</td>
</tr>
<tr>
<td>Chiropractic</td>
<td>8.6%</td>
<td>8.6%</td>
<td>11.8%</td>
<td>33.5%</td>
<td>289.5%</td>
</tr>
<tr>
<td>All Services</td>
<td>33.4%</td>
<td>34.4%</td>
<td>48.9%</td>
<td>61.7%</td>
<td>84.7%</td>
</tr>
</tbody>
</table>
Table 2 shows dramatic increases in network use for all six types of medical services directly preceding as well as following the introduction of MPNs in 2005. The network utilization rate was highest for evaluation and management services, climbing from 57.2 percent of E&M visits in 2002 to 72.6 percent in 2005 – an increase of 27 percent. The largest percentage changes in network utilization were in the physical medicine categories, as network utilization for physical therapy (PT) doubled to half of all PT visits, while the network utilization rate for chiropractic manipulation nearly quadrupled from 8.6 of visits in 2002 to 33.5 percent of visits in 2005, reflecting the requirement that chiropractors be included in MPNs.

**Medical cost containment**

The medical reforms arising from legislative and statutory changes, coupled with new rules, regulations and penalties for non-compliance, required new claims adjudication processes along with the need for providers and payers to implement more complex monitoring and administrative systems to track and manage medical utilization, MPN use and the unit price controls that resulted from the use of the additional fee schedules.

Medical management, also known as medical cost containment (MCC), refers to the payer’s oversight and management of unit price controls for medical and pharmaceutical goods and services and, where feasible, the use and volume of specific services. Payers assess the clinical efficacy and need for specific services based on the recommendations contained in approved treatment guidelines. MCC services have evolved steadily over the last 20 years. In the first several years following the creation of the California workers’ compensation system’s original Official Medical Fee Schedule in the early 1980s, medical bill review services compared the medical provider’s bill for a given procedure and adjusted the price to meet the allowed level of reimbursement. By the late 1980s and early 1990s, large hospital networks and physician panels began to take advantage of the benefits of scale by offering medical care at discounts to the fee schedule, and workers’ compensation PPOs became more prevalent. Inpatient and outpatient peer review, medical case management and sec-
ond opinion programs that were modeled after group health managed care plans were the components of the first workers’ compensation utilization management programs.

Senate Bill 228 made several changes to the California workers’ compensation system that institutionalized some of these early cost containment efforts. One change that had a significant effect on medical cost containment was the repeal of the existing voluntary utilization review (UR) system and the enactment of a mandatory UR model.

The contribution of mandatory UR is evident in Table 3, which shows data compiled from a sample of 944,215 open and closed California workers’ compensation claims that had both medical benefit and MCC payment data. The sample included claims with dates of injury from January 2002 through June 2006 and payment transactions through November 2006, totaling $3.7 billion in total reimbursement for both medical services and MCC. Of this total, $262 million, or 7.6 percent of the portion paid for medical services, was paid for MCC.8 Table 3 shows the average amounts and percentages of medical services paid per claim for MCC by accident year at 12 and 24 months post-injury.

Among indemnity claims, average medical cost containment payments at 12 months post-injury climbed from $433 in 2002 to $661 in 2005, a 52.9 percent increase, while average medical benefits at the same valuation point declined from $7,033 to $5,973, a 15.1 percent decrease. Average MCC payments for indemnity claims at 24 months increased by 42.7 percent while medical benefit costs declined by 16.4 percent. Medical cost containment as a percentage of average paid medical benefits among indemnity claims, valued at 12 months, rose from 6.2 percent in 2002 to 11.1 percent in 2005, an 80 percent increase while MCC as a percentage of average medical benefit payments among indemnity claims, valued at 24 months, increased from 5.9 percent in 2002 to 10.1 percent in 2004, a 70.7 percent increase.

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8 Payors assign specific transaction codes to distinguish MCC payments from medical treatment payments.
Access to primary care and specialist physicians

The implementation of managed care controls on unit prices and utilization of services has been a point of stress between payors and physicians, as payors struggle to lessen inflationary pressures on the cost of medical care and providers struggle to maintain viable business practices. Managed care controls and their associated stress points have been adopted at a slower rate in workers’ compensation systems than in federal programs and the group health sector. Now, these reform-imposed changes have moved the workers’ compensation provider community closer to their group health counterparts in the areas of utilization review, second
opinion for surgery and the general adoption of evidence-based medicine guidelines as the standard for medical care and have intensified the debate regarding the quality and availability of treatment to injured workers in California. The California Medical Association (2005) issued results from an Internet survey of providers, approximately 250 of whom responded, that indicated a high level of physician dissatisfaction with the current workers’ compensation environment. Sixty-three percent of the responding physicians threatened to abandon or significantly limit their care of workers’ compensation patients (CMA, 2005).9 Four years ago, in a CMA (2001) report entitled, “And Then There Was None: The Coming Physician Supply Problem,” researchers asserted that 43 percent of responding California physicians intended to leave practice within 3 years.10 Such surveys have significant methodological limitations and marginal predictive utility (Rittenhouse, Mertz, Keane, & Grumbach, 2004). For example, despite the CMA’s 2001 survey, the Center for Health Workforce Studies (2004) reported a 3.3 percent net gain in active California physicians between 2002 and 2004.

Is there a change in access to primary and specialist providers who actively treat injured workers in California? Defining access is a complex task. For most, access is ensured if the patient has insurance, and workers’ compensation insurance covers almost all workers. Access has other dimensions such as the ability to see one’s physician of choice,11 at a convenient time and place, the ability to be referred for specialized services as needed, and the right to have medically necessary services and therapies.

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10 The survey is available at http://www.cmanet.org/upload/Physician_Supply.pdf

11 California Labor Code Section 3209.3 and related sections define physicians to include “physicians and surgeons holding an M.D. or D.O. degree, psychologists, acupuncturists, optometrists, dentists, podiatrists, and chiropractic practitioners licensed by California state law and within the scope of their practice as defined by California state law.”
The present analysis employed one approach to assess the association between managed care in the workers’ compensation sector and changes in injured workers’ access to medical care. This research expanded on a prior study that assessed the proximity between injured workers and providers actively treating injured workers (Swedlow, 2006).

To quantify injured workers’ access to available providers before and after implementation of the reforms, the authors calculated the driving distance from an injured worker’s home location to the three nearest providers concurrently providing services to injured workers. Those providers were identified using medical service payment records. In deriving the distances, the researchers used GeoAccess™ software, a mapping program that determines the distance between two locations by converting address information into latitude and longitude coordinates and then calculating the distance between relevant pairs of codes.

The authors employed access standards based on rules and regulations promulgated by the California Division of Workers’ Compensation (DWC) for access to medical provider networks. These standards require:

- A choice of three primary care providers within 15 miles of the injured worker.
- A choice of three specialists within 30 miles of the injured worker.

Tables 4 and 5 display data on 1) the average distance between the injured worker’s home address and the three closest primary care physicians actively treating workers’ compensation patients and 2) the percentage of injured workers in the sample that meet the DWC standards for adequate access.

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Table 4 shows injured workers’ access to primary care providers before and after the reforms. In each of the years analyzed, greater than 95 percent of the injured workers in the study sample had a choice of three active workers’ compensation primary care providers within 15 miles of their homes. Furthermore, the average distance an injured worker in California needed to travel to access three primary care providers ranged from 2.7 to 3.2 miles – well within DWC’s 15-mile access standard. In fact, in 2006, 98 percent of the 210,000 injured workers whose access was measured had average access values that met the California access standard. Ninety-eight percent of all injured workers seeking access to active network primary care providers met California’s access standard with a choice of three physicians within 2.4 miles of their homes.

**TABLE 4**
Access to Choice of Three Closest Active Primary Care Physicians
(Three physicians within 15 miles)

<table>
<thead>
<tr>
<th>Calendar Year of Treatment</th>
<th>Average Distance to Choice of 3 Physicians (Miles)</th>
<th>Percent of Injured Workers with Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>3.2</td>
<td>97%</td>
</tr>
<tr>
<td>1998</td>
<td>3.0</td>
<td>97%</td>
</tr>
<tr>
<td>2004</td>
<td>2.7</td>
<td>98%</td>
</tr>
<tr>
<td>2005</td>
<td>3.0</td>
<td>95%</td>
</tr>
<tr>
<td>2006</td>
<td>2.1</td>
<td>99%</td>
</tr>
<tr>
<td>2006 (MPN)</td>
<td>2.4</td>
<td>98%</td>
</tr>
</tbody>
</table>
### TABLE 5
Access to Choice of Three Closest Active Specialists
(Three physicians within 30 miles)

<table>
<thead>
<tr>
<th>Calendar Year of Treatment</th>
<th>Average Distance to Choice of 3 Physicians (Miles)</th>
<th>Percent of Injured Workers with Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>2.7</td>
<td>98%</td>
</tr>
<tr>
<td>1998</td>
<td>2.3</td>
<td>99%</td>
</tr>
<tr>
<td>2004</td>
<td>2.3</td>
<td>99%</td>
</tr>
<tr>
<td>2005</td>
<td>3.9</td>
<td>98%</td>
</tr>
<tr>
<td>2006</td>
<td>2.7</td>
<td>99%</td>
</tr>
<tr>
<td>2006 (MPN)</td>
<td>3.3</td>
<td>98%</td>
</tr>
</tbody>
</table>

Table 5 shows injured workers’ access to specialist providers before and after the reforms. The average distance a California injured worker needed to travel to access three specialists ranged from 2.3 to 3.9 miles, again well within the DWC access standard of three specialists within 30 miles. Again, almost all injured workers seeking access to active network-based specialists met California’s access standard with a choice of three specialists within 3.3 miles of their homes.

Table 6 shows the access results for the four specialty categories commonly seen by workers’ compensation patients: Chiropractic, Orthopedics, Neurosurgery and Internal Medicine.
## TABLE 6

### Average Distance to Three Closest Providers (Miles)

<table>
<thead>
<tr>
<th>Year</th>
<th>Chiropractic</th>
<th>Orthopedics</th>
<th>Neurosurgery</th>
<th>Internal Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>3.7</td>
<td>6.9</td>
<td>16.7</td>
<td>5.8</td>
</tr>
<tr>
<td>1998</td>
<td>3.1</td>
<td>5.2</td>
<td>10.1</td>
<td>5.1</td>
</tr>
<tr>
<td>2004</td>
<td>2.9</td>
<td>5.3</td>
<td>11.9</td>
<td>5.6</td>
</tr>
<tr>
<td>2005</td>
<td>3.6</td>
<td>7.8</td>
<td>16.6</td>
<td>6.9</td>
</tr>
<tr>
<td>2006</td>
<td>3.6</td>
<td>5.2</td>
<td>11.2</td>
<td>6.9</td>
</tr>
<tr>
<td>2006 (MPN)</td>
<td>3.8</td>
<td>6.0</td>
<td>13.5</td>
<td>8.1</td>
</tr>
</tbody>
</table>

### Percent of all Injured Workers within Access Standard

<table>
<thead>
<tr>
<th>Year</th>
<th>Chiropractic</th>
<th>Orthopedics</th>
<th>Neurosurgery</th>
<th>Internal Medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>97%</td>
<td>96%</td>
<td>90%</td>
<td>97%</td>
</tr>
<tr>
<td>1998</td>
<td>98%</td>
<td>98%</td>
<td>92%</td>
<td>98%</td>
</tr>
<tr>
<td>2004</td>
<td>97%</td>
<td>97%</td>
<td>94%</td>
<td>97%</td>
</tr>
<tr>
<td>2005</td>
<td>94%</td>
<td>95%</td>
<td>91%</td>
<td>96%</td>
</tr>
<tr>
<td>2006</td>
<td>99%</td>
<td>97%</td>
<td>91%</td>
<td>97%</td>
</tr>
<tr>
<td>2006 (MPN)</td>
<td>98%</td>
<td>96%</td>
<td>90%</td>
<td>95%</td>
</tr>
</tbody>
</table>
In both the pre-reform (1996, 1998) and the post-reform (2004-2006) years, at least 90 percent of injured workers in California were within the state’s access standard. The average distance injured workers would have needed to travel to reach three workers’ compensation providers in each of these specialties was well within the standard. For example, the percentage of injured workers with a choice of three chiropractors within 30 miles of their home ranged from 97 percent in 1996 to 99 percent in 2006, with 98 percent of all injured workers within the access standard to MPN chiropractors.

Discussion

A series of new research studies on the effects of reforms in the California workers’ compensation system, including the findings presented above, have shown an association between reform implementation and changes in medical care utilization, physician network use and increased medical management fees.

The findings of the current analysis confirm a prior CWCI 2006 evaluation of access by injured workers to providers actively treating workers’ compensation patients, and show that in the post-reform period, injured workers’ access to a choice of active primary and specialist physicians remains at impressively high levels, virtually unchanged from pre-reform levels. These results are also consistent with another California workers’ compensation study that found that access was not a significant problem for the vast majority of injured workers and that most injured workers were satisfied overall with their care (Kominski, Pourat, Roby, & Cameron, 2006).

There is undeniable evidence that physician frustration with the health care delivery system is growing in the workers’ compensation system as well as in federal and group health programs. Results from recent surveys by the CMA and other publications predict a mass exodus of physicians from active practice due to the impact of recently implemented managed care programs on providers’ income and autonomy (Williams, 2008).
While such surveys are good indicators of physician dissatisfaction, they are not reliable predictors of future events. Despite the CMA’s 2001 survey measurement that 43 percent of physicians would leave patient care between 2001 and 2004, the Center for Health Workforce Studies (2004) reported a 3.3 percent net gain in California treating physicians between 2002 (90,470 physicians) and 2004 (93,462 physicians). Applications to medical schools are another good indicator of future supply of physicians, and researchers have reported that interest in medical school training has recently grown. According to the Association of American Medical Colleges (2007), there were 42,315 applicants to medical school in 2007, down 10 percent from ten year high point of 46,965 in 1997 but up 26 percent from 33,625 in 2002.

No single study can address all the objective and subjective variable components of the complete access to medical care situation, and the present study is no exception. The data for our analyses was limited to medical payment transactions through December 2006 and the geographic locations of injured workers who received medical treatment for their injuries; and the locations of physicians who delivered and were paid for those medical services. Data on other aspects of access, such as days from requests for a medical care appointment to the occurrence of the appointment, were not available. While there is anecdotal evidence that wait times have increased in the general health care system, the authors were unable to find any studies that compared workers’ compensation medical appointment wait times (whether in California or in other states) against the wait times experienced in group health or other medical delivery systems.

Regardless of recent changes in utilization and unit prices, quality of care remains a high priority for all stakeholders in the workers’ compensation sector. Many state workers’ compensation systems, including California’s, are looking to evidence-based medical treatment guidelines as a way of bringing more objectivity and consistency into medical treatment. Yet not all guidelines are created equal. Harris, Swedlow, Ossler, and Crane (2005) found significant differences in treatment recommendations across different guidelines, even within the same injury classification. Frequently, patients are unable or unwilling to act as their own medi-
Is There a Doctor in the House?

Milstein and Adler (2003) recently commented on the surprisingly high degree of tolerance by many stakeholders for the perceived erosion of clinical quality in the United States medical care system. Research has shown that many efforts to communicate the rationale and appropriateness of evidence-based guidelines and health information in general may be considered intimidating, overly technical or too emotional for many health care consumers (Epstein, 2000; Jencks, 2000). However, other recent studies have shown that patient acceptance of information that would improve consumer decision-making is slowly growing (Brodie et al., 2000). Clearly, there is a significant opportunity to improve further communication and to increase the prevalence of shared decision-making between healthcare providers, injured workers and payers.

Access to care in the future will depend on a variety of issues, many of which are too complex for the California workers’ compensation system to address in isolation. Managed care’s future role in the workers’ compensation sector, as well as the health care system overall, will continue to change over time. The integration of California’s occupational health and disability systems with the corresponding systems in non-occupational health are another point of debate in California. Recent census data shows that California’s population will have grown by 37 percent between calendar years 2000 and 2030. Higher group health premiums and other factors have increased the number of Californians without insurance to 6.8 million, or approximately 18 percent of the state’s residents (U.S. Census Bureau, 2007). The Institute of Medicine of the National Academies (2005) has reported that operational and technological inefficiencies in the healthcare sector unnecessarily consume almost 25 percent of total costs.

The public policy dimensions of reforming the healthcare delivery system in the California workers’ compensation system are emotional as well as fiscal. The California workers’ compensation system is the largest in the country, representing almost 20 percent of the total premium written nationwide. Future changes in medical care delivery and access to care through legislative and regulatory reform as well as private sector innovation are a certainty, and hopefully will include objective data collection
and monitoring of outcomes to balance the intensity of the stakeholders’ debate.

Acknowledgments

The authors wish to acknowledge several subject matter experts who contributed guidance and suggestions on a variety of academic, public policy, legislative and industry issues central to this report. In particular, we wish to acknowledge Marie Wardell and Laura Gardner, MD.

References


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WorkSafeBC is proud to host the BC in 2008 Conference, a unique event combining the IAIABC’s 94th Annual Convention with the annual AWCBC Learning Symposium, which brings approximately 400 delegates together to discuss topics relating to workers’ compensation in Canada, the U.S., and around the world.

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Reducing Disability in Occupational Injuries

Predictors of Long Term Disability
– A Literature Review

Ann Clayton*

Introduction

For the past three decades, there has been an interest in why workers with similar injuries, working in the same jobs, and treated with the same medical treatment, have very different outcomes in terms of length of work disability. In the early 1980s, Dr. Henry Feffer recognized that workers in the same jobs that he treated from a local Washington D.C. power company - for the same medical conditions - recovered at very different rates and had very different disability durations. He began using a consensus approach to identifying these factors with the hope that once developed, they could help educate physicians on what factors affected recovery. Later in the 1980s, the work of the Swedish researcher Dr. Alf Nachemson and Dr. Stan Bigos (currently at the University of Washington) took an evidence-based medicine approach in attempting to learn

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more about what factors may prolong disability for injured workers (specifically with back injuries). This type of research continues today.

The factors are important to identify, as successful return to work is not only a function of medical treatment, the worker’s response to injury, physical impairment caused by the injury, and job type, but also by workplace environment, relationships, and the actions and decisions of many people involved in the injured worker’s recovery. It is well documented that the longer an injured worker is off work, the greater the chance the worker will have both greater permanent disability (Borba, 2006) and larger long term wage losses (Boden, 1998; Kaganoff, 1997). So, prolonged disability significantly harms the worker physically and financially.

A recent publication by the American College of Occupational and Environmental Medicine (2006) claims that the odds of a worker ever returning to work drops 50 percent by the twelfth week of being off work. This makes it imperative that everything be done to help an injured worker return to work as quickly after injury as possible. Understanding the causes and predictors of work disability and delayed return to work outcomes should therefore be a prerequisite for the development of effective disability prevention strategies (Krause, 2001).

The purpose of this paper is to identify a number of potential predictors of long term disability. This paper does not pretend to measure the impact of the differing predictors or how they interact or work in conjunction with other factors to increase or decrease the likelihood of long term disability. The result of the literature review is that there are a number of factors that have consistently been found to influence length of disability in occupational injury cases. Knowing what some of these predictors are may allow service providers to focus on and develop interventions that may reduce the resulting disability for workers, yielding better outcomes for workers and their employers.
Reducing Disability in Occupational Injuries

The literature search methodology

The literature search was conducted using PubMed, Ovid Online and Thompson Gale using the key words and phrases “disability management,” “workers’ compensation,” “return to work,” “predictors of disability,” and “predictors of long term disability.” No separate search of non-medical sources was conducted. Not all articles found were reviewed. The 80 reviewed were those most recently published (within the last 15 years), those most cited regularly in multiple publications, those with large study populations, and those based on the workers’ compensation knowledge of the author. For purposes of this article, the focus was on research that helps predict prolonged disability cases or research that has identified negative effects for workers or employers from long term disability.

A short history

Physicians in Europe began studying why some patients with similar musculoskeletal injuries recovered at significantly different rates as early as the late 1970s. Pioneering research by Gordon Waddell of the United Kingdom, for example, has continued with assistance from A.K. Burton and others. Their current thinking suggests that “treatment of musculoskeletal injuries directed purely to the biological condition is often ineffective, particularly for functional and occupational outcomes” (Waddell, 2006). Waddell recommends a biopsychosocial model of disability in which the physical, psychological, and social factors involved with human illness and disability are recognized and dealt with in the initial course of treatment. This model would make the study and identification of those physical, emotional, and social barriers to recovery a very important part of the treatment protocol for musculoskeletal injuries.

Additionally, in the late 1970s and the early 1980s, statutory increases in benefit levels were being enacted by U.S. jurisdictions in response to the 1972 National Commission Report. The report made recommendations for improvements in state administered workers’ compensation systems, and states reacted by increasing benefit levels. In the 1980s, additional
incentives for employers to reduce costs were created by growing global competition. For large employers, self-insurance became more attractive as long as they could manage their losses as well or better than the insurance companies who were previously handling their claims. If employers could develop programs to more effectively prevent and manage workers' compensation losses, they could save considerable human and financial resources (Welch, 1994).

Learning as much as they could about where losses were occurring and how much losses were costing became important strategies for prevention and return to work efforts. According to Krause (2001), understanding the causes and predictors of work disability and return to work outcomes is a prerequisite for the development of effective disability prevention strategies. Employers were becoming aware that for each workers' compensation dollar that they paid out, on average they had an additional $4 to $15 in the hidden costs of replacement workers, training for those workers, administrative costs for staff to manage losses, and activities of supervisors and others to analyze and take steps to prevent similar injuries to others (Wassel, 2002). Employer efforts in identifying the source of their losses and using their own data to target factors that may have increased the number or costs of claims led to the development of:

1. More sophisticated data collection and analysis of losses.
2. The development of strategies to increase early return to work of workers with disabilities.
3. The development of collaborative training and communication programs with health care providers and all employees.
4. Greater investments in labor management relations, safety, prevention, and wellness activities by employers.

Workers' compensation claim handlers began recognizing more than 20 years ago some similarities in cases that resulted in longer disability durations or that were unusually difficult to resolve. Claims handlers began developing their own criteria for determining as early as possible in the life of a disability claim which injured workers were going to need additional resources in order to mitigate the potential costs of those claims.
These were eventually formalized in proprietary insurance company checklists for establishing reserves or for targeting additional resource use on specific claims. More recently, some companies have used either research or their own injury data – or those from their customer employers – to create a database of injuries in order to study and determine their own factors that are likely to predict delayed recovery and return to work. Additionally, there are now at least two software products that claim to predict claims that are likely to have longer than average disability durations.

As one would expect, these approaches toward disability prediction were developed for different purposes, and include those factors relevant to the purpose intended. The lack of consistency amongst these approaches prevents a rank ordering or weighting from being given to the various factors that have been associated with prediction of return to work, at least at the present point in development of this research.

**Predictors of return to work**

The length of work absence is the result of many influences other than the direct effects of injury. There have been a variety of publications in the last 15 years that have shed light on which claims may be more likely to become longer disability claims and which factors may be predictive of longer disability, and, therefore, higher costs for employers and more negative economic consequences for workers. Articles reviewed offer some common indicators of long term disability claims in individuals with certain types of complaints, such as low back pain (Burton, Bartys, Wright, & Main, 2005), or from injuries within certain jurisdictions (Fox, Victor, & Lui, 2006). The following factors were supported by findings in multiple studies as predictors of either greater disability or slower return to work.

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1 An example of this is the “Dis-o-bili-meter” previously used by Freemont Insurance Company and currently used as a tool in the Michigan State University “Certified Workers' Compensation Professional” course materials (p. 82).
1. Individual level worker characteristics

a. Age. Older workers tend to have longer disability and an increase in the likelihood of a permanent disability and unexpected medical costs (Biddle, Boden, & Reville, 2003; Borba, 2006; Dionne, 2005; Fox et al., 2006; Galizzi & Boden, 1998; Joling, Groot, & Janssen, 2006; Krause, 2001; Severeijns, 2001; Turner, 2006; Victor, 2005; Welch, 2005).

b. Education. In general, workers who had lower educational attainment were less likely to have a substantial return to work in all states studied by Fox et al. (2006). Significantly at risk appear to be those with only a grade school education, but return to work rates are lower for those with only a high school education over those with more education (Dionne, 2005; Fox et al. 2006; Galizzi & Boden, 1998; Krause, 2001; Turner, 2006).

c. Pre-injury income. Low pre-injury wage rates have been viewed as a proxy for disadvantages in the labor market (like a limited education, few marketable skills, or inability to speak English fluently), making re-employment for these workers particularly difficult (Galizzi & Boden, 1998).

d. Wage replacement rate. Workers whose workers’ compensation benefits equal or exceed their take home wages have little economic incentive to recover quickly and return to work. Conversely, workers whose wages were higher at the time of injury have a financial incentive to return to work, especially if their benefit levels are capped by a statutory maximum benefit (Dionne, 2005; Fox et al., 2006; Galizzi & Boden, 1998).

e. Pre-injury employment history. Including gaps in an individual’s pre-injury employment, a history of absenteeism prior to injury and/or disability or performance problems prior to injury are seen as a predictor of poor return to work outcomes. Galizzi and Boden (1998) found workers with just one spell off work in the year prior to injury took 34 percent longer to return to work. Additionally, even for shorter duration injuries, workers with intermittent pre-injury employment took substantially longer to return to work, more than twice as long than workers who had continuous employment in the year prior to injury (Galizzi & Boden, 1998; Joling et al., 2006; Krause, 2001).
f. **Tenure with current employer.** Galizzi and Boden (1998) reported that workers off work less than one month with less than six months job tenure and those with more than 10 years tenure returned to work more slowly. The workers tended to return to work about 1.5 to 3 days later for each two week period of disability than other workers. Additionally, most employees with at least one year of tenure with the pre-injury employer return to work within one year of the injury. But for those workers who cannot or do not return to their pre-injury employer, their time off work is two to three times longer (Galizzi & Boden, 1998; Joling et al., 2006; Krause, 2001; Welch, 2005).

g. **Individual expectation of continued disability.** If an injured worker sees him or her self as disabled and unable to do daily work activities, irrespective of the diagnosis or physician’s orders, the employee is more likely to remain disabled longer (Dionne, 2005; Krause, 2001; Turner, 2006). Similarly, a number of studies have found that a patient’s perception of their injury or illness can have a profound impact on the length of disability, irrespective of the severity of injury. Individuals who self restrict their activity because of a fear of pain or a belief that that activity will make them worse, may actually delay their own recovery (Christian, 2003; Dionne, 2005; Severeijns, 2001; Turner, 2006).

2. **Lack of clear systemic expectations concerning responsibility for medical rehabilitation**

Some studies have found that injuries have a longer disability when the physician’s role in return to work is not clear and/or the physician has a lack of occupational health training (Christian, 2003; Schweigert, 2004).

3. **Job tasks and work characteristics such as heavy physical work requirements**

These have been found by some to correlate to longer than average disability durations (although this is not consistent across studies and may be more affected by the size of employer) (Dionne, 2005; Krause, 2001).
4. Employer characteristics

a. Employers who place less value on employees may tend to have longer disability durations (Currier, 2001; Galizzi & Boden, 1998; Hunt, 1993).

b. Specific industries and industries with temporary or intermittent work. For example, Joling et al. (2006) found longer disabilities in agriculture and fishery, and Galizzi and Boden (1998) found greater disability in employment that is intermittent in the construction and service industries.

c. Smaller firms may operate on a scale that provides less opportunity to accommodate work restrictions or provide modified work. For example, Galizzi and Boden (1998) reported that among firms with 1-50 employees, 21 percent of injured workers did not remain with the pre-injury employer. This percentage declines to 16 percent in firms employing 51-250, to 10 percent with firms employing 251-1000, and to 7 percent for those employing over 1000 (Fox et al., 2006; Galizzi & Boden, 1998; Olson, 2006; Schweigert, 2004).

d. Expected employment changes such as plant closures, lay offs, shift or contract changes may predict longer than usual disabilities since employees do not have a pre-injury employer or position to which they can return. The need to actively seek other employment will predictably delay return to work efforts (Dionne, 2005; Welch, 2005).

e. Relations between the injured worker and employer. A study conducted by The Gallup Organization for Intracorp and Cigna Group Insurance (2001) showed that employees with work related injuries or illnesses who were satisfied with their employer’s treatment of them returned to work in half the time of those who were dissatisfied – 63.5 days compared to 125.8 days. Other studies have also found the employer/employee relationship (especially the employee/supervisor relationship) to be a key factor in the length of disability (Fox et al., 2006; Hunt, 1993).
5. *Psycho-social factors such as depression, socioeconomic and cultural expectations, and secondary gain unrelated to work*

These can affect a person’s ability or willingness to recover from a disability. Depression is fairly common during significant life changes when someone feels they have little control. Secondary gain can take the form of significant incentives to remain disabled; a need for continued attention, sympathy, nurturing, comfort, or support; and/or relief from responsibilities, obligations, or a job or supervisor one dislikes (Christian, 2003; Dionne, 2005; Fox et al., 2006; Walker, 1998).

6. *Time away from work*

The longer an employee is away from work, the less likely recovery and return to work becomes (American Association of Orthopedic Surgeons, 2000). Again, a combination of “causes” may contribute to this observation, including psychosocial factors, filling of pre-injury jobs by other workers, or perceptions of being abandoned by the employer. Unfortunately, this last “cause” is often preventable. Most disabled workers are capable of returning to work in some capacity fairly soon after their injury or illness and are eager to do so. But they may linger on disability much longer when they fail to get the necessary rehabilitation services or employer support to return to work. An employer that is willing to make a few simple, inexpensive accommodations can be especially effective at getting an employee back to work. According to the Job Accommodation Network, 70 percent of accommodations cost less than $500, and 20 percent of accommodations cost nothing at all (Olson, 2006).

**Analysis (and limitations thereon)**

Most of these predictors were unrelated to the severity of the injury as measured by physical impairment. To a limited extent, the impact of one or more of these factors on individuals has attempted to be measured. Much more research needs to be done to develop a weighting system to determine which of these factors may be a primary causal factor in a par-
ticular circumstance and which ones secondary factors. Work also needs to be done to understand how a combination of factors may affect the length of disability. Moreover, return to work is a complex phenomenon, with multiple players and a multitude of factors affecting individuals to varying degrees. A recently published guideline by the American College of Occupational and Environmental Medicine (ACOEM, 2006), Preventing Needless Work Disability by Helping People Stay Employed, states that “the fundamental reason for most lost workdays and lost jobs is not medical necessity, but the non-medical decision making involved in and the poor functioning of...the return to work process.”

As the authors state, “the return to work process does not occur in isolation” (ACOEM, 2006) It occurs in parallel with other processes such as the personal adjustment process of the employee; the medical care process, comprised of diagnosis and treatment; the disability benefits administration process, including a complex set of factors affecting litigation outcomes; and the “reasonable accommodation” process. It is important to note that all of these processes occur in parallel, in other words, at the same time. Without coordination and communication, it is impossible for all the processes to work together for the benefit of the worker. Sadly, these processes are not always directed at precisely the same end, as when maximization of economic recovery impacts medical decision making or decisions concerning return to work. The result is often that a worker remains off work longer than is healthy – and if too long, the employer may have replaced the worker and the job may no longer be available. This is the worst possible outcome for both the employee (who has now lost a job and will suffer significant future wage loss) and for the employer (who has lost a valuable employee and has had to pay to hire and train a new worker who may take years of investments to become as productive as the lost worker).

There is also a growing recognition that the disability benefit process itself may cause lengthened disability. For example, in his book, Understanding Disability, Jasen Walker (1998) states: 

Motivation is lost when a person has learned that outcomes do not directly depend on his or her responses. Perception of
control and personal power are diminished, and helplessness is eventually learned. Most workers’ compensation systems are fertile ground for the growth of injured worker helplessness. When a claimant is compelled to perform a job search, when compensation checks do not arrive on time, when health care providers do not explain their findings, medical diagnosis and the reason for particular treatments, patients begin to feel insecure and believe they have little control over the care necessary to get well. After a while, social dynamics tend to block the claimant from regaining control of decisions critical for his or her well-being.

According to Walker, physicians diagnose and treat physical impairment, but disability can either be induced or created. Induced disability can often result from suggestion. For example, *iatrogenic* disability can be caused by the physician failing to address ability to work, or by the employee failing to ask about return to work after minor surgery. *Beaurogenic* disability, as defined by Walker (1998), can be caused by organizational policies or procedures that delay return to work. Beaurogenic disability can be caused by the employer, administrator, or by the policies and procedures of the workers’ compensation system itself.

**Summary**

Perfecting a method of 1) identifying factors that prolong a worker’s inability to function and return to work and 2) learning what interventions can help reduce the effect of these factors could be an important strategy in reducing the negative effects of disability for both the employee and employer.

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2 “Iatrogenic” is defined by *Webster’s College Dictionary* as “induced unintentionally by the medical treatment of a physician.”
Reducing Disability in Occupational Injuries

This paper highlights a number of factors that have been shown in the literature to affect disability duration and prolong recovery and return to work for injured or ill workers:

- The worker’s age, education, income, pre-injury employment history, tenure with the current employer, individual self prediction of continued disability and fear avoidance, catastrophizing, and/or fear of change.
- Lack of clarity in the physician’s role in rehabilitation and/or a lack of a physician’s occupational health training.
- Employers who place less value on employees, those with temporary or intermittent work, those with plant closures, lay-offs, shift or contract changes, those with smaller organizations or those with poor relations with their workers.
- Psycho-social factors such as depression and secondary gain.
- Time off work.
- The structure and functioning of the disability process itself.

Obviously this is a crucial area of study. Our understanding of the degree to which these factors (and others not yet identified) affect the duration of disability and how their effects can be addressed and mitigated needs much more attention. A significant step would be to attempt to quantify the effect of these factors so a weighted model could be used to identify the cases that are likely to have a prolonged disability and then to determine which interventions, applied at what time, can affect the most rapid recovery and return to productivity for the worker and protect both the financial and human resources for the employer.
Acknowledgments

The author would like to acknowledge the U.S. Department of Labor for their support during the literature review which was done under contract on a project for them.

References


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From Data to Wisdom

Utilizing State of the Technology Techniques to Derive Wisdom at the Speed of Thought

Robin Jackson*
Laurie Pipenur**
David Andrews***

Where is the Life we have lost in the living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?

- T.S. Eliot, “The Rock”

Eliot in his own gifted way sums up the conundrum faced by the collectors of data in an information age. The challenge for all businesses and

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governmental agencies is to regain the wisdom that we have lost in an overwhelming sea of the information which we both generate and collect.

This challenge has been addressed since the earliest days of the advent of computers. In his article “Information as a Resource,” Harland Cleveland (1982) first discussed the cognitive characteristics of the bits and bytes that are accumulated by information systems using Eliot’s quote as the foundation for what can be considered the seminal work on this topic.

Like Eliot, Cleveland (1982) only named three parts of the hierarchy: information, knowledge, and wisdom. Cleveland acknowledges others’ versions of the hierarchy which include data, but interestingly he himself did not embrace the distinction between data and information in his own analysis.

While Cleveland and others worked towards opening a dialogue about the proper taxonomy for describing the levels of understanding associated with various data, Russell Ackoff (1989) popularized what is now commonly referred to as the Data-Information-Knowledge-Wisdom (DIKW) pyramid shown in Figure 1.

To many, the notion of data becoming information, then knowledge, and finally wisdom, seems almost intuitive. On the other hand, it can be rather difficult to fully explain what wisdom actually is, especially in a computerized environment. We also recognize that what is one person’s information may actually be considered another person’s data. So rather than deal with extremely precise definitions of each of the DIKW elements, this article assumes that increasing levels of refinement leads to greater value by enhancing insight and understanding. This increased value is illustrated by the fact that “Wisdom” sits at the top of the pyramid, while “Data” forms the base.
The role of IT versus the business user in the DIKW pyramid

The DIKW pyramid provides a useful way of thinking about the real purpose of data acquisition and its use once acquired. Unfortunately, until recently, most IT professionals have not regarded the higher echelons of this pyramid as their concern. IT professionals, by their very nature, focus on the proper acquisition, storage, and retrieval of data. While the business savvy IT manager is a rare, refreshing and valuable commodity, the truth is that IT professionals are merely the keepers of data. Information, knowledge, and ultimately wisdom can only be derived from those who understand the business for which the data has been collected.

Like many other entities, the State of Montana’s Department of Labor and Industry/Employment Relations Division (DLI/ERD) has become the collector, maintainer, and reporter of several gigabytes of raw data. As in many other organizations, our IT personnel, as well as the end users, fail to recognize the distinction between the various pyramid levels. This impacts the delivery of systems that provide valuable tools to enhance the work of the end user. The IT personnel tend to deal at the
lower levels of the pyramid, but the end users really need tools to work at the upper levels.

In our own efforts to objectively assess our organizational maturity in the use of our data, the definitions in Table 1 were used.

**TABLE 1**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>WISDOM</td>
<td>Use of knowledge to proactively improve the system</td>
</tr>
<tr>
<td>KNOWLEDGE</td>
<td>Understanding what is happening in our workers' compensation systems</td>
</tr>
<tr>
<td>INFORMATION</td>
<td>Statistical summaries and reports</td>
</tr>
<tr>
<td>DATA</td>
<td>Raw numbers</td>
</tr>
</tbody>
</table>

An analysis of our efforts to climb the data pyramid in the domain of workers’ compensation data showed that we had only risen to the level of “Information.” An examination of the root causes of our failure to rise higher quickly pointed to six fundamental problems:

- **Lack of Communication** – IT failed to effectively communicate to the business units the possibilities available to allow a better cognitive approach to the data. The end user had to request specific reports and IT personnel generally believed that it was a bad thing to allow free access to the data.
- **Lack of Adequate/Trained Resources** – IT did not have an in-house capability to investigate enabling technologies that would allow the business units to better understand the data at hand and to explore inter-relationships between the data in an ad hoc manner.
- **Lack of Funds** – Classic Business Intelligence strategies, including extensive data modeling and custom data warehouse
development, were perceived as being cost prohibitive when compared with the possible benefits.

- **Lack of Vision – Perception of IT as an end not a means** – IT believed that it had a primary function (gathering and storing data) and that this function was being met by giving the users what IT said they needed. IT was not doing enough to ensure that IT services actually improved the program objectives and business outcomes that the users were trying to achieve.

- **Lack of Alternatives** – Today’s IT practices are based heavily on Date and Codd’s (1974) early work in data normalization as well as a host of best practice information engineering methods and techniques. While these are essential foundations, they have managed to crowd out other valuable IT models and methods. The result is fewer approaches to solving increasing complex problems.

- **Lack of realistic vendor promises** – Almost every IT product or service promises to provide access to all the information we need. Our experience, as well as the experiences of others who have shared with us, points out that this is almost never the case. While tremendous advances have been made across a wide spectrum of hardware and software, users still complain of being overwhelmed by data and the explosion of information.

Ultimately, the end user did not know what technologies could help him function at the upper levels of the pyramid. Subsequently, most users have had to make do with basic tools such as spreadsheets and manual data manipulations. IT did not truly understand the business of the end user, nor what the end user was trying to accomplish. IT became a dictator of known technologies rather than an enabler to help the end user. The status quo was maintained as users began to expect little more useful information from the new systems than they received from the old one. In fact, this expectation became so ingrained, that when asked what reports they wanted, users simply asked for the old ones that they had become used to. The net result was that IT served the more common clerical functions like data collection rather than the higher value of more sophisticated analysis and decision making.
The above observations are not meant to be derogatory by any means. Seasoned IT professionals will admit that historically, the challenges described have been prevalent for quite some time. It has only been recently that IT has come to a much clearer understanding of its role as a support service for the core business (in non-IT related industries). Also, new technologies such as Business Intelligence (BI), which could help promote insight and understanding, were becoming more common, reliable, and robust.

As we considered the differences between the successful attainment of higher levels of understanding about the data, it became clear that the key to success lies in allowing the business units to have free access to their data without depending on IT hand holding. Furthermore, BI technologies provided a platform on which we could build and deliver.

**The pros and cons of using knowledge experts to climb the DIKW pyramid**

Traditionally, there have been two primary methods to achieving better organizational understanding of the data pertaining to its business. The first of these is the use of knowledge experts, individuals who have a great deal of expertise in the subject matter domain. These experts analyze the organization's data and deliver a black box assessment of their analysis and recommendations. Workers' compensation systems routinely engage such experts to audit their systems with a great degree of success. There are, however, limitations to the use of experts to help an organization stay at the pinnacle of the DIKW pyramid.

- The first and most obvious limitation is that the understanding is limited by the expert's domain experience. Implicit in the knowledge expert's analysis are all the preconceptions and empirical observations of the systems that he or she has previously studied. The more analyses the knowledge expert does, the more ingrained these biases may become.
• The second problem with this methodology is that there is an implied consistency between systems that may or may not exist. The knowledge expert’s inherent biases developed while working in a variety of jurisdictions may lead to assumptions about the current engagement that he does not adequately test. A knowledge expert cannot come into a given system for a limited engagement and have the same depth of understanding about processes and environmental factors that an in-house analyst intuitively knows from working in the system day in and day out, often for years.

• The third problem is that the expert’s work is difficult to validate. Given the black box nature of the expert’s work, it can be almost impossible for in-house staff to duplicate in order to confirm findings. Moreover, there is often no clear audit trail that can help conclusively prove that the raw data is properly reflected in the expert’s conclusions.

• The fourth problem with this methodology is that it is limited in time and scope. If we could have a knowledge expert working on staff everyday, for a reasonable salary, then it might represent a practical means of keeping the organization’s understanding of its data close to the top of the DIKW pyramid. Most jurisdictional budgets cannot absorb the expense of prolonged expert engagements without specific legislative appropriations.

In addition to the specific problems noted above, reliance on outside experts robs internal staff of important opportunities for professional development and more interesting work. These missed opportunities reduce valuable intrinsic motivations for staff to enhance their own contribution and thereby gain a greater sense of responsibility and control.

The pros and cons of Business Intelligence tools

Because of the inherent problems with the use and availability of outside knowledge experts, the IT community has developed tools and
techniques for the multidimensional analysis of data. These allow the subject matter experts within an organization to better glean knowledge and derive wisdom from the organization’s data. For the purposes of this discussion we will refer to these tools and techniques as classic BI tools. Today the number of tools categorized as BI continues to grow, and some of the more popular include:

- OLAP (Online Analytic Processing) could be thought of as spreadsheets on steroids or ad-hoc reporting times ten. OLAP allows the analysis and manipulation of large amounts of data in a very intuitive manner which allows even casual users to quickly gain insights which might otherwise be missed.
- Predictive analytics creates more reliable forecasts of future outcomes and trends using advanced statistical models.
- Data mining examines large amounts of data and uncovers trends and relationships that are usually missed by humans as well as other types of automated analysis.
- Dashboards organize, summarize, and present high level information from a variety of outputs in a unified display. Dashboards frequently present information in gauges or in controls much like those on an automobile dashboard or on a stop light (red, yellow, or green light indicating status).
- Performance monitoring and notification is the process of scrutinizing key indicators on a dynamic basis and alerting the user via email, voice mail, text message, or other digital means when certain thresholds have been met.

Classic BI tools almost always use multidimensional data views. In a workers’ compensation solution, dimensions may include: body part injured; cause of injury; and other data related to a claim such as industry, gender, age, and any other information contained on a First Report of Injury (FROI) record. As data is added for a given case, the dimensions expand beyond the FROI to include Subsequent Report of Injury (SROI) and any other relevant data.
The multidimensional views are typically extracts from relational databases and other sources of information that are designed to allow analysts to study the relationships between different data in an ad hoc manner. This extracted data is typically housed in a data warehouse, data mart, or cube. The user then accesses the data via proprietary tools designed expressly to work with the data warehousing technology for a specific vendor. The end result is that the end user has powerful tools to gain insight into massive amounts of data without having to rely on IT every time requirements change.

In this way, the use of classic BI tools obviates many of the problems associated with the use of a knowledge expert. However, most IT professionals will shudder as they contemplate some of the realities of implementing a classic BI system. These realities include:

- BI projects tend to be very time consuming and risky. They also rely heavily on knowledge experts to properly build the multidimensional views and identify the pertinent data that needs to be included. A significant proportion of BI projects fail, making many BI purchases little more than shelf-ware.
- BI software is usually both expensive and proprietary, driving up IT costs at the same time that it creates more islands of isolated information.
- BI systems can be slow. It is not uncommon for BI systems to take several minutes to return results to the user. While this is much faster than the days it takes to get a new report to a user from an IT department, or weeks to get a report from a knowledge expert, it still is less than desirable. In an era of instant gratification and high-speed bandwidth, several minutes for results could be a death knell for a BI implementation. In fact, without sub-second response time for most queries, users cannot explore at the speed of thought. Speed itself contributes to how well humans can gain new insights into familiar problems.
- BI solutions can be very expensive to maintain. Once the data warehouse and multidimensional views have been implemented, adding new data elements into the system is not cheap.
or easy. And finally, when the source transaction systems are replaced, so must the BI system be replaced.

DLI/ERD wanted to take advantage of what BI offered. However, given the risks and associated costs, we were not about to rush into a classic BI implementation.

Data fusion – Enhancing the next generation Business Intelligence application

What Montana’s DLI/ERD needed was a next generation BI solution that would have the advantages associated with classic BI tools and which could be used by internal and external knowledge experts to rapidly analyze both internally and externally collected data in real time. Such an approach did exist. Its earliest use was for military intelligence and sophisticated weapon systems. More recently it has started to be used for traffic control, weather forecasting, and forest fire mitigation. The technique is called data fusion.

What is data fusion?

Data fusion involves making sense out of massive amounts of data. It involves capturing data from multiple sources and processing it in a way that derives more information than if each of the sources had been processed separately. The data sources do not have to use the same format and standards. The collected data is refined in several cycles using proven techniques and methods until the resulting information is better than if the sources had been processed independently. Finally, data fusion comes to an expert-like conclusion or answer to the user’s problem. Data fusion strives to produce conclusions or answers that are actionable, meaning that the results of the data fusion process support near real time decision making, or they produce high order information that otherwise can be only produced by experts.
In summary, data fusion includes techniques that combine data from multiple sources and processes it against known rules in order to achieve highly efficient and effective inferences. The inferences gained from data fusion are even more efficient than if they were obtained from a single source.

Figure 2 illustrates a simple military example of data fusion. In this example, an unidentified aircraft is detected by three separate sensors related to a satellite, jet fighter, and ground radar. Data fusion will process the information from these sensors in four basic steps. These steps will be repeated over and over again as the sensors continue to receive more information as the unidentified aircraft gets closer. The data fusion process will help determine whether the unidentified aircraft is a threat, and if so, what type, and then help determine the best way to mitigate the threat. In a combat situation, the data fusion process could continue and include data gathered from the weapons systems required to neutralize the threat.
Another type of military data fusion involves intercepting enemy communications and other electronic signals and then extracting information about enemy intentions and activities. This later type of data fusion is closer to what DLI/ERD could use. The data intercepted from the enemy can come from many different, non-integrated sources. The enemy data is not integrated, does not follow any one standard, and is “all over the place” – a situation that while extreme, is not unlike what our IT department often faces.
Believing that data fusion might help, DLI/ERD looked for private vendors that used data fusion to solve real world financial analysis and reporting problems for state, county, and local governments. We brought our needs to them and asked if data fusion could be used to achieve similar results for the DLI/ERD workers’ compensation program in a timely and cost effective manner. We found one solution that had adapted data fusion for non-military needs – “business data fusion.” A proof of concept project confirmed that business data fusion could be a decisive factor in meeting DLI/ERD needs.

Our further work with business data fusion suggests that it represents a step level improvement in BI solutions. It increases functionality while also lowering costs. For example, our access to data was so flexible that we didn’t need to involve IT every time we needed to look at data in a different view or relate it to other data in the way we wanted to see it. The next result is that we can better deal with user complaints about drowning in data and not being able to access the information they need. Further it enables both common and sophisticated users to rapidly ask what-if questions and receive answers at the speed of thought.

_Data fusion propels the climb up the DIKW pyramid_

Data fusion builds on the value that a classic BI solution can deliver and contribute additional value in three primary ways:

- Refines raw data from multiple sources in a way that creates data that is more valuable than if each source was processed individually.
- Adds expert context, perspective, and business rules from a particular domain such as workers’ compensation, budget execution, or other detail area of business activity. This enables interaction with the BI solution to be more responsive and appear more intelligent to the end user.
- Significantly reduces the time and cost to implement and maintain the solution.
In this manner, data fusion allows DLI/ERD to gather data from dispa-
rate sources, such as from the internal central workers’ compensation
databases, spreadsheets, and from external data sources like NCCI data.
Then the data fusion engine harmonizes and renovates the data and pre-
pares it for user queries.

The queries are not predefined, anticipating what the user would ask;
rather they allow the user to navigate and interrogate the data following
his natural curiosity and need to know. From an IT perspective, data fu-
sion allows the user to connect data elements that may not be joined or
related in a database sense providing “any to any” reporting relationships
on demand.

Figure 3 illustrates how data fusion helps refine data into wisdom with
interactive support from the end user. Unlike classic BI, business data fu-
sion enabled BI requires a tightly defined domain. The business data fu-
sion domain considers several factors, the most common being: industry,
subject matter, best practices and external standards, and the user’s role
in the organization. Within the context of a tightly defined domain, then
interaction between the output of data fusion processes and the end user
creates a virtuous cycle where data turns into information, information
into knowledge, and eventually knowledge into wisdom. Any action that
the user takes – either to change a query or parameter – causes the data
fusion process to produce different insights.

Actions taken (for example, to change a policy) also eventually add to in-
sight, as results occurring after the policy change can easily be compared
to those before. At each level, increasingly sophisticated data fusion pro-
cesses and expert skills come into play. As the level of sophistication
increases, one moves higher up the DIKW pyramid. While the diagram
suggests that data fusion occurs in a step-wise fashion, in fact most steps
occur in parallel and changes in any one area of the pyramid can become
input for any other. For example, a decision made at the highest level,
“Wisdom,” can result in one or more data points entering the lowest
level, “Data.”
One of the key requirements for any proposed solution was that it could work with any major user interface. We wanted our users to be able to select the tool they wanted, including any BI tool, Microsoft Excel, or browser as a viewer. That way, the user would not have to learn a new tool and could work with what they already liked. Such a proposal would allow the organization to leverage previous investments in BI tools – and not have to throw anything out and start over. The solution we deployed allows us to do just this.

The data fusion engine does all the heavy lifting on a server and creates results that can then be displayed on Excel or any other viewer the user wants. A simple user interface like Excel hides the complexity of the underlying data fusion from the user, but the results achieved can be as powerful as any high-end BI tool. The user interface is just the medium, not the message. The data, information, knowledge, and wisdom are a result of the underlying data fusion engine. Then the various user in-
Interfaces can generate reports, graphs, and charts to document and demonstrate the knowledge gleaned from the data fusion exercise. The user spends time gaining knowledge rather than worrying about data and/or how a new interface works. And with that knowledge, one learns and gains wisdom to proactively improve the system and related performance measures.

Data fusion renovates raw data

A problem at DLI/ERD is that some data is recorded using outdated coding standards. We have used data fusion to renovate raw data. One example is the newer North American Industry Classification System (NAICS) and older Standard Industry Classification (SIC) codes. Montana DLI/ERD contains both codes in its source data. Some records use the SIC codes while others use the NAICS codes. Meanwhile, the user really does not care what code is used, but they do care what the data means. The user wants reports that use words, not codes, which they find to be meaningful. And the user wants those words to be related to quantitative data about the industry code in claims and benefits. The user is not interested in the fact that the source data was either a SIC code or a NAICS code.

DLI/ERD wanted to seamlessly renovate SIC and NAICS data to represent the most current NAICS classification. However, the complications included: 1) there is not always a one to one correspondence between SIC and NAICS codes, 2) some DLI/ERD SIC codes were actually modified from the standard, and 3) DLI/ERD used several older variations of NAICS codes. Using data fusion, we seamlessly renovated our industry data to comply with NAICS 2007 and added intelligent summaries as well – so, it does not matter to us whether a source recorded used a SIC or a NAICS code. Moreover, this was achieved without having to manually change old data, or make changes to our systems or business processes.
Data fusion links internal data to outside databases

We also wanted to be able to link our claims data to external databases that are not specifically designed for workers’ compensation programs. We found that data fusion has extensive ability to associate data from internal data sources to external data sources. For example, we have tested the ability to link the “Class Codes” to the wealth of information contained in the O*NET™ database in order to gain even more insight to the internal workers’ compensation data.1

In another example, we were able to integrate our workers’ compensation data with information provided by the US Census Bureau. When we include more types of external databases, we achieve richer contexts in which to analyze our program results. For example, how do changes in the demographics shown in the census numbers potentially affect the workers’ compensation program? Our original internal data becomes much more valuable when data fusion blends it with outside data sources.

Data fusion harmonizes data

While data renovation converted our older and disparate data standards to one new standard, we were concerned that it could create other potential problems:

- Renovation changes to the raw data could possibly destroy the ability to tie reports back to the original source data.
- The renovation process could inadvertently introduce errors.
- Different users prefer different standards for different purposes in some cases.

Data fusion’s harmonization capabilities allowed us to overcome these concerns. Our data fusion process supported the integration of sources

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1 O*NET™ is the nation’s primary source of occupational information, providing comprehensive information on key attributes and characteristics of workers and occupations.
that use different data standards. It creates enterprise-wide consolidation of data without requiring any changes to the disparate data sources. Data fusion provides meaningful aggregation of data for analysis as do classic integration and consolidation solutions. Unlike most other integration and consolidation approaches, data fusion also maintains the original details for proof and reliability. Moreover, reports and analysis can be examined using any of the source system classifications and taxonomies.

A welcome by-product of this is the reduction of internal disagreements about data validity. Each group can see the enterprise-wide data in its own terms. Overall, this capability makes interactive reports and analytics that are self-evident and self-supporting, and therefore virtually audit-proof. Self-evident reports are those that can be understood by most casual users who have no direct knowledge of the organization distributing the report, much less the details of the underlying systems. Self-supporting reports are interactive and can drill to the extracted detail and show that detail in its original form as well as any refinements made by the data fusion process. Self-evident and self-supporting reports allow an auditor to prove the correctness of the report without having to go through the process of examining spreadsheets with all their links, formulas, and possibilities for error.

Sometimes the end user needs to do more than to just consolidate or standardize a given set of data. Another harmonizing feature allows the user to see both homogeneous and heterogeneous classifications in the same view. For example, “Employment Status” information can be presented in either the ANSI standard, the IAIABC standard, or a harmonized view that resolves differences between the two. It does not matter to the data fusion engine, and both of these classifications can be combined to roll up to a total or drilled down to show the break-down of each.

Just beginning the climb

Montana DLI/ERD has just begun to experience the many benefits of data fusion. On the horizon, we see the automatic generation of the DLI/
ERD annual report complete with diagrams and associated numbers inserted in the text. Other potential initiatives include closed-loop predictive modeling to better forecast assessments/surcharges and the addition of data sources such as macro economic data (e.g. housing starts, employment rates by sector), safety data (e.g. safety program types, inspections/year), and demographic data (e.g. education, median income), to name a few. Data mining will also be deployed to help uncover insights that could be missed by other analytic techniques. We also plan to add dashboards and other features such as event detection and notification. In all, the intention of using data fusion is to bring us closer to the wisdom we have lost in the data.

Editor’s Note: Starting with the next issue, all authors submitting to the IAIABC Journal will be asked to disclose in writing any financial interest they may have in the subject matter upon which they are writing, and such disclosures will be made public. Although such disclosures have not been requested for the current issue, the Journal is aware that one or more of the authors of this article has some financial interest in products, services, training or other activities discussed in this article.

References


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The Growing Importance of Vehicle Accidents to Workers’ Compensation Claims and Cost

Gregory Krohm*

Introduction

Most business managers think of onsite accidents when they consider injury threats for their employees. However, outside of the construction, agriculture and a few natural resource industries, vehicles cause more serious injury to workers than anything else. Moreover, traffic accidents result in a disproportionate share of serious disability and fatalities. Highway accidents have been the leading cause of occupational fatalities in the United States, accounting for 1,329 thousand civilian worker deaths in 2006, or 23 percent of all injury-related deaths (U.S. Bureau of Labor Statistics, 2007). This level of fatality and share of all work-related deaths has been at this level since 2000. Following is a high level review of the risks of vehicle injury and basic measures to control injury.

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A primary goal of the paper is to acquaint the reader with interesting current research on the issue of occupational vehicle accidents. The paper draws on both general highway safety and injury statistics and information particular to occupational injuries. A second goal of the paper is to point the reader to technical resources for a more in-depth study.

**Overall vehicle injury trends and risk factors by type of organization and job classification**

Ironically, the death rate for occupational injuries, 1.02 per 100,000 workers, is far lower than the rate of fatalities from traffic deaths in the general U.S. driving population, at 14.8 per 100,000. This comparison, based on National Institute for Occupational Safety and Health (NIOSH) and National Highway Traffic Safety Administration (NHTSA) data for 2000, is not quite an “apples to apples” comparison, but it does illustrate the point that highway vehicle travel is dangerous. Hopefully, the habits that workers learn to protect themselves while driving for work should also protect them against the risks of vehicle fatality away from work. Because vehicle accidents occur sporadically and seem to be an everyday risk to the general population, it is easy to see why some employers would overlook this risk factor. Yet, for most businesses, highway vehicles present the biggest threat of very serious injury to employees, and are associated with workers’ compensation claims of relatively great dollar severity. Thus, it behooves all employers, even in industries with low claims frequencies, to consider at least the basics in accident prevention and loss control. This section relies heavily on the National Council on Compensation Insurance (NCCI) studies, which contain the only source of published data on vehicle related workers’ compensation claims (see Restrepo, Shuford, & De, 2006a, 2006b).

**Trends in injury over time**

The injury rate from vehicle accidents is declining, but less slowly than other workers’ compensation injuries. Hence, vehicle accidents are becoming a large source of workers’ compensation claims and losses. It will be interesting to explore later in the paper why highway vehicle opera-
Vehicle Accidents and Workers’ Compensation Claims and Costs

Injury by industry/occupation

Truck drivers face a disproportionately high risk of death, but relatively fewer non-serious injuries. Private passenger cars have lower fatalities but nearly double the rate of non-fatal injury. This is intuitively plausible because the size and mass of trucks protects occupants well in low speed collisions with other vehicles. In addition, trucks are susceptible to jack-knifing and overturn, which are likely to result in fatal injury.

<table>
<thead>
<tr>
<th></th>
<th>Fatalities</th>
<th>Non-Fatal Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy trucks</td>
<td>2.3</td>
<td>60</td>
</tr>
<tr>
<td>Passenger vehicles</td>
<td>1.5</td>
<td>109</td>
</tr>
</tbody>
</table>


The above federal data covers all highway accidents. However, the data is consistent with workers’ compensation claims data collected by the NCCI. The NCCI data shows that truck drivers have disproportionately high rates of serious injury. In addition to high fatalities, trucking occupations tend to generate longer duration claims and higher average costs of workers’ compensation.

As shown in Table 2, the workers’ compensation class codes covering “Salespersons, messengers, collectors” and “Clerical office NOC” generate the top ranked shares of claims, and similarly, costs, for workers’ com-
Vehicle Accidents and Workers’ Compensation Claims and Costs

pensation vehicle accidents. Trucking codes fill three of the top ten spots. These are rankings of absolute numbers of injuries, not rates of injury per 100 workers. Hence, the clerical code is the largest single employment code so, all things being equal, it would have a large share of accidents. The point of this exhibit is to show that occupations not intuitively associated with traffic accidents can indeed generate large volumes of workers’ compensation claims. Anyone whose job requires a good deal of highway travel, especially at relatively dangerous times, is in harms way.

TABLE 2
Workers’ Compensation Injury by Class Code

<table>
<thead>
<tr>
<th>Class code</th>
<th>% Share of claims</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clerical office NOC</td>
<td>6.2</td>
<td>1</td>
</tr>
<tr>
<td>Sales, collectors, or messengers</td>
<td>6.1</td>
<td>2</td>
</tr>
<tr>
<td>Drivers, chauffeurs NOC commercial</td>
<td>5.5</td>
<td>3</td>
</tr>
<tr>
<td>Trucking – long distance</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Auto service/repair</td>
<td>2.9</td>
<td>5</td>
</tr>
<tr>
<td>Trucking NOC</td>
<td>2.7</td>
<td>6</td>
</tr>
<tr>
<td>Police</td>
<td>2.6</td>
<td>7</td>
</tr>
<tr>
<td>Trucking local</td>
<td>2.3</td>
<td>8</td>
</tr>
<tr>
<td>Bus company</td>
<td>2.2</td>
<td>9</td>
</tr>
<tr>
<td>Nursing/home health and public health</td>
<td>1.6</td>
<td>10</td>
</tr>
</tbody>
</table>

NOC=not otherwise classified
Source: Restrepo et al., 2006a
Traffic accidents are a high risk to the general driving population. Hence, anyone whose job requires that they spend long hours behind the wheel faces a high risk of injury from an accident. This includes management and technical employees that travel frequently in the course of their work.

**Characteristics of workers’ compensation claims**

Again, the authoritative resource on workers’ compensation claims from vehicle accidents is provided by the National Council on Compensation Insurance (Restrepo et al., 2006a). Figure 1 is based on that NCCI study. It covers claims reported by its member insurers over the period 1997-2003.

Traffic vehicle claims make up almost 2 percent of claims but represent more than 5.5 percent of total losses. The share of costs and claims due to vehicle accidents grew over the period 1997-2003.

![FIGURE 1](image)

*Motor Vehicle Accidents Produce More Severe Injuries*

Source: Figure from Restrepo et al., 2006a, and used with permission of the NCCI. Note that claims and incurred cost are at 2nd report for accident years 1997-2003 on the NCCI database.
As shown in Figure 1, vehicle injuries produce fewer “medical only” claims (about 61 percent) compared to all workers’ compensation claims (about 77 percent). As a corollary to the relatively low medical only claims, Figure 1 shows vehicle injuries had a far higher rate of Permanent Total (PT) and Fatality (Fatal) workers’ compensation claims than claims overall. Finally, although they make up only about 2 percent of all claims, vehicle accidents account for over a fifth of the fatalities.

The average dollar severity of medical only claims is greater for vehicle claims. Likewise, the average severity of every Temporary Total, Permanent Injury, and Fatality is worse for vehicle versus non-vehicle claims. For example, over accident years 1997-2003, total severity for motor vehicle accidents in trucking classifications averaged close to $29,000, but for all other occupations it was just over $16,000 (Restrepo et al., 2006a).

According to NCCI, neck injuries are by far the leading part of body injured. Based on the injury codes in workers’ compensation claim reports, neck sprain and cervicalgia (pain in neck) were the first and second ranked codes, and accounted for 15 percent of all vehicle claims. But the same codes amounted to less than 2 percent of all workers’ compensation claims. The code for “face and neck injuries” ranked fourth with 1.4 percent of all workers’ compensation claims reported (Restrepo et al., 2006a). This is consistent with the relatively high medical and indemnity costs of vehicle related claims.

**Costs other than workers’ compensation**

Workers’ compensation constitutes only a small fraction of the cost to employers of work related vehicle accidents. According to a study done by the NHTSA (2003), the combined cost of motor vehicle crashes to employers averaged $60 billion per year between 1998 and 2000. According to that study, employer medical expenses from motor vehicle crashes was $7.7 billion in 2000; another $8.6 billion was spent on sick leave and life and disability insurance for crash victims. Truck accidents in particular may have very high property damage, personal injury liability, and environmental cleanup costs. Workers’ compensation costs, by
comparison, averaged $2 billion per year over the same period (NHTSA, 2003, Table 2, p. 5). Thus, employer actions to reduce vehicle accidents can have a powerful effect on human resource, property, and casualty costs for their organizations.

Specific causes of injury

State of driver (sleep deprivation, distractions, multi-tasking)

Unsafe operation by the driver is the leading cause of injury, and in a sense, the easiest to control. According to the NHTSA, behavior related causes hold five of the top six causes of vehicle accidents:

1. Driver distractions
2. Driver fatigue
3. Drunk driving
4. Speeding
5. Aggressive driving
6. Weather

Two specific behaviors to focus on are seat belts and driving under the influence of alcohol. Both are very expensive to employers. According to the NHTSA and Network of Employers for Traffic Safety, employers paid $2.1 billion per year for work related highway crashes for the 1998–2000 period. Alcohol-related motor vehicle highway crashes while on work time cost employers an estimated $3.1 billion annually over the same period (NHTSA, 2003).

State of vehicle (improper tire pressure, mechanical failure, failing brake systems, mirror/blind spot)

Fleet operators take pains to comply with specific safety requirements on their vehicles. Other businesses may not be so careful about vehicle maintenance or the maintenance of private vehicles used by employees
in the line of work. Yet the evidence seems to show that mechanical problems with vehicles are a minor cause of injuries.

*Outside factors (weather, other drivers, highway construction and signage)*

The nature of the travel itinerary route makes a big difference in serious accidents. Interstate highways have a small fraction of the injury rate on state and county routes. The difference is due to the careful engineering of interstates to avoid crashes and to minimize the serious injury from those that do occur. Unfortunately, there is not much that can be done about these outside factors, other than to train employees to adjust speed and breaking distance to adverse conditions.

**Steps to improve safety**

The risk management/safety profession has long used a hierarchy of methods for controlling risk in any occupation or context:¹

- Elimination
- Substitution
- Engineering controls
- Administrative controls
- Personal protective equipment

Experts generally believe that methods at the top of the list are potentially more effective than those at the bottom. On the other hand, elimination and substitution are often the most costly and impractical for a business, e.g., avoiding deliveries in bad weather or avoiding dangerous highways. Experts further note that employers are often quick to em-

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¹ For example, see the National Institute for Occupational Safety and Health (http://www.cdc.gov/niosh/topics/engcontrols/) and the Rochester Institute of Technology (http://www.rit.edu/~outreach/training/Module3/M3_Hierarchy-Controls.pdf)
brace personal protection equipment because it is intuitive and relatively inexpensive. In the review of risk controls below, we will touch on all of these methods.

*Training*

Training can be directed at practical information about safety, the practice of driving techniques, or motivational information. Standard topics include avoiding distractions, seat belt use, trip planning, speed reduction, and obedience to traffic laws. Specialized training is needed for specialized work requirements, such as hazardous materials, loading and unloading injuries, and securing cargo. Training is often targeted at high risk groups, e.g., new hires or employees with poor driving records. The resources listed in Appendix I offer assistance in designing a training program.

*Health and wellness*

Certain health issues can impede driver judgment, alertness, and other behavior to the extent that accidents are more likely. The most important of these are:

- Vision
- Obesity
- Hypertension
- Stress

Health factors may be directly related to the ability to operate a vehicle safely, especially vision. The federal government has prohibitions on truck drivers operating long distance freight trucks with hypertension, diabetes, epilepsy, and certain heart conditions. Physical condition may also contribute indirectly to losses, e.g., obesity leading to a poor night’s sleep and drowsiness behind the wheel of a car.
Technology/Engineering controls

Engineering a system to separate the worker from the hazard is considered by NIOSH to be a very effective strategy.\(^2\) There is a growing arsenal of technologies to prevent crashes in trucks and cars. Examples include:

- Better performance brakes for trucks and buses
- Camera technology for blind spots
- Collision prediction technology
- Cargo securing devices

Other “administrative controls”

Besides training and health and wellness programs, employer safety practices should include accident investigations for purposes of reviewing causes and remedies. Such investigations should be integrated into a loss/accident management information system. Business practice should reinforce messages delivered in training. For example, zero tolerance for substance abuse and failure to use protective equipment should be both preached and practiced by management.

Planning for safe operations should also incorporate shift scheduling and realistic expectations for driving time and routes. Accident rates vary tremendously by time of day and part of the week. Accident rates spike on late Friday afternoon, perhaps due to fatigue. Early morning driving on weekends is an especially dangerous time. Studies show that drivers drowsy from long hours without rest can be as impaired as those impaired by drugs or alcohol.\(^3\)

Speed and risk taking can be associated with unrealistic work schedules.

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\(^2\) NIOSH, op. cit.

\(^3\) For a review of the literature on “alcohol interactions and comparison with fatigue” for vehicle accidents, see the Canadian Fatigue Impairment Web site at: http://www.fatigueimpairment.ca/
Maintenance of vehicles, including safety inspections, should also be built into operational procedures. Finally, high rates of staff turnover are associated with workers’ compensation injury in general and with traffic accidents in particular. Thus, focusing safety training on new hires may be a good targeting strategy.

**Specific safety issues**

Below is additional discussion of topics that might be of particular interest to employers in establishing risk control measurers.

**Driver distractions**

According to a study by the University of North Carolina Highway Safety Research Center (Stutts, Reinfurt, Staplin, & Rodgman, 2001), each year an estimated 284,000 distracted drivers are involved in serious crashes. Distractions have always been part of driving. Today, however, distractions of all sorts are a growing cause of vehicle crashes. There are more distractions than ever: cell phones, laptops, GPS systems, and other multi-tasking instruments. Despite heavy use of cell phones in vehicles and the strong suspicion that cell phone use is dangerous, the evidence is mixed on how large a contribution cell phone use makes to vehicle accidents. Presented below are vignettes that describe the findings of research on the contribution of cell phone usage to accidents. It is beyond the scope of this paper to take sides in this controversy.

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4 The University of North Carolina Highway Safety Research Center was funded through the AAA Foundation for Traffic Safety to explore the role of driver distraction in auto crashes, as well as the types of distractions most commonly experienced by drivers. Their 2001 report contains some rather counterintuitive findings, found at: http://www.aaafs.org/pdf/distraction.pdf

The University of North Carolina study strongly implicated distractions with crashes, but ranked cell phone use as a relatively low source of distraction leading to crashes (Stutts et al., 2001).

A recent statement of the National Highway Traffic Safety Administration on the evidence for cell phone related accidents:

Research shows that driving while using a cell phone can pose a serious cognitive distraction and degrade driver performance. The data are insufficient to quantify crashes caused by cell phone use specifically, but NHTSA estimates that driver distraction from all sources contributes to 25 percent of all police-reported traffic crashes.

The “100 Driver Study” (Neal, Dingus, Klauer, Sudweeks, & Goodman, 2005) monitored the behavior of 100 Washington, D.C. metro area commuters with on-board cameras. That study found the use of wireless devices to be the single greatest secondary activity to driving associated with near crashes and incidents. Wireless devices were by far the leading secondary activity immediately before a driving irregularity (judged by the researchers to be “incidents”). However, they were not much different than the other distractions as they related to “crashes.”

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6 See “NHTSA Policy and FAQs on Cellular Phone Use While Driving” at http://www.nhtsa.dot.gov
Research has pinpointed slow reaction time to the cause of cell phone related accidents. Some experts assert that cell phone users have the reaction time of an elderly driver, or one intoxicated. Yet, on balance it seems that cell phone use is not the worst culprit for driver distraction, particularly for short, simple business exchanges.

**Substance abuse**

According to the Federal Motor Carrier Safety Administration (2007), in 2003, “about 2% of drivers with a commercial driver’s license (CDL) used controlled substances, and 0.2% used alcohol (0.04 or higher blood alcohol content) while performing their duties.” Of course, driving while under the influence of alcohol is a national scourge not limited to truck-
ers. Every job class can experience serious accidents from workers driving while under the influence of alcohol or other substances. According to the NHTSA (2007), driving under the influence of alcohol is responsible for 41 percent of all highway deaths. Therefore, screenings at time of employment and random testing for employees can be an effective preventative measure. The NHTSA (2003, “Conclusions”) estimated the payoff to employers for controlling impaired driving (and controlling failure to use seat belts) to be $15 billion in 2000.

Age and accidents

The aging workforce is creating many new human resource and workers’ compensation challenges, including the propensity of older workers to sustain serious injuries from vehicle accidents. According to NHTSA data, cited above, both accident rates and fatality rates are highest for drivers in the 16-24 years age range, and decline thereafter. Older drivers get in fewer accidents. However, they meet or exceed the rate of fatal injuries from work related traffic accidents for middle age drivers. The fatality rate spikes for drivers 74 years of age or older.

The above-mentioned accident patterns for the general population are confirmed in the workers’ compensation loss data collected by NCCI (Restrepo et al., 2006b). They show that workers’ compensation injuries in vehicles are inversely related to age, but that the severity of injury measured by total medical and indemnity payments is positively correlated with age. The higher costs for older workers is due in part to their higher earnings, and in part to longer healing periods required from injury, and a variety of other differences between older and younger workers.

Cell phone use seems to be a particularly dangerous activity for older drivers because it deteriorates their already slow reaction time to traffic. Likewise, it is particularly dangerous to distract older drivers with the re-

7 Comprehensive information on federal highway drug and alcohol rules and testing procedures for trucking can be found at the Federal Motor Carrier Safety Administration Web site at http://www.fmcsa.dot.gov/safety-security/safety-initiatives/drugs/drugs-alcohol.htm
requirement to operate on-board equipment while driving, e.g., computers or GPS devices ("Cell phone," 2005).

**Conclusion**

Vehicle accidents make up an increasing share of workers’ compensation claims and costs. No employer type or industry is immune from vehicle exposures. Moreover, for most businesses vehicles represent the largest single source of exposure to fatalities and serious work injuries.

Behavioral causes appear to be at the root of most accidents, with distractions and fatigue leading the list. Relatively simple measures can be taken to teach and reinforce good driving behaviors. Of course, not all employees will respond to safety messages equally, hence monitoring and reinforcement of desired behaviors is essential. Strong policies on substance abuse by drivers and the failure to use protective equipment by all vehicle occupants should be in place and vigorously promoted and enforced.

Human resource and property costs from work related traffic accidents dwarf the direct costs of workers’ compensation. In addition to their own costs of accidents, employers ought to consider the value of promoting safe driving to protect their employees from the huge risks they face in vehicles while commuting and during non-work pursuits. Thus, employers have many good reasons to take at least the basic steps to learn more about risk factors and accident prevention techniques.
References


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APPENDIX I
Recommended Resources on Safety and Loss Control

AAA Foundation for Traffic Safety
http://www.aaafoundation.org/multimedia/index.cfm?button=disdrv

Federal Motor Carrier Safety Administration
This Web site has a comprehensive set of links to truck, bus, and fleet safety related information.

This Web site has a good link for information on drug and alcohol abuse program.

National Highway Traffic Safety Administration
This Web site contains a wealth of data and analysis of injuries and their causes.
http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.9fa154a4d39f02e770f6df1020008a0c/

National Institute for Occupational Safety and Health
http://www.cdc.gov/niosh/docs/2003-119/

National Safety Council
The “Guide to Determine Motor Vehicle Accident Preventability” can be previewed and purchased at http://www.nsc.org/onlinecart/product.cfm?id=263

Network of Employers for Traffic Safety
Nanotechnology, Occupational Safety and Health, and Risk

Frank Dolinar*
Diane Fearn-Desrosiers**

Introduction

The prefix “nano” is derived from the Greek word “nanos,” which means dwarf. In the context of this document, nano indicates one billionth of something (that’s 10 to the minus 9th power). Therefore, a nanometer is a billionth of a meter.

The National Nanotechnology Initiative (NNI, 2007) provides this definition: “Nanotechnology is the understanding and control of matter at dimensions of roughly 1 to 100 nanometers, where unique phenomena enable novel applications.”

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At the nanoscale, chemistry and physics behave differently, exhibiting properties that are simply not available when working with materials of a larger size. Nanotechnology research and development (R&D) is largely directed toward understanding and creating improved materials, devices, and systems that exploit these new properties. This includes nanoscale science, engineering, and technology, and investigation of imaging, measuring, modeling, and manipulating matter at this scale.

These efforts are expected to create industrial processes for placement of molecular building blocks with precision measured in nanometers. Many things fabricated using nanotechnology will be very small, but that isn’t a requirement. Nanotechnology is really about the fabrication techniques. It’s not about the size of the result.

As we discussed in our first article, “Nanotechnology: Many Small Steps to the Future,” a working nanotechnology will cut across geographic, economic, political, and social boundaries that we currently take for granted, which means that nanotechnology will bring change and shake up the status quo (Dolinar & Fearn-Desrosiers, 2007). Although it is early, nanotechnology promises a portfolio of surprising breadth, capability, and flexibility – the basic recipe for a major disruptive technology. It will probably bring its own share of surprises, concerns, and problems.

Should nanotechnology be considered “risky business?” This question, or something like it, often arises with new technologies, particularly those evaluated as potentially disruptive. The questions for the workers’ compensation community are whether those risks are new or familiar; can we apply current knowledge to the control of these risks in the workplace or must new understandings be developed? As industrial products are already using these techniques and products, occupational exposures in the supply chain, transportation, production, use, and end-of-life-cycle disposal issues must be the concern of workers’ compensation insurers, prevention organizations, and workplace health and safety regulators.

Nanotechnology promises a lot, with materials, energy, electronics, and medicine seen as primary areas of impact. It will probably deliver even more than we currently imagine. It is so new and different, well beyond
most people’s day-to-day understanding, that we find ourselves being appropriately concerned that its unprecedented capabilities will be risky. This requires us to think beyond our current experience to what might be possible, and what might pose a danger.

The opportunities and potential benefits of nanotechnology will bring some risks. Insofar as possible, these risks should be evaluated and managed. However, risks should not stop us from traveling the path to development of a working nanotechnology.

On the other hand, we certainly should not go forward without due diligence – doing all we can to identify and understand potential hazards. “We don’t want to look back in 50 years if something bad has happened and say, ‘Why didn’t we ask these questions?’,” says Maria Palazuelos, a doctoral student in chemical engineering and a member of a small team within the University of Florida’s Nanotoxicology Group (“Nanotechnology – Friend or Foe?,” 2007).

The work being done by these researchers, among many others within the United States and around the world, is becoming more timely, as manufacturers expand the use of nanoparticles in their products and processes.

**Risk**

If we entertain the possibility that the development of Nanotechnology may be risky business, then we need to understand what we mean by “risk.” Formally, “risk” denotes a potential negative impact to an asset that may occur because of some present process or future event. Such processes or events are possible, but uncertain. Yet if they occur we may not achieve our objectives. “Risk” in everyday usage is synonymous with the probability of loss. The word “probability” summons memories of college courses in probability and statistics. If you have ever wondered where they came from, a small history lesson is in order.
Chevalier de Méré, Blaise Pascal, and Pierre de Fermat

The modern conception of risk is rooted in the Hindu-Arabic numbering system that reached the West seven to eight hundred years ago. But the serious study of risk began during the Renaissance, when people broke loose from the constraints of the past and subjected long-held beliefs to open challenge. This was a time when much of the world was to be discovered and its resources exploited. It was a time of religious turmoil, nascent capitalism, and a vigorous approach to science and the future.

In 1654, a time when the Renaissance was in full flower, the Chevalier de Méré, a French nobleman with a taste for both gambling and mathematics, challenged the famed French mathematician Blaise Pascal to solve a puzzle. The question was how to divide the stakes of an unfinished game of chance between two players when one of them is ahead. The puzzle had confounded mathematicians since it was posed some two hundred years earlier by the monk Luca Pacioli. This was the man who brought double-entry bookkeeping to the attention of the business managers of his day – and tutored Leonardo da Vinci in the multiplication tables. Pascal turned for help to Pierre de Fermat, a lawyer who was also a brilliant mathematician. The outcome of their collaboration was intellectual dynamite. What might appear to have been a seventeenth-century version of the game of Trivial Pursuit led to the discovery of the theory of probability, the mathematical heart of the concept of risk.

Their solution to Pacioli’s puzzle meant that people could for the first time make decisions and forecast the future with the help of numbers. In the medieval and ancient worlds, even in illiterate and peasant societies, people managed to make decisions, advance their interests, and carry on trade, but with no real understanding of risk or the nature of decision-making. Today, we rely less on superstition and tradition than people did in the past, not because we are more rational, but because our understanding of risk enables us to make decisions in a rational mode.

From the Introduction to Against the Gods: The Remarkable Story of Risk, by Peter L. Bernstein (1996)
Knowledge and communication of risk (real or perceived) are essential factors in human decision making. A deep understanding of risk is why casinos make so much money. A misunderstanding of risk is why their customers do not.

The commerce of the modern world depends on an understanding of risk. Insurance, finance, health care, pharmaceuticals, aircraft design, and nuclear power generation would be lost without a fundamental understanding of how each facet of these businesses is affected by risk.

The products and processes of nanotechnology are going to be pervasive in the modern world within a decade. If we are to take advantage of the promised benefits, we must also be aware of the potential risks and do everything possible to avoid or control them.

**Nanotechnology and risk**

The Project on Emerging Nanotechnologies, a joint venture of the Woodrow Wilson International Center for Scholars (Wilson Center), in Washington D.C., and the Pew Charitable Trusts, in Philadelphia, has created a database of consumer products that use nanomaterials in their manufacture. As of the end of 2007, there are over 500 products in this database, with new products being added as they are identified. Many of these products may be ordered directly from the manufacturer’s Web sites.

This may not be a good idea in all cases.

An example is in order. In October of 2007, Andrew Maynard, a nanotechnology expert at the Wilson Center, brought a packet of carbon nanotubes to a Congressional hearing. These were purchased on the Internet and were delivered with a safety sheet describing them as graphite (the stuff of which ordinary pencil lead is made) – a material that requires

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2 See the Project’s Web site at http://www.nanotechproject.org/44
no special precautions. We can ask whether any harm would have been caused had the bag broken and the carbon nanotubes been scattered into the air. To the best of our knowledge today, the answer is “Probably not.” However, as an answer, “probably not” is not good enough.

The problem here is that while both graphite and carbon nanotubes are composed of carbon and you might reasonably visualize carbon nanotubes as rolled graphite, carbon nanotubes are not graphite and are not made by rolling sheets of graphite into tubes. Since carbon nanotubes are not graphite, to describe them as such is roughly equivalent to describing diamond as pencil lead.

The Emerging Risks team of the well-known insurance house Lloyd’s notes that questions have been raised concerning “whether nano-particles can cause chronic health affects similar to asbestosis? The short answer is that we simply do not know. Initial investigations show that some nano-particles are acutely toxic when compared to larger particles composed of the same material” (“Nanotechnology – What Are the Risks?,” 2007).

The article goes on to state:

> Regulation specifically for nanotechnology is still under development with stakeholders in nanotechnology having opinions ranging from “nano-specific regulation is not needed” to those who believe that there is a regulatory void that could harm both health and the economic stability.

> At best, insurers may have new products to insure made with safer materials that lead to lower insurance losses. At worst,

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3 Carbon nanotubes are examples of a Fullerene molecule, only the third allotrope of carbon ever discovered, graphite and diamond being the other two. An allotrope is a molecular form of an element, in this case carbon. Each allotrope of an element has its atoms bound together in a different way. Fullerenes have different physical, chemical, and electronic properties than either graphite or diamond.
nanotechnology could lead to unexpected life, health and workers’ compensation and physical damage and pollution losses (Ibid.).

Regulatory agencies are examining whether new regulations are needed for nanotech products and processes. It is a question that needs to be answered to guard against potential, but currently unknown, hazards. The question is being taken very seriously. The workers’ compensation industry must participate in the developing consensus. Insurance carriers need to determine and track what risks they are insuring so that they can assist their customers to control their exposures.

What we know

The National Institute for Occupational Safety and Health (NIOSH, n.d.) has published the following statement on its nanotechnology Web site:

Occupational health risks associated with manufacturing and using nanomaterials are not yet clearly understood. The rapid growth of nanotechnology is leading to the development of new materials, devices and processes that lie far beyond our current understanding of environmental and human impact. Many nanomaterials and devices are formed from nanometer-scale particles (nanoparticles) that are initially produced as aerosols or colloidal suspensions. Exposure to these materials during manufacturing and use may occur through inhalation, dermal contact and ingestion. Minimal information is currently available on dominant exposure routes, potential exposure levels and material toxicity. What information does exist comes primarily from the study of ultrafine particles (typically defined as particles smaller than 100 nanometers) (NIOSH, n.d.).

On November 22, 2007, the Economist published an article which examines some of the questions related to nanotechnology and risk. In particular, it says:

Research on animals suggests that nanoparticles can even evade some of the body’s natural defense systems and accumulate in the brain, cells, blood and nerves. Studies show there is a potential for such materials to cause pulmonary inflammation; to move from the lungs to other organs; to have surprising biological toxicity; to move from within the skin to the lymphatic system; and possibly to move across cell membranes. Moreover, these effects vary when particles are engineered into different shapes. There is currently no way of knowing how each shape will behave, except by experiment ("A Little Risky Business," 2007).

If, as is currently true, experiment is the only way of determining each nanoparticle’s behavior, then bringing safe nanotechnology to market will be significantly more expensive and take longer before we begin reaping its benefits – because each change in each particle’s size or shape means another round of experiments. The search for a general theory of nanoparticle behavior has already begun in hopes that we can eventually understand what characteristics of nanoparticles presage specific behaviors.

Before the behavior of nanoparticles can be evaluated from the point of view of physics, chemistry, or biochemistry, it is important to know the characteristics of these systems without the interaction of nanoparticles, insofar as possible. In March of 2007, nanoparticle manufacturer QuantumSphere5 completed a baseline facility review of its own workplaces in conjunction with NIOSH. The goal of this study is to minimize, and if possible eliminate, nanoparticle related problems. “We sum up our commitment to environmental, health and safety excellence with one phrase: The Goal is Zero,” said Ryan Armasu, Vice President of Operations at

5 See http://www.qsinano.com
QuantumSphere. “This means zero accidents, zero injuries and illnesses, and zero environmental incidents” (“QuantumSphere Completes,” 2007).

This is a laudable intent, but it is only a beginning. And as these technologies and particles become more pervasive, we know from experience that this level of commitment will not be maintained by all businesses and employees. The real goal in dealing with possible risks of nanotechnology must be a fundamental understanding of how and why such materials interact in whatever environment they find themselves, so that detrimental effects can be mitigated. The principal worry is that we will not understand the possible dangers to living tissue, in the form of human beings, before we encounter a real problem in which nanotech can be clearly identified as the culprit. Just as asbestos was not considered a workplace hazard for many years until asbestosis became a workers’ comp issue, nanotechnology may carry much the same hidden risk.

We should follow the advice of Kevin Powers, associate director of the University of Florida’s Particle Engineering Research Center, sponsored by the National Science Foundation. He says: “Before we start producing these materials in large quantities to go into everyday products, we should know what effect they have on our health and the environment” (“Nanotechnology – Friend or Foe?,” 2007).

This may not be easy to do. There is still disagreement on the definition of nanotechnology and the classification of what is and what is not a nanoscale particle. It typically comes down to who is doing the defining, whether the definitions can be trusted, and whether the definitions are accepted by researchers, industry, legislators, and regulators.

Generally accepted definitions and classifications will be necessary before adequate risk assessment can be done and before definitive research into the risks of nanotechnology can be performed at all. On the positive side, several national and international bodies are discussing standardization of terminology, metrology, characterization, and approaches to safety and health.
What we do not yet know

In the United States, legislation that deals with clean air and water is based on standards and the ability to monitor them. There are no such standards for nanotechnology. Terry Davies, a fellow at Resources for the Future, a Washington D.C. think-tank, and a former assistant administrator for the US EPA says, “We don’t have a clue what kind of standards there are for nanoparticles in air or water” (“A Little Risky Business,” 2007).

It is unclear what should be monitored in airborne nanoparticles, and we do not yet have the ability to monitor the presence of nanoparticles in water. Further, no one knows how to control such materials in air and water, even if appropriate measurements were possible.

The products and processes of nanotechnology have already become part of our lives. There are too many question marks about the possible hazards to go forward without doing everything we can to get some answers.

The first place to look for those answers is NIOSH (n.d.), whose Web site provides the following statement:6

NIOSH is the leading federal agency conducting research and providing guidance on the occupational safety and health implications and applications of nanotechnology. This research focuses NIOSH’s scientific expertise, and its efforts, on answering the questions that are essential to understanding these implications and applications:

- How might workers be exposed to nano-sized particles in the manufacturing or industrial use of nanomaterials?

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How do nanoparticles interact with the body’s systems?
What effects might nanoparticles have on the body’s systems?

As part of this effort, NIOSH is conducting strategic planning and research, partnering with public and private-sector colleagues from the United States and abroad, and making the information and interim recommendations widely available.

NIOSH (n.d.) has identified ten critical topic areas for investigation, which it is using as a guide for identifying and addressing knowledge gaps, developing strategies, and providing recommendations. Topics are shown below and listed on the Web site with brief descriptions of the research being conducted:

- Toxicity and Internal Dose
- Risk Assessment
- Epidemiology & Surveillance
- Engineering Controls and Personal Protective Equipment (PPE)
- Measurement Methods
- Exposure Assessment
- Fire & Explosive
- Recommendations & Guidance
- Communication & Education
- Application

Another aspect of what is known or not known about nanotechnology is the arena of public perception. The Wilson Center’s Project for Emerging Nanotechnologies, in conjunction with the Cultural Cognition Project of the Yale University Law School, published a report entitled Nanotechnology Risk Perceptions: The Influence of Affect and Values (Kahan, Slovic, 7 See, specifically, “Critical Topic Areas,” at http://www.cdc.gov/niosh/topics/nanotech/critical.html
Braman, Gastil, & Cohen, 2007). The report documents an extensive survey of public perception of nanotech. We include, with permission, quotes and graphs explaining the first two results and have described some of the other findings.

How Much Does the Public Know About Nanotechnology?

The answer is, not very much. Asked how much they had heard about nanotechnology before the study, 81% of subjects reported having heard either “nothing at all” (53%) or “just a little” (28%) about nanotechnology prior to being surveyed, and only 5% reported having heard “a lot.”

![Pie chart showing the distribution of responses to the question of how much subjects had heard about nanotechnology.](image)

Nanotechnology Risk Perceptions: The Influence of Affect and Values
Cultural Cognition Project of the Yale University Law School (Kahan et al., 2007)

Although nanotechnology had its origins at least twenty years ago, the public is only now beginning to be aware of its existence.
What Do Members of the Public Think about the Risks and Benefits of Nanotechnology?

Despite the novelty of the issue, most members of the public have an opinion on whether the benefits of nanotechnology outweigh its risks or vice versa. A slight majority (53%) appears to view benefits as outweighing risks.

Looking at subgroups, however, reveals more division. Men (59% to 36%) are significantly more likely than women (47% to 40%) to think that risks outweigh benefits. Moreover, whereas a majority of whites (54%) believe that risks outweigh benefits, a plurality of African-Americans (49%) view risks as outweighing benefits. White males were the most pro-benefit (61% to 30%). The differences among persons grouped by political ideology or party affiliation were fairly minor.

Nanotechnology Risk Perceptions: The Influence of Affect and Values
Cultural Cognition Project of the Yale University Law School (Kahan et al., 2007)

Further analysis of the data showed that interest, education, race, gender, socio-economic status, information available about nanotech, and other factors all have influence on an individual’s perception of the potential benefit and/or possible risk of nanotechnology.
There are many unknowns in the current state of development of nanotechnology. What we need is solid information, grounded in fact provided by meticulous research. The potential benefits are too great and the hazards too unknown to let this effort of research and development be done without the best possible resources we can bring to the task. Such research will take talent, dedication, an extensive budget, and enough time to do it right.

While such research is ongoing, while we wait for the results, regardless of what they will be, we do not want to be too optimistic, seeing the promise of nanotech in the light of fantasy. Nor do we want to be too pessimistic, seeing nanotech's hazards as a film *noir* horror.

Everyone from researchers to the man in the street suffers from a lack of hard information, though there are many government, industry, and academic research facilities around the world seeking that information. As the facts are discovered and their import assessed, whether it be pro versus con or benefits versus hazards, these results need to be communicated to all of us and we need to learn how to inform different segments of the population with fact instead of rumor.

Nanotech’s real danger was described decades ago in a quote attributed to Will Rogers: “It ain’t what people don’t know that’s so dangerous, it’s what people know that just ain’t so.”

### Closing the knowledge gap

At this time in its development (early 2008), a lot of people are asking a lot of questions about the safety of nanotechnology. Unfortunately, it is by no means clear whether we have learned enough to ask the right questions, even if we limit the questions to concerns about safety with respect to human health.

It seems to us that the first questions asked should deal with determining how much we know, how certain we are of that knowledge, how it was
gathered, codified, and presented, and whether the experimental process can be duplicated. In short, we should use the scientific method to gain knowledge necessary to take the next steps – to identify, evaluate, and manage possible hazards. Industry risk control specialists must begin to educate themselves and participate in the development of a shared knowledge-base. As explained in an issue of MIT’s Technology Review:

Some research does exist. NIOSH has an active program for studying the safe handling of nanomaterials in the workplace. Nanotoxicity studies of carbon-based materials as well as quantum dots have been conducted, but the overwhelming conclusion is that more work is needed. All nanomaterials are not created equal and will clearly span the gamut from toxic to benign. If research helps us understand the root causes of toxicity in these materials, then safer materials can be engineered. Putting real data on toxicity into the iterative design cycle for these materials has the potential to save human lives as well as development dollars (Coe-Sullivan, 2007).

Such research at NIOSH is only the tip of the iceberg, both within NIOSH itself and elsewhere around the world. The topic “Strategic Plan for NIOSH Nanotechnology Research: Filling in the Knowledge Gaps” on the NIOSH (n.d.) Web site identifies a number of strategic goals as part of this research agenda. The details for achieving these goals are quoted from the Web site:

1. Understand and prevent work-related injuries and illnesses possibly caused by nanoparticles/nanomaterials.
2. Conduct research to prevent work-related injuries and illnesses by applying nanotechnology products.
3. Promote healthy workplaces through interventions, recommendations, and capacity building.
4. Enhance global workplace safety and health through international collaboration on nanotechnology.

See http://www.cdc.gov/niosh/topics/nanotech/strat_plan.html
In addition, efforts are underway in government, industry, and academia to codify various factors that may contribute to risks in nanotechnology.

On October 15, 2007, Johns Hopkins University announced that it had received federal funding for development of an undergraduate minor in nanotechnology risk assessment and public policy. The program is expected to be ready for Fall semester 2009. Based on the announcement, this will be an interdisciplinary program including course work from the departments of Chemical and Biomolecular Engineering, Geography and Environmental Engineering, and the Bloomberg School of Public Health, all of which are affiliated with the Johns Hopkins Institute for NanoBioTechnology.

Dr. Justin Hanes, professor in Chemical and Biomolecular Engineering and co-author of the proposal says, “We want students to learn about the potential risks associated with the development of nanotechnology-based solutions, as well as come to understand the risks presented by not developing these nanoscale solutions” (Spiro, 2007).

From our point of view, this comment about the “risks presented by not developing these nanoscale solutions” is crucial to a balanced understanding of nanotech’s potential. According to Dr. Jonathan Links, professor in the Bloomberg School of Public Health:

Nanoparticles are small enough to cross cell membranes. They also possess a large surface area, which enhances their reactivity. However, little research has been done to examine the toxicity potential of these ultrafine particles. Some concerns have been based only on the extrapolation of studies on other substances, such as quartz, asbestos or particulate air pollution (Ibid.).

This program at Johns Hopkins and similar programs in other places will add to our knowledge, deepen our understanding, and help clarify what is and what is not hazardous in current and future nanotechnology.
Risk assessment

Robert Landry, President and CEO of Zurich Financial Services Canadian operations, addressed delegates of the Property Casualty Underwriters Club in November of 2007. He stated that nanotechnology, climate change, aging infrastructure, and ‘the unknown’ are four emerging risks facing insurers. Landry also compared the development and use of nanomaterials to that of asbestos. He stated, “With so many unknowns, and such widespread use (by 2008 the demand for nanoscale materials will be $28 billion), we cannot be sure that there is not a risk to human health somewhere” (“Nanotechnology, Climate Change,” 2007).

The comparison to asbestos is emotionally compelling. But, until we get more data about the actual risks of nanoscale materials, such comparisons are unsupported and, at best, premature. Research into potential health risks of nanotechnology is just getting underway and, in 2007, there is no long-term data available from which to make such assessments.

Risks from nanoscale particles do exist. Because of their minute size and various shapes, some nanoparticles can be absorbed through the skin or inhaled. Once inside the body the ultimate location of such particles is indeterminate. We do not want nanoparticles to be accidentally introduced into living tissue, but, if it should happen, we need to know the risks involved and how to mitigate them. Robert Landry had one final point to make: “We have to get involved and influence public policy, because at the end of the day it might be us picking up the tab” (Ibid.).

An article in Nature Nanotechnology states:

Not surprisingly, scientists were generally more optimistic about the benefits and less concerned about the risks of nanotechnology than the general public. For example, scientists were more optimistic about the potential for nanotechnology to lead to breakthroughs in medicine, environmental cleanup or national defense. Members of the general public, in contrast, were more concerned about potential drawbacks of nanotechnology than
scientists, including the potential loss of privacy\(^9\) or adverse economic impacts.

However, scientists expressed more concerns than the general public about two areas of potential risks: more pollution and new health problems as a result of nanotechnology. This makes nanotechnology unusual among emerging technologies in that scientists working directly with the technology express stronger concerns about specific potential risk areas than the general public does (Scheufele et al., 2007).

In February of 2007, at the request of the National Nanotechnology Initiative, Trudy E. Bell wrote “Understanding Risk Assessment of Engineered Nanomaterials.” This excellent article is well worth the time of anyone interested in having a better understanding of the possible hazards of nanotechnology and how to assess them.

Ms. Bell’s article is a comprehensive overview of the current understanding of the challenges before us. We provide a (draconian) summary of Ms. Bell’s article here.

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\(^9\) The military and intelligence agencies are examining the use of nanotech devices for surveillance. Such devices would be effectively invisible and undetectable, thereby raising concerns for invasion of privacy.
Nanoparticles, and the nanostructured materials made from them, are big news at the beginning of 2008. Theory indicates that manipulation of matter at the molecular scale makes possible materials with new electronic, mechanical, optical properties, among others, that are not available in bulk materials. Worldwide R&D is being driven by the need to understand and to fabricate materials that use those properties. Achieving that understanding is expected to create new frontiers in electronics, materials, energy, medicine, and consumer products.

There are disagreements in classifying nanoscale particles, which currently fall into three types: natural, incidental, and engineered. Essentially all questions about the toxicity of nanomaterials deal with the properties of engineered nanomaterials.

The author also makes the following points about how to read the literature becoming available on nanotechnology:

- Consider original sources of popular stories and potential sources of error or exaggeration.
- Look for appropriate qualifiers.
- Look for issues of scale, i.e. is the material being discussed really a nanoscale material or did the author get the scale wrong.
- Check to see whether reported exposures were actually to nanomaterials rather than micrometer-sized particles – and indeed, to individual nanomaterials.
- Be cautious about generalizing results from one study to another.
- Don’t assume that experimental results can be extended to actual biological systems or the environment. In many cases, the levels of toxicity used in controlled experiments are much higher than could ever occur naturally or even by accident.
- Probe for possible other reasons for toxicity.
- Don’t assume that common-sense macroscopic physics holds at the nanoscale, because it may not.
There are typically four different categories of nanomaterials, but not everyone agrees on what those categories should be. Some organizations use: metal oxides; nanoclays; nanotubes; and quantum dots. Others, such as the EPA divides engineered nanomaterials into: carbon-based materials, metal-based materials, dendrimers, and composites.

There is disagreement on the definition of what is or is not a nanoparticle. In the US and the UK, anything smaller than 100 nanometers (nm) is considered a nanomaterial. By contrast, the Japanese consider nanomaterials to be less than 50nm and anything from there to about 100nm is considered an “ultrafine” material. Several national and international standards organizations are discussing standardization of terminology, metrology, characterization, and approaches to health and safety – in the workplace and the environment.

The physics and chemistry of engineered nanomaterials is surprising:

- Size matters – the chemical properties of matter rely heavily on the surface area, because that’s where chemical reactions involving solids occur. A single cubic centimeter of matter has a surface area of 6 square centimeters. If reduced to particles a single nanometer on a side, the surface area grows to 60 million square centimeters – about a third larger than a standard (American) football field. That’s a lot of chemistry.

- Shape matters – different shapes have different physical properties, again in large part because of where and how the chemical reactions at the surface can take place.

- Other properties also play a part: charge, crystal structure, residual contamination due to the method of synthesis, and the tendency of such particles to aggregate into clumps.
There are questions of hazard based on the possibility of exposure and dose, with questions of dosimetry arising because it appears that nanoparticles should be measured not on the mass per unit volume, but on the total surface area of the dose.

Nanoparticles are showing surprising toxicology and there is a lot of research underway in attempt to understand it.

- Size matters, again, and with possible biological consequences, i.e. where the nanoparticles may end up in the body.
- Shape matters, again, because materials with the same chemical composition but of different shapes may have significantly different toxicities.
- Purity matters, possibly having to do with residues of the processes used to make the nanoparticles/nanomaterials. Some trace elements of the processes may be more toxic than the intended product. Some forms of nanoscale carbon, such as fullerenes, are being investigated as possible antioxidants.

**Risk assessment continued**

No one can know what the future holds, but we in the workers’ compensation community need to prepare for the future based on the best risk assessments that we can make with the knowledge we have today. Terrance J. Bogyo, Director Corporate Planning and Development WorkSafeBC, said it best in a private communication with the authors: “The challenge for the workers’ comp community is to be on the vanguard, to plan, to be aware of developments to protect workers, employers and the sustainability of the system.”

It is incumbent on each of us to educate ourselves, to consider how these futures will affect our work, and to determine how we will prepare for the changes. Because some things are certain, it is risky for insurance carriers to wait for the claims to appear before adjusting their thoughts about
how to underwrite a business using these new technologies. And as we found in terrorism risk discussions following 9/11, speculative rates based on guesses about frequency or severity would also have a negative impact on this developing market segment. Loss control expertise must be available to employers exploring new business methods before they find out their employees have been put at risk. And the regulatory community needs good information in order to make good public policy decisions. We stand at the threshold of a grand adventure; don’t begin that adventure without a map and a plan, because that is “risky business.”

Editor’s Note: Starting with the next issue, all authors submitting to the IAIABC Journal will be asked to disclose in writing any financial interest they may have in the subject matter upon which they are writing, and such disclosures will be made public. Although such disclosures have not been requested for the current issue, the Journal is aware that one or more of the authors of this article has some financial interest in products, services, training or other activities discussed in this article.

References


Frank Dolinar began following the development of nanotechnology in 1986 after reading *Engines of Creation*, K. Eric Drexler’s first book. Since 1992, he has provided nanotechnology seminars for Michigan State University, corporations, business groups, and technical groups. He writes essays examining the history, current topics, trends, and implications of various technologies, including nanotechnology. Frank is the owner of nanoSteps, a consultant with the Firefly Consulting Group, and a software developer for the Michigan House of Representatives.

Diane Fearn-Desrosiers became fascinated with the concept of nanotechnology at a presentation given by K. Eric Drexler at the International Space Development Conference in 1987. From that initial introduction, she has continued to consider the effects this technological change will have on workers, businesses, and the carriers who insure them. After working in Claims and Data operations for several carriers since 1979, she founded Firefly Consulting Group in 2006 to provide consulting services to the workers’ compensation carrier community.
APPENDIX I
Additional References

Woodrow Wilson International Center for Scholars
Project on Emerging Nanotechnologies (PEN)
http://www.nanotechproject.org

Each of the following references is available from the PEN links provided.

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Introduction

In 2004, the California’s workers’ compensation system had reached a crisis stage. Insurance premium rates were the highest in the country, almost 40 percent higher than the next highest state (Reinke & Manley, 2004). Among the cost drivers was permanent partial disability, where claim frequency and benefit cost per 100,000 workers were also the highest in the nation (Burton, 2006). Legislation was proposed to raise the threshold standard for defining a condition as occupational, arguing the current “contributing cause” standard used by most jurisdictions should be replaced by something more restrictive such as the “major contributing cause” standard adopted by Oregon in the 1990s (Welch, 2000).
Faced with this threat, labor made a deal with employers to maintain contributing cause as the standard for access to medical and temporary disability benefits, but to allow permanent disability benefits to be apportioned on the basis of causation. California thus became the first state to use such a standard for permanent disability.

As the first state to adopt such a standard, California rushed headlong into an area where some claim the science and medical knowledge is not yet prepared to go (Guidotti, 2006). Since the change, tens of thousands of California workers have had their claims reviewed for apportionment and thousands have had their awards reduced. Constitutional challenges have been brought, supported by state and national organizations. AARP and the American Civil Liberties Union (ACLU) among others claim the law discriminates against California workers based on their age and gender.1

This article presents the first evidence on the impact of apportionment to causation as broadly applied in practice by a workers’ compensation system. Specifically the paper addresses the extent to which apportionment has been applied and how the application has varied by important characteristics including impairment type, gender, and age. The next section briefly outlines the legal standard adopted by California and contrasts it with the standard previously used in California and currently used by most other jurisdictions. Section 3 describes the data and methods. Section 4 presents the results of the analysis and the last section covers conclusions and policy implications.

**Apportionment**

*Common uses of the term “apportionment”*

The concept of apportionment to cause, the topic of this paper, is distinct from several other ways the term apportionment is used in workers’ comp-

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1 See for example Vaira v. WCAB, 3rd California District Court of Appeal.
Apportioning Impairment to Cause

Compensation and other legal systems. There are three common uses of apportionment in workers’ compensation. First, the process of determining whether a claim meets the threshold definition of an occupational injury is sometimes referred to as apportioning the cause or causes of injury between occupational and all other causes. If the fraction apportioned to occupational cause meets the legally defined threshold, then the worker is eligible for benefits.

Second, if a claim is accepted as industrial, responsibility for payment of benefits may be apportioned between one or more employers or between an employer and a third party that contributed to the injury (e.g., a worker injured in a delivery van accident where the other driver was partially at fault). Apportionment of benefits costs to a third party outside the workers’ compensation system is relatively rare and more often referred to as subrogation.

Once an injury or illness is determined to meet the threshold level and accepted as a workers’ compensation claim, benefits (medical, temporary disability, and death benefits) have typically been fully paid by the employer without regard to partial contribution by other causes. For example, if a worker’s condition is accepted as an occupational cumulative injury claim, the employer/insurer is responsible for the full cost of medical treatment. The worker or worker’s health insurer is not liable for any part of the cost of medical treatment, even if one or more non-occupational causes substantially contributed to the injury.

Thus, while jurisdictions have not apportioned the cost of medical treatment or temporary disability benefits, permanent disability benefits are subject to apportionment, at least nominally, in most jurisdictions. However, when used for impairment, apportionment has not been to cause, it has been to pre-existing disability, often as a result of a prior occupational injury. Occasionally, apportionment may be made to a previously non-disabling condition if the defense can prove that the condition would have become disabling by a specific time even in the absence of the occupational injury. In practice, particularly in California, this made apportionment rare, requiring the defense to demonstrate prior disability and allowing the injured worker to argue that any prior disability, includ-
ing prior occupational injuries for which permanent disability had been awarded, had been rehabilitated.

**A new use of the term “apportionment”**

California's new law went much further. Apportionment no longer requires that a pre-existing condition result in actual disability or be likely to have proximately resulted in disability. Rather, if multiple causes contributed to the existence of a disability or to the severity of the disability, apportionment of the impairment rating and award is required.²

² California Labor Code Sections 4663 & 4664 state in main:

4663. (a) Apportionment of permanent disability shall be based on causation.
(b) Any physician who prepares a report addressing the issue of permanent disability due to a claimed industrial injury shall in that report address the issue of causation of the permanent disability.
(c) In order for a physician's report to be considered complete on the issue of permanent disability, it must include an apportionment determination. A physician shall make an apportionment determination by finding what approximate percentage of the permanent disability was caused by the direct result of injury arising out of and occurring in the course of employment and what approximate percentage of the permanent disability was caused by other factors both before and subsequent to the industrial injury, including prior industrial injuries. If the physician is unable to include an apportionment determination in his or her report, the physician shall state the specific reasons why the physician could not make a determination of the effect of that prior condition on the permanent disability arising from the injury. The physician shall then consult with other physicians or refer the employee to another physician from whom the employee is authorized to seek treatment or evaluation in accordance with this division in order to make the final determination.
(d) An employee who claims an industrial injury shall, upon request, disclose all previous permanent disabilities or physical impairments.

4664. (a) The employer shall only be liable for the percentage of permanent disability directly caused by the injury arising out of and occurring in the course of employment.
(b) If the applicant has received a prior award of permanent disability, it shall be conclusively presumed that the prior permanent disability exists at the time of any subsequent industrial injury. This presumption is a presumption affecting the burden of proof.
Case law interpreting the California statute is still in its infancy. But, current interpretation is substantially at variance with the prior standard. Even if there was no prior disability and the industrial cause alone was sufficient to result in disability, apportionment is required for the contribution of the non-occupational cause to the ultimate severity of the disability. In the argot of law, even if “but for” the occupational cause no disability would have existed, apportionment is still required for the contribution of non-industrial cause(s) to the total degree of impairment. As an example, consider the injury and ultimate disability considered in the Viara v. WCAB case, discussed in a later section.

As Guidotti (2006) points out in his review of the California statute, “In principle, [apportionment to cause] is very much like apportioning impairment or disability, except that the underlying cause of the disorder is being considered rather than its expression in functional impairment. In practice, it is much more complex and uncertain.”

To this, the author of this article would add, it is also more controversial.

Proponents argue that apportionment of permanent disability to cause is fairer to employers who are not responsible for and have little or no control over non-occupational causes. Apportionment also has the potential to distribute the cost of disability across those, in this case workers, who have the most direct ability to control the non-occupational risks.

Opponents argue that assignment of causation is an uncertain science with little current methodological support and complicated by even less formal training for evaluating physicians. This uncertainty, it is argued, can lead to arbitrary application of apportionment in individual cases.


*California has provisions in statute to convert impairment, based upon the AMA Guides, to a rating of the worker’s disability.*
While apportionment to cause might on average have a small effect on total indemnity payments, the effect on any individual disabled worker can be large. Consequently, there is a risk that apportionment will be arbitrarily applied in an uncertain portion of cases resulting in large and arbitrary differences in awards between workers with otherwise similar impairments.

In California nearly all workers have access to state administered, non-occupational temporary disability insurance. Most workers also have health insurance covering medical treatment for non-occupational conditions. On the other hand, virtually no workers have access to insurance against the risk of most non-industrial permanent partial disabilities. Workers have access to insurance against the costly risks related to medical treatment temporary disability and permanent total disability, but not for most long-term partial disabilities.

Finally, the impact of apportionment to cause may fall disproportionately on particular groups. The affected groups might be defined by age and gender. Or, apportionment might disproportionately apply to certain types of conditions, such as carpal tunnel or heart disease. Osteoporosis is a good example, as it is more likely to affect women – particularly older women (Melton, 2001).

All of these arguments, for and against apportionment, raise important public policy considerations. This study is the first to analyze data on a large number of claims to derive empirical evidence to support public policy decisions in the area.

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5 California is one of five states with a near universal non-occupational disability program. The state-run State Disability Insurance (SDI) program pays disability benefits similar to workers’ compensation except that duration is limited to 52 weeks versus the state’s workers’ compensation limit of 104 weeks. SDI is entirely employee supported through automatic payroll deductions.

6 While it is possible to purchase insurance for wage replacement while off of work, there is virtually no availability of a product that compensates directly for diminished capacity, except for precisely defined conditions such as loss of an eye or amputation of a limb.
Data and methods

In California, the Disability Evaluation Unit (DEU) of the Department of Industrial Relations calculates disability ratings based on doctors’ reports of impairment. All cases where the worker is not represented by an attorney are rated by the DEU. Unrepresented cases make up about 35 to 40 percent of permanent disability cases. Doctors’ reports of impairments in represented cases can bypass the DEU and be rated independently, but in practice a substantial portion (about half) of represented cases are also rated by the DEU. The remaining represented workers have doctors’ reports that are rated by the attorneys involved or private raters hired by one of the parties in a disputed claim.

For purposes of this article, the sample is restricted to unrepresented cases. The reason is that the DEU establishes the apportionment in all unrepresented cases after referring the reports to an administrative law judge. The judge makes a legal ruling on whether the doctor’s application of apportionment is consistent with statute and case law. This makes the DEU evaluation on unrepresented claims definitive in those cases. With represented cases, the DEU does not decide whether apportionment indicated in the doctor’s report is consistent with legal definitions. Also, reports submitted to the DEU in represented cases are often from competing doctors advocating for the worker or employer and giving very different opinions on issues in the same claim (Bhattacharya, Neuhauser, Reville, & Seabury, in press). The ultimate rating and resolution in a represented case may be based on either report or a compromise between competing reports. Further complicating the use of represented cases, sometimes one of the competing reports may not be submitted to the DEU for rating, consequently the results would not be included in the database.

Because represented cases are not included, the results should be interpreted as a conservative estimate of the application of apportionment of permanent disability to cause. Represented cases typically involve more serious impairments and claims with more issues in dispute. One would expect apportionment as an issue to arise more often in complex cases,
particularly cases involving disputes over the cause of injury. Also, apportionment can have a large impact on the dollar amount of permanent disability and might trigger an unrepresented worker’s decision to seek attorney representation.

The DEU data included 22,805 permanent disability claims with complete data, impairment ratings greater than zero, and rated under the new statute requiring apportionment to causation. The ratings were performed between June 2005 and June 2007. Variables include detail on the body part(s) or system(s) impaired, the whole person impairment as defined by the American Medical Association’s Guides to the Evaluation of Permanent Impairment (5th ed.), age, wage, occupation, and the amount apportioned to industrial causes.

Gender is not included in the DEU database. A name-gender matching program was used to define gender based on the workers’ first name. Gender was defined when it could be assigned with a probability of greater than 90 percent. Otherwise gender is listed as missing.7

Results

Nearly ten percent (9.9%) of permanent disability claims in the sample had some percentage of final permanent partial disability awards apportioned to non-industrial causation. When apportionment was applied, on average approximately 40 percent of the award was apportioned to non-industrial cause(s). Across all claims in the sample, including those without apportionment, the average impairment rating was reduced by 5.5 percent due to apportionment.

The combined effect (5.5%) is larger than the simple product of the two separate effects (frequency, 9.9%, and fraction apportioned, 40%) suggesting that, on average, larger awards have more frequent apportion-

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7 The California Employment Development Department developed the original name-gender match list from unemployment insurance data and makes it available to other users.
ment or a larger fraction apportioned to non-industrial causes. This is confirmed in Figure 1. As the severity of impairment increases, the fraction of claims where apportionment is applied increases steadily, from 3.6 percent for the lowest rated impairments to 25 percent of the most serious impairments.

Remarkably, as the severity of impairments increases, the fraction of the impairment rating apportioned to non-industrial causation does not appear to change. For 99 percent of claims in the sample, the AMA Guides whole person impairment (WPI) ratings are below 31 percent. When apportionment is applied to this set of claims, the average fraction apportioned is about 40 percent at each range of impairment. It is striking that the rate at which claims are apportioned could increase so steadily, but the fraction apportioned would remain constant. On the other hand, it is not clear, a priori, whether one would expect the fraction apportioned to increase or decrease as the fraction of cases apportioned increases. It is simply confounding that the fraction apportioned does not change when the fraction of claims apportioned changes so dramatically.

Only 1 percent of claims in the sample had WPI ratings above 30 percent, so the range of error on the apportioned percentage is too large to draw conclusions about the observed increase in the fraction apportioned at the very high end.
While apportionment was not frequent (9.9% of claims) and on average across all claims of modest impact (5.5%), the impact on individual injured workers can be large when apportionment is applied. Nearly half of workers (48.6%) had their percent of permanent disability reduced by 50 percent or more. This makes the concern about arbitrary or inconsistent application of apportionment particularly troublesome.

Figure 2 highlights another reason to be concerned about the application of apportionment. Figure 2 shows how often different fractions were apportioned to non-industrial cause. The split between occupational and non-occupational contribution to conditions should be a continuum: for example, 50% should appear about as often as 49% and 51%, and the same goes for 10%, 11%, and 12%. We expect that an accurate application...

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8 In California, the dollar amount awarded increases more rapidly than the percent of disability assigned. Consequently, when apportionment is applied the impact on the dollar award will usually be larger than the impact on the percent of disability assigned.
Apportioning Impairment to Cause

Apportionment would result in a smooth distribution of apportionment percentages. The shape of the distribution may not be known a priori, but an expectation of smoothness can be assumed.

This is certainly not what we observe in the actual application of apportionment. “Heaping” occurs at major fractions, for example 10%, 25%, and 75% and even more strongly at 50%.

These modes suggest that doctors are applying fairly rough heuristics or rules-of-thumb to assign a precise value to something for which they have a great deal of uncertainty. The use of rough, often biased heuristics is a commonly observed phenomenon in situations with limited information (Tversky & Kahneman, 2004). Particularly troubling is the existence of a dominant mode at 50 percent. The mode here implies even more guessing on the part of doctors. In statistical analysis, 50 percent is considered the best guess when one has no knowledge of the likelihood of an outcome.

**FIGURE 2**

Distribution of Percentage Apportioned to Non-industrial Causation: Claims with Apportionment
Apportionment by type of impairment

It is hard to establish the precise frequency with which apportionment to causation is applied in California because the sample is limited to unrepresented claims. However, we can examine the differential application of apportionment across different injury and claimant characteristics. The findings for the unrepresented cases are likely to be consistent with the pattern of application of apportionment across the entire population for characteristics like age, gender, and impairment type. These analyses can offer labor, employers and policymakers insight into the equity with which apportionment is applied and whether application is consistent with broad public policy goals.

First we will examine how the probability of apportionment varies by the body part or system impaired. Table 1 breaks the data on apportionment down by part of body impaired.
### TABLE 1
Application of Apportionment by Body Part Impaired

<table>
<thead>
<tr>
<th>Body part</th>
<th>Number of claims</th>
<th>Fraction of claims with apportionment*</th>
<th>Average percentage apportioned to non-industrial causes (when apportioned)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist/Hand</td>
<td>2,842</td>
<td>.027 (.003)</td>
<td>47.7% (.423)</td>
</tr>
<tr>
<td>Upper Extremity</td>
<td>5,821</td>
<td>.059 (.003)</td>
<td>34.8% (.283)</td>
</tr>
<tr>
<td>Lower Extremity</td>
<td>4,903</td>
<td>.094 (.004)</td>
<td>46.8% (.331)</td>
</tr>
<tr>
<td>Back</td>
<td>7,299</td>
<td>.151 (.004)</td>
<td>40.1% (.262)</td>
</tr>
<tr>
<td>Vision</td>
<td>35</td>
<td>.000 N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Psych</td>
<td>281</td>
<td>.199 (.024)</td>
<td>31.5% (1.388)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>368</td>
<td>.220 (.028)</td>
<td>46.4% (1.546)</td>
</tr>
<tr>
<td>Hearing</td>
<td>227</td>
<td>.249 (.028)</td>
<td>39.3% (1.629)</td>
</tr>
<tr>
<td>Other</td>
<td>241</td>
<td>.076 (.014)</td>
<td>45.2% (1.167)</td>
</tr>
</tbody>
</table>

*Std. errors in parentheses (std. errors on last column, percentage non-industrial, are scaled to reflect percentages, e.g., if wrist/hand was presented as a decimal, the apportioned amount would be 0.477 and the std. error would be 0.00423).
The frequency with which apportionment is applied varies greatly across different types of impairment. Hearing and cardiovascular conditions are apportioned about eight or nine times more often than impairments affecting the wrist and hand. More generally, impairments of the extremities are apportioned significantly less often than those to the back or body systems (psychiatric, cardiovascular, or hearing). Although only a small number of cases involved vision impairments, none of these was apportioned. The difference between the two groups of impairments may be driven by the fraction of each group’s underlying conditions that are the result of traumatic injuries. For example, vision loss is likely to be a traumatic injury while hearing loss is most likely a cumulative injury. Traumatic injuries are almost surely less likely to be apportioned than impairments that are more often the result of cumulative trauma or disease.

When impairment is apportioned, the fraction of impairment attributed to non-industrial cause varies, but not as widely or across the same impairment types as we observed for the frequency of apportionment. When apportioned, wrist/hand, lower extremity, cardiovascular, and “other” conditions have an average of 45-48 percent of the impairment apportioned to non-industrial causes. For upper extremity, back, psychiatric, and hearing, the range is 30-40 percent.

Psychiatric claims are a special case. It appears at first glance that a smaller fraction (31.5%) of psychiatric disability is being apportioned to non-industrial cause(s). However, psych claims are the only condition for which California requires a higher threshold of injury causation for the claim to be considered occupational. To be occupational a psychiatric claim must be at least 51 percent caused by work. Consequently, all cases where non-industrial cause contributed 50-99 percent of impairment are eliminated for psychiatric claims but not for other impairments.

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9 Finding no apportioned cases in the small vision sample implies that it would be very unlikely for the actual percent with apportionment to exceed 8% and is very likely much closer to 0% than 8%.
Age and apportionment

Two of the key legal challenges to apportionment to causation brought in California are that it represents discrimination based on age and gender. AARP and the ACLU submitted *amicus curiae* in the *Vaira v. WCAB* case maintaining that apportionment to osteoporosis represents both age and gender discrimination because osteoporosis disproportionately affects older women (Melton, 2001). It is not the intent of this paper to address the legal questions (including apportionment to osteoporosis). However, we will present data on how apportionment is applied in practice and offer insight into the impact of both age and gender. These data may help the courts decide the legal questions and policymakers craft appropriate legislative language.

Table 2 splits the sample of permanent disability claims by age ranges and gives statistics on the fraction of claims apportioned and the amount apportioned. There is a strong relationship between age and the likelihood that a claim will be apportioned. Workers over 55 years are about twice as likely to have their conditions apportioned as workers under 35 years.

However, when apportionment is applied, the fraction apportioned to non-industrial cause is not a function of age. Except for the small groups of the youngest and oldest workers, there is no substantial difference between the average fraction apportioned when a claim is apportioned. Both the youngest (16-24) and oldest group (65+) are statistically and substantially different from the 25-64 age groups in the fraction apportioned on cases with apportionment.
### TABLE 2
Frequency and Extent of Apportionment by Age

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Number of claims</th>
<th>Portion of claims with apportionment*</th>
<th>Average percentage apportioned to non-industrial causes (when apportioned)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-24</td>
<td>853</td>
<td>.085 (.008)</td>
<td>29.0% (4.86)</td>
</tr>
<tr>
<td>25-34</td>
<td>2,890</td>
<td>.065 (.005)</td>
<td>39.8% (1.67)</td>
</tr>
<tr>
<td>35-44</td>
<td>5,564</td>
<td>.076 (.004)</td>
<td>40.1% (1.10)</td>
</tr>
<tr>
<td>45-54</td>
<td>7,524</td>
<td>.112 (.004)</td>
<td>40.5% (0.77)</td>
</tr>
<tr>
<td>55-64</td>
<td>4,404</td>
<td>.128 (.005)</td>
<td>42.5% (0.98)</td>
</tr>
<tr>
<td>65+</td>
<td>700</td>
<td>.150 (.014)</td>
<td>46.4% (2.41)</td>
</tr>
<tr>
<td>All, including age missing</td>
<td>22,017</td>
<td>.099 (.002)</td>
<td>40.9% (0.49)</td>
</tr>
</tbody>
</table>

*Std. errors in parentheses (std. errors in last column, percentage non-industrial, are scaled to reflect percentages, e.g., if wrist/hand was presented as a decimal the apportioned amount would be .477 and the std. error would be 0.00423).

The small differences in amount apportioned, combined with the large impact of age on the frequency with which apportionment is applied, results in a strong trend on the average fraction apportioned across all awards in an age group. Figure 3 exhibits the average portion across all awards in the age range that is apportioned to non-industrial causes. The trend from 18 to 44 is fairly flat, but increases rapidly at age 45 and above.\(^\text{10}\)

\(^{10}\) The formula is: 

\[
\frac{\sum (\% \text{ non-industrial} * \% \text{ impairment})^{\text{claims with apportionment}}}{\sum (\% \text{ impairment})^{\text{all claims in range}}}
\]
In a previous section we observed significant differences in the amount apportioned between a couple of broad categories of impairments. Aggregating all impairments within an age group may mask differences in apportionment that are driven by age if age also drives changes in the type of impairment experienced by workers. A question to answer is whether the distribution of types of impairments changes with age. And, within types of impairments, does the severity change with age? To evaluate these possibilities, the sample was split into the major impairment categories used in Table 1.

For claims with apportionment, the only impairment category that exhibited significant differences in the average amount apportioned to non-industrial cause across the different age categories was “back.” With backs, both the fraction apportioned and the amount apportioned has a strong, positive correlation to age.
TABLE 3
Back Impairments: Impact of Age on Probability of Apportionment and Fraction Apportioned

<table>
<thead>
<tr>
<th>Age range (years)</th>
<th>Number of claims</th>
<th>Portion of claims with apportionment*</th>
<th>Average percentage apportioned to non-industrial causes (when apportioned)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24</td>
<td>295</td>
<td>0.071 (.015)</td>
<td>23.15 (2.53)</td>
</tr>
<tr>
<td>25-34</td>
<td>1203</td>
<td>0.086 (.008)</td>
<td>39.07 (2.38)</td>
</tr>
<tr>
<td>35-44</td>
<td>2090</td>
<td>0.117 (.007)</td>
<td>37.18 (1.41)</td>
</tr>
<tr>
<td>45-54</td>
<td>2413</td>
<td>0.181 (.008)</td>
<td>40.17 (1.07)</td>
</tr>
<tr>
<td>55-64</td>
<td>1128</td>
<td>0.217 (.012)</td>
<td>43.39 (1.38)</td>
</tr>
<tr>
<td>65+</td>
<td>150</td>
<td>0.327 (.038)</td>
<td>47.18 (3.07)</td>
</tr>
</tbody>
</table>

*Std. errors in parentheses (std. errors on last column, percentage non-industrial, are scaled to reflect percentages, e.g., if wrist/hand was presented as a decimal the apportioned amount would be 0.477 and the std. error would be 0.00423).

The fraction of back impairments with apportionment shows an even stronger age trend than we observe for all impairments combined. Older workers are over four times as likely to have their back conditions apportioned as the youngest workers. Because backs are the most common impairment, the strong relationship to age for this impairment is responsible for an important fraction of the trend we observed in Figure 3 above.
Apportioning Impairment to Cause

FIGURE 4
Fraction of All Impairment in Age Range Apportioned to Non-industrial Cause (Backs vs. All other impairments)

Does gender matter?

A key pillar of the constitutional assault on the use of apportionment to cause has been the perceived bias against women, particularly because they are more likely than men to be subject to osteoporosis as they age (Melton, 2001).

Figure 5 below explores the impact of age and gender on the fraction of all impairment in a gender-age group that gets apportioned to non-industrial cause(s). Here we include all claims whether or not they had apportionment applied, and estimate the total impact of apportionment on the gender-age group.
Across all impairments, the data in Figure 5 do not exhibit a gender bias to the application of apportionment, even disaggregating for age. The fraction of total impairment apportioned exhibits the age trend we observed earlier, but that trend is similar for both genders. The apportionment might be driven by different non-industrial causes, osteoporosis vs. cumulative trauma, but the effect is very similar across gender.

Difference in the composition of impairment types across gender and age groups could be masking potential gender bias. That is, bias could exist for specific impairments but be obscured in the aggregate data by the gender differences in the distribution of impairments. For example, the greater prevalence of osteoporosis in older women might lead to more frequent apportionment of back conditions in women. To explore this, Table 4 shows how gender affects the odds that an impairment will be subject to apportionment and when apportioned, the fraction that is considered non-industrial.
### TABLE 4
Impact of Female Gender on Probability of Apportionment and Portion Attributed to Non-industrial Cause (Statistics given in relation to males)

<table>
<thead>
<tr>
<th>Body part</th>
<th>Odds ratio (Values above 1.0 mean females are more likely to be apportioned)</th>
<th>Percentage point difference (Female vs. Male) Percent non-industrial (Apportioned cases)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist/Hand</td>
<td>2.137** (.002)</td>
<td>3.77 (.504)</td>
</tr>
<tr>
<td>Upper Extremity</td>
<td>0.949 (.644)</td>
<td>-8.76** (.000)</td>
</tr>
<tr>
<td>Lower Extremity</td>
<td>1.223* (.050)</td>
<td>3.24 (.165)</td>
</tr>
<tr>
<td>Back</td>
<td>0.927 (.262)</td>
<td>-1.23 (.375)</td>
</tr>
<tr>
<td>Vision</td>
<td>(a)</td>
<td>(a)</td>
</tr>
<tr>
<td>Psych</td>
<td>1.547 (.195)</td>
<td>-2.15 (.775)</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>0.657 (.473)</td>
<td>-3.77 (.792)</td>
</tr>
<tr>
<td>Hearing</td>
<td>0.444 (.150)</td>
<td>-5.08 (.746)</td>
</tr>
<tr>
<td>Other</td>
<td>1.830 (.173)</td>
<td>6.91 (.580)</td>
</tr>
</tbody>
</table>

(a) No vision cases were apportioned
Odds ratios are from Logit models with a dependent variable equal to one when apportionment was applied and zero otherwise. Controls are included controls for age, wage, and missing gender.
Column 3 is from OLS analysis on the sample of apportioned cases with the dependent variable the amount apportioned, a dummy variable for gender as the key dependent variable and controls for age, wage, and missing gender.
(Statistical significance of difference between male and female in parentheses)
*Denotes statistical significance greater than or equal to .05.
**Denotes statistical significance greater than or equal to .01.
The results in Table 4 challenge the concern that gender plays an important role in apportionment. Only for wrist/hand (very strong association) and lower extremity (weak association) are the differences in the frequency of application of apportionment by gender statistically more likely for women. The odds ratio is large for wrist/hand impairments but the impact is small because only a small fraction of all wrist/hand claims are apportioned (2.7%). Consequently, the impact on women of average age is about a 3 percentage point increase in apportionment (1.7% vs. 4.5%). For lower extremities, the probability that a woman has her impairment apportioned is about 1.8 percentage points higher (8.8% for men, 10.6% for women).

The only category where the amount apportioned is statistically different between men and women is upper extremity. In that case, men had nine percentage points more apportioned to non-industrial cause(s).

Small sample sizes for psych, cardiovascular, and hearing may obscure important differences. Some of the results, for example the probability of psych apportionment and the amount apportioned for all three conditions by gender, are notable. But, the small sample sizes and the large variance for these results place them within the range of normal statistical variation. Policymakers should follow the results on these conditions closely. As larger samples become available, it may become apparent that age is a source of significant variation between genders in application of apportionment.

Most important, the key impairment category of “backs” that is most often identified as likely to exhibit gender differences, shows no gender differences. The likelihood of apportionment and the fraction of the award apportioned show small differences that are not statistically significant.

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11 Wrist/hand is the other category often considered likely to exhibit differences by gender, with women more likely to be apportioned.
Discussion

These initial data on apportionment to causation suggest that it is not a source of large cost savings for employers. Permanent partial disability (PPD) represents 32 percent of workers’ compensation benefits (Blum & Burton, 2007). Reducing PPD by the 5.5 percent we observe for non-litigated claims in California would generate premium savings of around 1-2 percent of future premiums in the average state. The estimate given here is conservative, but it suggests that even expanding the sample to include represented cases may not result in a compelling argument for apportionment to cause as a major cost saving option. In some ways this echoes the surprisingly small impact that Oregon’s adoption of major contributing cause as a threshold standard had on total employer costs (Welch, 2000).

However, apportionment to cause does raise important questions about fairness and equity. These questions are not easily answered. Labor and employers might have very different perceptions of equity in the same situation. And, the impact on employers’ decisions to hire and retain older workers and insurer/employer decisions to dispute claims raise additional, secondary issues about the impact on workers.

Current litigation over apportionment

Let us consider the facts in the Vaira, previously cited, that will likely be the first test case to be ruled on by the California Courts of Appeal and probably the California Supreme Court:

On January 27, 2003, while working as a receptionist for respondent …, petitioner hurt her back when she bent over to pick up some travel brochures that had fallen of a shelf…

Petitioner was 73 years old at the time of injury. Five months earlier, on August 14, 2002, petitioner had suffered another work-related injury and filed a separate workers’ compensation claim.
An agreed medical examiner...examined petitioner on May 23, 2005. He concluded plaintiff suffered a compression fracture at the T12 on her spinal column and had become permanent and stationary by February, 2004. He further concluded petitioner’s age and preexisting osteopenia or osteoporosis of her spinal column contributed to her disability. Doctor ... apportioned 40 percent of petitioner’s disability to her preexisting conditions and 60 percent to the industrial injury.

The parties stipulated to overall disability of 64 percent after adjustment for age and occupation but before apportionment.

Prior to California’s adoption of apportionment of disability to causation as part of Governor Schwarzenegger’s reform package, Lois Vaira's disability would not have been apportioned. The non-industrial cause, advanced osteoporosis, had not resulted in disability and one could not say with any precision when it would have expressed itself as a disability “but for” the occupational injury.

Employers argue that they should not be held responsible for disability that results from non-occupational causes, particularly when they have no influence or control over the other causes. In the Vaira case, the employer was only liable at all, because the triggering event occurred at work. If Vaira had bent over to pick up something at home, triggering the disability, the employer would have had no responsibility, even for medical and temporary wage loss payments. Consequently, the arbitrary timing of the triggering event made the employer responsible for large medical and compensation payments.

In this case, labor might argue that an employer takes the worker as they come, the “thin skull” argument. This raises the question, “would observers feel differently if an amateur rugby player bangs his knee at work, ‘lighting up’ a cumulative degeneration of the knee joint?”
Another aspect highlighted by the Vairə case is the concern that the science of apportionment to cause is not yet sufficiently developed. As stated by the Court of Appeal:

We agree with the [Workers’ Compensation Appeals Board] that substantial evidence supports an apportionment of disability to preexisting conditions...However, the question here is not whether it is proper to apportion some disability to preexisting conditions but whether it was proper to apportion 40 percent of the disability to those conditions.

...In his deposition...[in] response to a question about how he arrived at a 40 percent apportionment, Dr [name] said: ‘[I]t was my opinion that, you know, her age predisposed her to the injury, the presence of osteoporosis, and possibly other factors of which, you know, in the physical examination may have shown up. You put those together, and it just seemed to me like she was pretty significantly at risk.’

...It is not enough to say that Dr. [name]’s opinion supports an apportionment to the preexisting conditions. The opinion must support the particular apportionment made.

We saw indication in the data from California (Figure 2) that apportionment may be subject to a degree of arbitrariness in actual application. In the Vairə case, the doctor expressed an opinion about the level of apportionment, but there was no clear reasoning as to why he apportioned 40% versus 80% or 20%. In this case, the appellate court ruled that the record did not reflect substantial evidence supporting the level of apportionment and on this basis the case was returned to the trial court to develop the record.

It will not come as a surprise to many observers that developing a substantial record for apportioning a specific fraction of impairment based on clear reasoning and medical evidence is difficult. This is an area where there is very little medical science to guide physicians (or lawyers, judges, etc. (Guidotti, 2006)). The AMA Guides to the Evaluation of Permanent
Impairment (Guides) are the most commonly used standard for evaluating permanent impairment. The Guides Fifth Edition, running over 600 pages, offers only four paragraphs discussing how to apply apportionment and that is meant to cover causes of the initial injury/illness as well as permanent impairment. A search of the PubMed database (suggested by an anonymous referee for this journal) found only two articles pertaining to the application of apportionment (Beckett et al., 2000; Guidotti, 2002), even when using a variety of search terms. Guidance for evaluating physicians is simply lacking on this important issue.

In the absence of clearer guidance, medical evaluators may rely on available information that is not designed for the purpose. An example would be applying epidemiological study results to individual cases. Leigh’s and Robbins’ (2004) important work highlights estimating the contribution of occupation to the prevalence of illness. It is not designed to inform physicians about individual cases, but might be misused that way. Guidotti (2002) and Beckett et al. (2000) are examples of a still limited epidemiological literature that can inform doctors about evaluating individual cases.

Policy considerations arising from apportionment

A major public policy concern, highlighted in Vaira, is that apportionment might lead to discrimination based on age and gender. It is useful to consider whether the adoption of apportionment to cause might actually reduce age and gender discrimination. An employer faced with two otherwise similar workers might chose a younger or male worker if the employer is concerned about workers’ compensation costs. Gender and age discrimination are prohibited by statute but that does not mean that discrimination does not exist. One common justification for Second or Subsequent Injury Funds (SIFs) is that they improve the employment opportunities for workers with prior disabilities. SIFs are still widely used by jurisdictions even though national and state/provincial statutes outlaw discrimination based on disability.

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12 The AMA Guides Sixth Edition is recently released. We have not yet had a chance to examine the discussion of apportionment in this newest edition.
Labor and employers might consider how they would respond to expanding second injury funds to cover the portion of permanent disability awards apportioned to non-industrial causes. What if the fund is supported by a state’s general fund tax revenue instead of employer contributions? Would that change labor or employers’ perspective?

The results presented here suggest that discrimination based on gender in the actual application of apportionment is a minor issue. We find only limited evidence that apportionment is more likely to affect women, any differences that exist are small, and the conditions where we observe gender differences are ones where apportionment is infrequent.

On the other hand, it is no surprise that we find evidence that apportionment is strongly linked to age. This is particularly true for back conditions. An aging workforce is likely to make this an even bigger issue in the future.

Alternatively, policymakers might consider replacing the use of apportionment to cause with changes in the calculation of the final indemnity dollar award. We observed in earlier figures that age is strongly correlated with the frequency with which apportionment is applied. And for back impairments, the correlation is strong for both frequency and the fraction apportioned. This pattern of application may be appropriate or it may reflect commonly held assumptions about age and disability. If policymakers were concerned that the application was arbitrary in individual cases but generally correct in application overall, a simpler method for achieving the same result would be to reduce the final disability dollar awards as age increased.

An important next step in research on apportionment would involve linking medical diagnosis data (e.g., ICD-9 codes) on the underlying injury or illness to data on the ultimate impairment type. Medical treatment data and secondary diagnostic information could also be useful. For example, wrist impairments from repetitive stress injuries will have very different diagnosis and treatment patterns as well as apportionment (frequency and amount) than wrist impairments resulting from crushing
injuries. California has the data to link the medical diagnosis and treatment data to the disability outcome data.

The continued use of apportionment to causation in California and/or its adoption by other jurisdictions is a compelling reason for improving the scientific basis for its application. The aging workforce and continued evolution of the workers’ compensation system away from traumatic injuries towards cumulative injuries and diseases is another reason to focus more attention on improving our understanding of the underlying causes of disability. Current workers’ compensation law may be poorly structured to deal with disabilities with multiple causes. But parties may wonder whether California’s efforts represented a step forward or backward.

References


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Workers’ Compensation Facility Fee Schedules

Some Considerations for States Looking at Fee Schedule Implementation or Modification in Their Existing Fee Schedules

Janet Jamieson*
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Introduction

State-adopted workers’ compensation reimbursement policies for facility fees impact payers and providers as well as the overall cost of medical services within the state. Not all states have adopted fee schedules or reimbursement policies. In states that are unregulated with no facility fee schedules or reimbursement policies (there are 11 such states), reimbursement is based on contracts between payers and providers, negotiations, and proprietary audits. Although fee schedules don’t always result

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in cost containment, states that do not have fee schedules create an environment for higher medical costs (Roberston & Corro, 2007, p. 18).

Overview of state facility fee schedules: Diversity prevails

Based on a 2007 national survey (see footnote 1), it appears that there are still a number of states that have not adopted facility fee schedules. Thirty-eight states have adopted some type of hospital payment methodology. Methodologies range from a very unique approach such as in Alabama (which pays inpatient services on a two-tiered length of stay per diem and a stop loss, and where each hospital has its own unique rate) to a state like Pennsylvania (which bases their inpatient reimbursement on the Medicare payment system).

Thirty-six states that have fee schedules for hospital inpatient services also have separate schedules for outpatient services. There are many different fee schedule models for paying for hospital outpatient services; this has occurred because hospital outpatient services are not reported using standardized coding, nor are they reported using the same level of billing detail (Roberston & Corro, 2007, p. 2). On the other hand, there are services provided in a hospital/facility setting such as physical therapy, radiology, and laboratory that are very similar to services provided in a clinical setting (non-hospital). Some jurisdictions such as California include these hospital outpatient services within their professional fee schedule. The proposed hospital outpatient fee schedule in Illinois creates a separate fee schedule (apart from the professional services fee schedule) for these common procedures.

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1 Unless otherwise noted in this section, conclusions were drawn from co-author Glen Boyle’s national survey of facility fee schedules conducted for the Illinois Workers’ Compensation Commission (November 2007). Editor’s Note: Please contact the authors for details on the survey.

2 The consensus process in Illinois concluded that the unique economics of providing these services in a hospital setting warranted a separate/dedicated fee schedule. Proposed rule section 7110.90 (h)(7).
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Since the coding and reporting for facility surgical services is non-standardized, the impact of “cross-usage” of professional fee schedules is quite limited, and thus requires a state to adopt a facility specific fee schedule. North Dakota is an example of a state that incorporates Medicare’s Outpatient Prospective Payment System (OPPS). Under an OPPS, services are grouped into categories called Ambulatory Payment Classifications (APCs), and in North Dakota the APC amount is paid at 165 percent of Medicare. Other states, such as Georgia, use an unorthodox approach utilizing fee levels associated with ICD-9 codes (Volume 3 procedure codes) for outpatient surgical facility fees. The fee schedule proposed for Illinois uses a HCPCS/CPT coding scheme for both hospital outpatient and ambulatory surgical centers (ASCs) – with a lesser percentage being paid for the same service being performed in an ASC setting.

There is a great deal of diversity among states in how they establish fee schedules for free-standing ambulatory surgery center services. Alabama pays on a discounted rate, which is assigned at the facility level, and Alaska includes their ASC services within the hospital outpatient fee schedule. California and 12 other states base their ASC reimbursement on the Medicare OPPS-based model for ASCs. Fifteen states have no fee schedules for ASCs, and non-fee schedule states tend to exhibit higher medical costs (Roberston & Corro, 2007, p. 18). States with no reimbursement policies also open the door for third party vendors who add, arguably, significant costs within a workers’ compensation system. This occurs because reimbursement decisions in non-fee schedule states default not to a fee schedule, but to a wide array of auditors and auditing processes. While the adoption of a facility fee schedule, in all of the areas being discussed, will not totally eliminate a payer’s desire to supplement fee schedule provisions with “proprietary” audits, it should significantly reduce the need for utilizing such services.

3 While there can be some use of CPT/HCPCS fee schedules in the surgical facility setting, the majority of facility costs are directed to line items not associated with a professional services fee schedule.

4 Proposed rule section 7110.90 (h)(1) and (7).

5 This should not be confused with the APC fee schedule for outpatient hospital surgeries.
The challenge of implanted devices and other emerging technologies

Another growing cost driver associated with workers’ compensation facility costs is the payment of “implantables.” Implantables are unique medical hardwares, devices, and emerging technologies that are usually part of a surgical procedure. Despite the fact that the implantable market has been projected to grow by 16 percent per year (Wee, 2006), 20 states have not implemented any reimbursement strategies. The states that have addressed this issue have done so in a number of different ways. For example, some fee schedules include the reimbursement of an implant in the facility fee schedule (e.g., a global concept, pure DRG method), while others carve-out these costs and reimburse separately. The carve-out methodology is usually the invoice cost plus some percent markup; therefore, providers must present an invoice as a part of this fee schedule model. Georgia serves as an example of a jurisdiction where implantables are reimbursed at an actual invoice cost, with no markup.

A number of states also include the reimbursement of implantables within the hospital fee schedule, but carve them out in an ASC setting. California has a unique approach, which includes reimbursement for some implantables within the hospital fee schedule, while carving out others – which are then billed separately. The Illinois fee schedule carved out historical charge data for implants when it calculated its hospital inpatient, hospital outpatient, and ASC fee schedules: the charges for implantables pass through the fee schedule amount and are paid at 65 percent of charges. While some observers in Illinois have argued that a percentage discount will simply result in inflated prices being charged/paid, it is probably an improvement over the pre-fee schedule era in

6 The Illinois Workers’ Compensation Commission removed the historical charge data associated with implants so as to avoid a fee schedule that might unintentionally “twice pay” implants.

7 The Illinois Workers’ Compensation Commission received many comments from both sides of the “implantable debate” during the public commentary period of the regulatory process. Comments on file with IWCC.
Illinois where these implantables were often paid at 100 percent. The Illinois fee schedule does require that implantables be billed at a hospital’s standard chargemaster rate, a deviation from which could result in fraud charges. Fraud and gross overpayment appear to be the major concerns being raised by the insurance industry in jurisdictions that are currently addressing the issue of implants (“Insurance Council,” 2008); hence, this can lead to discussions that we would describe as contentious. Key participants in a workers’ compensation system are polarized as to how they view a fee schedule limiting “access” to quality care. With the issue of implants, labor and providers might join forces against the insurance industry/management, based on a position that a fee schedule that deeply cuts the reimbursement of implants will, in effect, limit their desired use.8

Different methodological approaches for creating workers’ compensation facility fee schedules

When workers’ compensation jurisdictions create or modify their facility fee schedules, there are two major components to the consensus process that need to be considered: building consensus on the architecture of the fee schedule and addressing the level of reimbursement therein. The following discussion focuses on the structure or architecture of the fee schedules to be developed and how different approaches relate to actual medical/facility costs.

If we are to agree that state facility fee schedules should have some grounding related to actual facility costs, and be based upon generally accepted coding systems and payment models, then we might agree that Medicare-based fee schedules are the desired model. It seems convincing to us that Medicare-based facility fee schedules are better than those based upon historical charge or payment data (UCR-based), or those based upon discounted rates.

8 See footnote 7, above.
A Rubik’s Cube exercise: Creating facility fee schedules from historical charge data

Fee schedules based on historical charge data are inherently problematic: charge data has questionable value in relation to actual costs, and new codes and procedures are introduced every year which historical charge data does not address. Charge data is the source of UCR-based methods of fee schedule development, but these types of fee schedules often produce inconsistent results using relative value scales as a backdrop (Roberston & Corro, 2007, p. 11). However, historical payment/charge data might be beneficial in benchmarking and measuring the impact of a new fee schedule and achieving goals such as budget neutrality. A major drawback in utilizing charge data (or payment data for that matter) in the area of facility fee schedules is that coding on the facility surgical side, is inconsistent (Roberston & Corro, 2007, p. 2): This results in the creation of non-homogeneous datasets, which then require an almost “Rubik’s Cube-type” exercise to standardize the data and develop a fee schedule.9

The use of historical data can also create incongruent results. In particular, UCR/percentile schedules can produce results that do not correspond with relative weighting.10 It is also important for jurisdictions to understand that establishing a fee schedule based on a “percentile” means that a fee schedule level is actually based upon a single service that was provided in the past. Depending on where this service lines up on a continuum of data points from the lowest to highest, unexpected results can occur. An emerging concern about historical charge data surrounds validating the source data.

9 It took the Illinois Workers’ Compensation Commission nearly two years to develop its ASC and hospital outpatient surgical facility fee schedules which were derived from historical charge data from the Illinois Department of Public Health. See proposed rule section 7110.90 (h) (1) and (7).

10 An example is where the 80th percentile of data points for a lesser weighted hospitalization (based on DRG) falls on a higher fee than the 80th percentile of data points for a higher weighted DRG. This is a reality that can be easily encountered when using historical charge data.
Considerations for adopting a Medicare IPPS DRG fee schedule

Section 1886(d) of the Social Security Act established a system of paying acute care inpatient stays for Medicare Part A (Hospital Insurance) – a system that has been in effect since the early 1980s. This fee schedule sets Inpatient Prospective Payment System (IPPS) rates which are based on a coding system commonly referred to as “DRG.” Through September 30, 2007, there were 538 DRG classifications; however, effective October 1, 2007, Medicare made sweeping changes to the DRG system which introduced the new MS-DRG system (which has codes numbering from 1-999). In a nutshell, CMS placed all diagnosis codes into one of three severity levels and this is used to further refine DRGs into homogeneous classifications now referred to as MS-DRGs. As with the old DRG system, each classification/code establishes a single reimbursement level (with limited exceptions) for a particular inpatient stay/case. In other words, an inpatient stay is reimbursed with one global payment as opposed to consideration being given to every line item charge that would be displayed on the bill.

The same basic elements are considered when establishing an MS-DRG, as with the old DRGs, in an attempt to identify clinically cohesive groups that require similar hospital resources, and that address the uniqueness of each hospital. The basic components in establishing an MS-DRG payment include the following elements:

- Standardized labor and non-labor shares.
- A wage index to account for differences in hospital labor costs.
- The MS-DRG relative weights, which account for differences in the mix of patients treated across hospitals (i.e. severity of illness, etc.).
- An add-on payment for hospitals that serve a disproportionate share of low-income patients (commonly referred to as DSH payments).
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- An add-on payment for hospitals that incur indirect costs of medical education (commonly referred to as IME payments).
- An additional payment for cases that are unusually costly (referred to as outliers).

It is from this list of basic components that a state would design the architecture of its Medicare-based fee schedule. More importantly, from this list of basic components, a state can calibrate the complexity and reimbursement levels of the fee schedule. It is important for a jurisdiction to understand that a precise replication of Medicare reimbursement(s) is nearly impossible for non-Medicare participants to “pull-off.” Hospitals receive interim payments from Medicare which are eventually adjusted in lump sum based on a hospital’s cost report. Medicare then adjusts final payments based on final IME, DSH, and other hospital specific ratios. Medicare now adjusts some of these factors periodically during the course of a year (for each individual hospital) so as to avoid a large final adjustment for an individual hospital. By no means do the authors of this article endorse any of the cost reporting adjustments of the Medicare system.

South Carolinas’ new “Medicare Plus” fee schedule for hospital inpatients serves as a recent example of a Medicare Part A-designed fee schedule with a percentage increase modification (40 percent increase). A challenge for participants in the South Carolina system, or similar systems with Medicare-based fee schedules, is adjusting to and identifying CMS changes to key components: This will require participants to be aware of changes as published in the Federal Register.

The positives of using a Medicare-based MS-DRG fee schedule:

- All of the elements that go into calculating a MS-DRG are in the public domain and can be obtained through CMS and/or the Federal Register.
- All of the elements that go into calculating MS-DRGs are updated by CMS.
Hospital systems are familiar with MS-DRG methodology.
All the core rules relating to MS-DRG payments are firmly established and available.
The methodology is intended to reflect actual costs.
A Medicare-based fee schedule can be adjusted by any number of variables in order to achieve public policy goals and/or a desired level of reimbursement.

The negatives associated with a Medicare-based MS-DRG fee schedule:

- Perception: Hospitals are concerned with Medicare reimbursement levels, and this can become an obstacle and overshadow the validity of the underlying methodology.
- It is important to note that the following hospitals do not fall within the IPPS/MS-DRG payment system:
  - Psychiatric hospitals and units
  - Cancer hospitals
  - Long-term care hospitals
  - Children’s hospitals (of questionable concern)
  - Rehabilitation hospitals and units
- Left in its purest form, the Medicare Part A design can be a bit complicated, and CMS does update some key components intermittently – so some lines of demarcation might need to be established, as it is undesirable to have a schedule that appears to be a “moving target” (since every update and change has administrative costs associated with it).
- Medicare DRGs and their evolution have focused primarily on the elderly population, and as such might not be a perfect

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11 Cases that require services in these facilities are the exception; however, these facilities can be addressed by considering Medicare reimbursement policies such as per-diems or other groupings. Illinois will be unveiling a rehabilitation hospital fee schedule based on per diems. See proposed rule section 7110.90 (h)(8).
fit within the context of workers’ compensation. How the new MS-DRGs address this concern is not yet known. Jurisdictions such as the State of Washington (Department of Labor and Industry), utilize a more hybrid MS-DRG grouper.12

- There is a debate as to whether or not the described methodology properly reflects actual costs.

Considerations for adopting Medicare OPPS: APC and ASC fee schedules

As with the Medicare IPPS MS-DRG fee schedule discussed above, Medicare’s outpatient facility fee schedules for both hospital and ambulatory surgical settings offer states options in this most difficult area of coding, billing and fee schedule development.

As discussed above, Medicare has developed a unique coding system for hospital outpatient surgical facility fees known as ambulatory payment classifications. These codes and unique systems contain many of the MS-DRG characteristics discussed above (such as a code with a relative weight, standardized amounts and wage index considerations). A major benefit of adopting an APC system would be the rules surrounding this coding scheme. Hospitals and payers alike put forth that calculating fees/payments for multiple surgical procedures performed in a single operative setting is one of the most difficult “bill adjudication” tasks encountered. A ready set of rules would be of great benefit to any state that adopts APCs. As with the MS-DRG system, the APC system provides a cost outlier provision, and a jurisdiction will want to determine if they wish to incorporate this component into the fee schedule. An important point that a state might have to consider is whether or not the APC fee schedule contains components that might actually drive costs: the APC

12 The State of Washington utilizes an “All Patient Diagnosis Related Group” (AP-DRG) system which encompasses newborn, pediatric and adult populations. Discussions in this area are perfect for a state’s fee schedule advisory body to address; however, the authors of this article believe the existing Medicare MS-DRGs to be sufficient.
schedule might provide reimbursement levels for minor facility costs that a jurisdiction might not currently pay. APC reimbursement levels are not as easy to reproduce as MS-DRG levels, and some hospital specific components are not as readily available in the public domain. Nonetheless, Medicare has pioneered a coding system designed to establish fee schedule levels for this most difficult area and it should require a close examination by any jurisdiction looking at a fee schedule in this area.

Medicare ties reimbursement levels for freestanding ambulatory surgery centers around CPT/HCPCS codes. This coding system is familiar in appearance as it corresponds with American Medical Association’s Physicians’ Current Procedural Terminology (CPT). Procedures are relatively weighted, multiplied by a conversion factor, and other facility characteristics are factored into the reimbursement amount – as is seen in the MS-DRG and APC fee schedules. A major point of examination for a state will be in the difference of listed procedures between Medicare’s APC and ASC fee schedules. In some cases, a state might find that Medicare excludes procedures commonly performed on an outpatient basis from its ASC fee schedule, and a gap filler might have to be considered. The State of Colorado might be a good reference point for examining some of these “adoption issues.” In the development of the proposed Illinois fee schedule, for hospital outpatient surgical facility fees, the Illinois Hospital Association (IHA) favored a fee schedule based on the ASC13 coding system as opposed to an APC coding system. Simply, the “architecture” and more common usage of the ASC coding system was preferred over the lesser used and less predictable outcomes of an APC coding/fee schedule system.

13 It is strongly noted that IHA did not endorse ASC reimbursement levels promulgated by Medicare – only the coding system which used CPT codes. It was noted by IHA that this ASC coding preference was tied to the fact that it was commonly used by commercial insurances which represented a large bulk of their business – and that hospitals were having difficulty predicting (an important concept in this article) Medicare APC reimbursements. See proposed rule section 7110.90 (h)(7).
Recommendations

The development of facility fee schedules can be a challenging task for any jurisdiction. Payers desire reimbursement levels and coding systems that are reproducible and that can be effectively/efficiently applied. Providers desire predictable reimbursement amounts that are properly weighted and based on a commonly used coding system. State agencies desire a fee schedule system that is reasonably administered and accepted by all participants. It is well understood that a workers’ compensation system with less friction is a better system, and the adoption and/or modification of Medicare-based fee schedules may best produce this result. There is also evidence that group health insurers are gravitating toward Medicare-type fee schedules, and away from UCR-based schedules (Roberston & Corro, 2007, p. 2).

Medicare fee schedules are designed with extensive research and carefully supported by rules that can be incorporated by a state. Medicare schedules address the complexities of facility coding, from multiple surgeries to major medical trauma. In the difficult area of implants, a jurisdiction contemplating a Medicare-based fee schedule will want to consider how it wants to proceed. Specifically, will the jurisdiction adopt Medicare reimbursement policies for “implantables” lock, stock, and barrel, or will the jurisdiction carve out these items? In any event, a state will want a strong policy in this area as it is an extremely contentious area of facility fees.

The design of Medicare fee schedules also allows for unlimited calibration to achieve desired fee schedule amounts. It is in this calibration that a state will want to research how the fee schedule will be updated. Will a state want to tie increases(updates to Medicare indices that are tied to budgetary constraints? Or will a state want to tie updates to another inflationary index? Such decisions should be the result of careful deliberation. There is plenty of national talent in this area of Medicare fee schedules and states can look locally for analysts to fine tune their
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Medicare adopted schedules. Additionally, states may not need to look to proprietary data sources for fee schedule development.

Medicare policies strongly influence most intuitional providers throughout the United States; hence, a Medicare-based system can address both major (e.g., new MS-DRG system) and lesser changes (e.g., AMA annual code updates) when they are mandated.

The adoption of Medicare-based facility fee schedules is not without its challenges. A jurisdiction will have to determine whether or not they want to incorporate all of the factors that go into calculating Medicare fee levels. It is likely that a jurisdiction might want to freeze some components of a Medicare-based fee schedule, at least on an annual basis, so as to eliminate the fee schedule becoming a “moving target.”

As we look towards the near future of coding, fee schedules, and the Medicare system, we see a system of change. Medicare has left large gaps in the new MS-DRG coding scheme – which are sure to be soon addressed (as in terms of adding many new MS-DRGs). Hospital outpatient facility schedules might be best described as being in a state of flux, and big changes could be on the horizon. One might ask: Why adopt such a changing fee schedule system? Medicare is the national catalyst for developing coding and payments systems on the facility side. Their coding systems must and will be adopted by the vast majority of facilities, and as such, the provider community will move on and adjust their systems to meet these needs. Since providers want uniformity and predictability, they are and will become more adverse to workers’ compensation systems that cling to old coding schemes and fee schedules. Likewise, payers may welcome the ability to abandon antiquated fee schedules, and the need to continuously program diverse and unique fee schedules into their payment systems.

Specifically, the Medicare fee schedules contain non-proprietary weights and conversion factors that can be adjusted to allow easy and unlimited analysis.

As discussed in some detail in this report, some of the Medicare components are hospital specific and can actually be altered by Medicare during the course of a year.
References


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Practical Implementation of Treatment Guidelines in a Workers’ Compensation Environment – A New Approach

Matthew Stanhope*
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Introduction

Treatment guidelines are increasingly being used as part of efforts to control workers’ compensation costs. This paper advances the proposition that these efforts will fail to reach their full potential if they are not coupled with appropriate implementation strategies. Worse, just as the institution in the late 1980s and early 1990s of widespread peer review as a feature of medical cost containment gave rise to an expensive peer review industry, the utilization of treatment guidelines will likely give

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rise to increased litigation and an expensive derivative industry if proper mechanisms are not provided to the payer to implement the guidelines.

Experience with treatment guidelines within the medical community has highlighted many organisational and professional barriers to implementation, which may have implications for the workers’ compensation environment. In a period of significant legislative reform it is timely to consider treatment guidelines, their limitations, and ways in which to maximise their effectiveness.

**A critical summary and analysis of relevant literature**

Recent trends demonstrate a decreasing incidence of workers’ compensation claims in the United States (Thompson Williams, Reno, & Burton, 2004). Despite this, treatment cost in workers’ compensation in the United States has risen (Llewellyn, 2004; Thompson Williams et al., 2004). Data from the National Academy of Social Insurance in the United States demonstrates between 1998 and 2004 there was an annual increase in treatment costs of 9.9 percent per annum (Mont, Burton, Reno, & Thompson, 2001; Thompson Williams et al., 2004).

Various strategies, including fee schedule modification, peer review, and insurer pre-approval of treatment, have been employed in an attempt to limit increases in treatment expenditure (Wickizer & Lessler, 2002). Despite the widespread use of such strategies, treatment expenditure continues to rise. Therefore, workers’ compensation schemes are turning to treatment guidelines as a potential solution. The use of guidelines in the workers’ compensation environment aims to decrease inappropriate treatment, reduce variability in treatment provision and therefore decrease treatment expenditure (Guidotti, 2006).

In the United States many workers’ compensation schemes have legislation which require guidelines be a component of the utilization review processes. This translates into a need for case managers and claims adjus-
tors to have access to, interpret and implement the recommendations of treatment guidelines.

The potential impact of guidelines is highlighted in the 2003 California scheme reforms. The California legislation states that insurance carriers and third party administrators must adopt a utilization schedule in which treatment is consistent with the American College of Occupational and Environmental Medicine Guidelines (Nuckols et al., 2005). This has led to a significant modification of the claims adjustor and case management processes of insurance carriers and third party administrators (TPAs).

In California the scheme reforms require case managers and claims adjustors to approve treatment only if it is consistent with the ACOEM Guidelines. Whilst simple in its objective, practical implementation of the guidelines into insurance carrier and TPA work practices has proved difficult (Ibid.).

The RAND Corporation, as part of a review of medical guidelines, undertook a qualitative assessment of the impact of ACOEM Guidelines from the provider and payers perspective (Ibid.). The provider community expressed the view that the use of guidelines needs to allow for provider autonomy. Such autonomy would allow treatment providers a degree of flexibility to allow for clinical judgement. This view is consistent with the principles of evidence based practice as understood by the medical community (Genuis, 2005; Sackett, Rosenberg, Gray, Haynes, & Richardson, 1996).

Conversely, the payor community expressed the view that the guidelines needed to be converted into a schedule to provide more specific instructions as to appropriate quanta of treatment (Nuckols et al., 2005). This view stemmed from concerns that different interpretations of guidelines by payers are being made in the absence of regulatory guidelines (Ibid.).

The competing needs of treatment providers and payers have the potential for treatment guidelines to be applied in a conflicting manner. This in turn has the potential to increase disputes with consequent increases in litigation. To find a solution to this problem, workers’ compensation
schemes need to consider the intended purposes of treatment guidelines and how they fit with the decision making processes within insurers and TPAs. In particular, insurance carrier and TPA decision making must control expenditure whilst ensuring that decisions do not limit treatment that will lead to an improved functional capacity and return to work.

Historically, treatment guidelines have evolved in the medical community in response to the emergence of a significant body of evidence for many treatment types (Genuis, 2005). Treatment guidelines are defined as systematically developed statements that assist practitioners and patients regarding health care for specific clinical conditions (Shaneyfelt, Mayo-Smith, & Rothwangl, 1999). A number of reviews have demonstrated that there exists variable quality of published guidelines according to well defined criteria (Grilli, Magrini, Penna, Mura, & Liberati, 2000; Hasenfeld & Shekelle, 2003; Shaneyfelt et al., 1999).

There has been a rapid increase in the number of treatment guidelines to assist clinicians in the management of musculoskeletal injuries commonly seen in workers’ compensation (Genuis, 2005). The purpose of treatment guidelines is to provide a critical appraisal of the medical literature and to improve the quality of clinical decisions (Woolf, Grol, Hutchinson, Eccles, & Grimshaw, 1999).

Traditional treatment guidelines typically describe the level of evidence for particular treatment and often provide expert interpretation of the evidence to assist in clinical decision making (Hayward, Wilson, Tunis, Bass, & Guyatt, 1995, Woolf et al., 1999). This combination of evidence-based and clinical expertise-based decision making is consistent with the principles of evidence-based practice (Sackett et al., 1996). Clinical expertise includes the role of clinical judgement in interpreting the evidence base and the personal characteristics/values of the patient (Ibid.).

Claims adjustors and case managers using traditional treatment guidelines may not have the necessary skills in interpreting the recommendations and applying them to control treatment expenditure. For example, the American Pain Society provides the following recommendation with
respect to manipulation for chronic low back pain (Chou & Huffman, 2007):

For chronic low back pain, the Cochrane review found spinal manipulation moderately superior to sham manipulation (3 trials) and therapies thought to be ineffective or harmful (5 trials). Against sham manipulation, differences in short- and long-term pain averaged 10 and 19 points on a 100-point visual analogue scale, and differences for short-term function averaged 3.3 points on the RDQ. There were no differences between manipulation and general practitioner care or analgesics (6 trials), physical therapy or exercises (4 trials), and back school (3 trials). Evidence was insufficient to conclude that effectiveness of spinal manipulation varies depending on the presence or absence of radiating pain or the profession or training of the manipulator.

This type of information is appropriate for clinicians who are responsible for deciding what treatment they will provide to their patient. However, the above example recommendation does not provide clear guidance to claims adjustors or case managers as to whether or not they should approve manipulative therapy. Leading authorities highlight the need for guideline developers to consider the objectives of the guideline and the intended users of the guideline as this will direct the guideline recommendations (AGREE Collaboration, 2003).

In the above example, the claims adjustor is required to interpret the significance of the control comparison, the effect size, outcome variable and follow-up periods. This information then needs to be matched to the patient diagnosis, duration of injury and response to prior manipulation (if applicable). This is a complex task and claims adjustors and case managers require decision rules to ensure the appropriate application of evidence-based recommendations to individual patients.

Decision support systems (DSS) are knowledge systems that use patient specific information and match that to an evidence base to produce individual specific recommendations (Johnston, Langton, Haynes, & Ma-
thieu, 1994; Randolph, Haynes, Wyatt, Cook, & Guyatt, 1999). In a workers’ compensation environment, a DSS has the potential to assist in the management of treatment expenditure by providing recommendations regarding treatment that are based on the medical evidence combined with individual worker characteristics.

The evolution of treatment guidelines into a DSS for medical providers has been extensively researched (Bates et al., 2003; Colombet et al., 2005; Essaihi, Michel, Shiffman, 2003; Maviglia et al, 2003; Shiffman, Liaw, Brandt, & Corb, 1999). In the same way that a DSS assists treatment providers in matching evidence to their patients, they can assist case managers and claims adjustors in matching the evidence to their claimants.

Systematic reviews of DSS used throughout the health industry demonstrate a number of benefits (Garg et al., 2005; Kawamoto, Houlihan, Bala, & Lobach, 2005). These benefits include the reduction of medical errors, reduced practice variability, increased health care quality and dissemination of guideline findings (Maviglia et al., 2003; Shiffman et al, 1999; Sim et al., 2001).

Decision support systems are a logical progression in the implementation of treatment guidelines into the decision making workflows of insurance carriers and third party administrators. The development of a DSS for workers’ compensation can utilize the medical literature relevant to individual workers’ characteristics and provide recommendations consistent with the objectives of case managers and claims adjustors. There are a number of steps that need to be undertaken in the development of a DSS, outlined below.

**Decision Support System development**

There is no specific literature available on the development of a DSS for claims adjustors and case managers in a workers’ compensation environment. The final development protocol requires a review of various literature and resources, and includes the following steps:
• Development of an evidence-base for the efficacy of the treatment of musculoskeletal injury based on existing systematic review literature that meets minimum quality criteria.

• Development of a series of decision rules that allow interpretation of the evidence-base with reference to individual claimant situations.

• Combining the evidence-base and the decision rules to build a series of decision algorithms.

• Inputting the decision algorithms into a computer software program resulting in a DSS.

Following is a description of a tested, working methodology for development of a DSS. The description is an accurate depiction of how one such system was developed for case managers and claims adjustors. There may be other possible valid methodologies that have not come to the attention of the authors.

Development of the evidence-base

Available statistics from workers’ compensation schemes were analysed to establish the most prevalent musculoskeletal injury types, which were grouped by anatomical region. For each anatomical region, a preliminary list of common treatment types was generated based on a combination of workers’ compensation statistics, clinical experience and review of the systematic review literature.

Search terms for the anatomical regions and treatment types were further refined by reviewing the search terms of relevant Cochrane Review Groups (Higgins & Green, 2006). Identification of relevant systematic review literature was balanced for sensitivity and specificity and performed according to a clearly defined protocol (Montori, Wilczynski, Morgan, & Haynes, 2005). In the event that no systematic reviews were identified for a given treatment modality, the controlled clinical trial literature would be reviewed for appropriate evidence.
Systematic reviews provided a synthesis of the findings of the primary literature (Jadad, Cook, & Browman, 1997) and an appropriate evidentiary base from which to build a DSS (Cook, Greengold, Elldrot, & Weinberg, 1997). Due to variable quality in the systematic review literature, minimum inclusion criteria were established based on the National Health and Medical Research Council (1998) and Montori et al. (2005) definitions of a systematic review.

Identified systematic reviews were sorted based on title and abstract against the inclusion criteria. Full text versions of remaining papers were then subject to the same process. For the final included papers, specific criteria relating to treatment efficacy was extracted and placed into an evidence table. Treatment efficacy was determined by the complex relationship of a number of criteria including the level of evidence, effect size, control comparison, outcome variable and follow-up period (Higgins & Green, 2006; National Institute for Health and Clinical Excellence, 2007).

Additional criteria extracted from the included systematic reviews included patient population and duration of injury to ensure that the evidence-base was applied to the appropriate individual patients. Evidence tables were developed for each treatment modality included in the DSS and represented the evidence-base which formed one component of the DSS.

Development of DSS decision rules

Decision rules allow an evidence-base to be combined with certain conditions (such as patient characteristics) to produce a clinically relevant recommendation/action (Brokel, Shaw, & Nicholson, 2006; Shiffman, 1997). The application of decision rules to an evidence-base has been used successfully in medical fields (Shiffman, 1997). The use of decision rules in a DSS for claims adjustors and case managers obviates the need for interpretation of the research findings from an evidence-base.

A series of decision rules for the DSS was developed by combining criteria from the evidence-base (level of evidence, effect size, etc.) with
patient specific characteristics including body region, duration of injury and response to previous treatment. The decision rules were assessed for clinical plausibility by an expert with extensive clinical and research experience. To ensure that the total rule set was consistent, each rule was assessed for ambiguity, redundancy and conflict (Ibid.).

An example of a decision rule for treatment relevant to the proposed DSS is as follows:

IF “treatment X” has a moderate level of evidence

AND a small effect size

AND a short term benefit

AND the patient has low back pain

AND the patient has had pain for greater than three months

AND the patient’s functional capacity has not improved as a result of “treatment X”

THEN continued treatment is not indicated

*Development of decision algorithms*

A decision tree (algorithm) was developed by combining body region, treatment type, the evidence-base and decision rules. Appendix 1 provides a schematic representation of a decision algorithm. The decision algorithm was designed so that a claims adjustor or case manager can apply individual patient characteristics to the decision algorithm and generate a recommendation. The recommendations in the decision algorithm constitute the combination of patient characteristics with an evidence-base in a clinically appropriate manner.
Conversion of the decision algorithms to a computer application

The efficacy of a DSS is enhanced when it is computer-based (Kawamoto et al., 2005). As such the decision algorithms were converted into a computer format by computer development experts. The software version of the decision algorithms constituted the DSS.

Decision support testing and validation

Having completed the development of a decision support system, a series of validation studies have been undertaken to ensure that the DSS is appropriate for a workers’ compensation environment. This validation process has included a usability study, a concurrent validity study and a content validity study. These studies have been undertaken in collaboration with the University of Melbourne.

The results of these studies demonstrated that the DSS was usable, covered the appropriate content for case managers and claims adjustors and provided recommendations consistent with an accepted standard (i.e. ACOEM Guidelines).

Conclusion

Treatment guidelines have a vital role in addressing the escalating cost of medical treatment in workers’ compensation. The practical implementation of these guidelines will be restricted without consideration of the professional background of case managers and claims adjustors, and the organisational environment, objectives and legislative responsibilities in which they operate. A DSS is an appropriate way to address the challenges of payers who utilize non-medical personnel in the interpretation and application of treatment guidelines.

Giving treatment guidelines to most claims adjusters, without implementation assistance, is akin to giving a U.S. taxpayer Internal Revenue Service forms without instructions – it is possible that they will end up with
correct results, but not likely. Given the complexities of treatment guideline interpretation, the non-medical personnel utilizing them require assistance to ensure appropriate decision making and avoid questionable interpretations that lead to controversy and litigation.

A DSS, like a treatment guideline, cannot “make” decisions regarding medical cost in workers’ compensation. Rather a DSS aims to provide the right information at the right time to claims adjustors and case managers to “support” decision making. There continues to be a need for skilled claims adjustors and case managers to balance the medical evidence, legislative responsibilities and individual claim factors in the overall management of workers’ compensation claim.

The development of a DSS for case managers and claims adjustors requires a comprehensive development protocol. Such a protocol must include a clear understanding of the intent of the guideline and the practical requirements of implementation. One such decision support system has been outlined in this paper.

Editor’s Note: Starting with the next issue, all authors submitting to the IAIABC Journal will be asked to disclose in writing any financial interest they may have in the subject matter upon which they are writing, and such disclosures will be made public. Although such disclosures have not been requested for the current issue, the Journal is aware that one or more of the authors of this article has some financial interest in products, services, training or other activities discussed in this article.

References


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Dr. Jon Ford heads The University of Melbourne Low Back Pain Research Team. Dr. Ford’s teaching and research focus is identifying homogenous subgroups of low back pain based on pathoanatomical and psychosocial dimensions. His research team is working on the development of sophisticated treatment algorithms specific to five different subgroups. Dr. Ford is a partner and clinician in the LifeCare network of physiotherapy practices, which enables a high level of collaboration between clinicians and researchers. He is a member of the Spine Society of Australia and the Australian Physiotherapy Association. He is involved in the undergraduate and postgraduate teaching program, lecturing in the areas of clinical reasoning, occupational health, exercise prescription, manipulative therapy and evidence-based practice.
APPENDIX I

The DSS consists of a series of decision algorithms that combine the body region, treatment type, evidence base and decision rules to provide the user with a recommendation.
WorkSafeBC is proud to host the BC in 2008 Conference, a unique event combining the IAIABC’s 94th Annual Convention with the annual AWCBC Learning Symposium, which brings approximately 400 delegates together to discuss topics relating to workers’ compensation in Canada, the U.S., and around the world.

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Editor’s Note: With this issue, the IAIABC Journal continues a cooperative venture with the Workers’ Compensation Policy Review. This important publication will provide summaries to the journal of research and articles that appear in its pages in forthcoming editions of the IAIABC Journal. The hope is that by providing the Journal’s readership with easy reference to the information contained in WCPR, the workers’ compensation industry will have access to a broader range of timely and valuable information.

Summary of the Contents – July/August 2007

Workers’ compensation incurred benefits per 100,000 workers vary significantly among jurisdictions in a particular year as well as nationally over time. “Workers’ Compensation Incurred Benefits: 1985-2003,” by John F. Burton, Jr. and Florence Blum, provides information on cash benefits, medical benefits, and total (cash plus medical) benefits per 100,000 workers for up to 48 jurisdictions for each of the years between 1985 and 2003.

*Contributed by John F. Burton, Jr., Professor Emeritus, School of Management and Labor Relations, Rutgers: The State University of New Jersey, Princeton, NJ. Email: JBWCR@aol.com
Figure A of the article provides an historical record of changes in the national averages of total benefits per 100,000 workers for the same 42 jurisdictions between 1985 and 2003. The national data exhibit interesting data over time. Total benefits increased for the five years between 1986 and 1990; declined for the five years between 1991 and 1995; marked time in 1996 and 1997; increased for the four years between 1998 and 2001; and then were essentially unchanged in 2002 and 2003. As indicated in the article, the results in the two most recent years reflect a modest decline in cash benefits per 100,000 workers coupled with a slight increase in medical benefits per 100,000 workers.

The article examines the changes in cash and medical benefits (as well as total benefits) from 1985 to 2003 for individual states. One interesting finding is that the interstate differences in cash, medical, and total benefits narrowed considerably over these 19 years, although there was a modest increase in the dispersion of medical and total benefits per 100,000 workers among the states between 1998 and 2003.

Summary of the Contents – September/October 2007

Underwriting results for the workers’ compensation insurance industry improved for the fifth year in a row, as discussed in “Workers’ Compensation Insurance Industry Profitability Surges in 2006” by John Burton. As discussed in the article, the overall operating ratio, which is the most comprehensive measure of underwriting results because it considers investment income, was 83.9 in 2005. This is a sharp improvement from the overall operating ratio of 108.1 in 2001 and is also significantly better than the operating ratios of 98.1 in 2003, 94.5 in 2004, and 90.5 in 2005.

When the overall operating ratio is greater than 100, carriers lose money even when investment income is considered. In 2001, workers’ compensation carriers lost $8.10 for every $100 of premium. Conversely, when the overall operating ratio is less than 100, the industry is profitable when
investment income is considered. In 2006, carriers made $16.10 of profit for every $100 in premium.

“Workers’ Compensation Benefits: Frequencies and Amounts in 2003” by Florence Blum and John Burton provides the latest information on the frequency, average benefits per claim, and total benefits per 100,000 workers for four types of cash benefits, for all cash benefits, and for medical benefits. Detailed data on incurred benefits are provided for 47 jurisdictions in 2003, and tables providing comparisons among those states relative to national averages are provided for six years. The differences among jurisdictions are substantial. For example, in 2003, four jurisdictions had permanent partial disability (PPD) cash benefits per 100,000 workers that were at least 50 percent above the national average and seven jurisdictions had PPD benefits that were at least 50 percent below the national average.

Information on the Workers’ Compensation Policy Review

The Workers’ Compensation Policy Review is published six times a year. Requests for a sample copy or for subscription information can be sent to WCPR, 56 Primrose Circle, Princeton, New Jersey, 08540-9416; by FAX to 732-274-0678; by e-mail to JBWCR@aol.com; or electronically by visiting the Web site at: http://www.workerscompesources.com.
WorkSafeBC is proud to host the BC in 2008 Conference, a unique event combining the IAIABC’s 94th Annual Convention with the annual AWCBC Learning Symposium, which brings approximately 400 delegates together to discuss topics relating to workers’ compensation in Canada, the U.S., and around the world.

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