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In this issue of the Journal of Disability Medicine readers are presented with a collection of well written articles and studies that represent the many areas that physicians and independent medical examiners need to maintain an awareness about. For example, the advent of health literacy and its role in positive healthcare outcomes is at the crux of the complexity of our healthcare system in the United States. Patients need to properly understand medical instructions given to them in order to take care of oneself or a family member. Many disabled patients are unfamiliar and quite likely uncomfortable with their healthcare situations and experiences. Medical terminology and jargon act to further alienate and sometimes frighten patients. Ideas and approaches to remedy this are provided in this edition.

As the so-called Baby Boomer generation ages, issues of joint replacement will likely also increase. Thus it is important to better understand the outcomes of such procedures—not from just the operative outcomes, but in addition, the functional outcomes of such patients at follow-up, months after their procedures. This is examined in detail in this edition of the Journal of Disability Medicine.

Traumatic brain injury sequela can manifest in a number of ways and on the other hand, malingering and outright fraud can also present. It thus becomes critically important for independent medical examiners and disability medicine specialists to be able to better understand this all too frequent injury and disability.

Similarly, occupational electrical injury can result in trauma and complex disability. In order to best work with such populations, disability medicine specialists need a context by which to understand concomitant work disability subsequent to such occupational electrical injuries and the associated trauma and burns.

All of these issues, and others to be discussed in upcoming editions of the Journal of Disability Medicine, occur in a current backdrop of the advent of the Affordable Care Act being more fully functional and insinuated across the country. So as new payer models are trialed and as older methods evolve to new systems, we are starting to see some interesting models of innovative payment schemes that show promise. For example, Harbor Health Systems, LLC’s focuses on quality as a practical and effective tool for managing workers’ compensation costs. “They utilize historical claims and billing data to select physicians for an outcome-based medical network solution. They establish fees for these physicians that are actually higher than those with other payers due to the belief that physicians that have demonstrably positive clinical outcomes actually save money through a reduction in complications, improvement in care decisions, and higher quality patient management” (Stout & Wang, 2014).

Similarly, the Prometheus Payment Model focuses on patient-centered payment through the use of what are referred to as evidence-informed case rates which are bundled prices for care that split patient-related risks (such as demographics, comorbidities, severity of condition) from provider management failure related risks—which cause much of the economic waste in healthcare. Since patient-related risks can be adjusted based on severity, providers are compensated fairly. In addition, the payment isolation of provider management failure-related risks discourages their use, and therefore cuts waste. Approaches such as these may be harbingers of what may come for injured workers’ care.

In these times, it is a challenge to manage all the competing demands of clinical practice—compliance concerns, effectively managing the costs of doing business, competitive issues, increasing regulatory demands, the ever-changing landscape of national healthcare reform and workers’ compensation reforms that vary from state-to-state. Keeping current with the literature in order to ensure quality patient evaluation and care is not an easy challenge. But the rewards of helping make one’s patients functional, pain-free, and once again effective individuals is without comparison, and it is what the Journal of Disability Medicine strives for in each edition.

As the Journal continues to grow and evolve, we plan to have periodic special topics editions that focus on a particular area of disability medicine. We welcome guest editors to compile collections of high quality studies to submit to the Journal for peer reviewed consideration. If you have an interest in developing a topical focused collection, please first send your ideas and area of interest to Dr. Chris Stout, Acquisitions Editor, at chris.stout@atipt.com

Mohammed Ranavaya, MD, JD, MS, FRCPI, FFOM
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Health Literacy and Occupational Disability: The Barrier to Positive Health Care Outcomes

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Abstract:

Background: Despite the availability of health care education and information, wellness seems an unreachable goal to a significant portion of the population considered health care consumers. Health care information is available in a multitude of languages and is disseminated from a variety of media sources. Every effort is made to educate the health care consumer. But do these efforts make a difference? It seems the availability of information has not impacted the health care consumer in preventing illness or in achieving positive outcomes after being diagnosed with illness.

Purpose: To explore the various reasons health care education and information do not seem to impact the wellness of health care consumers.

Study Design: A systematic review of published government and private industry material was completed to explore efforts placed on dissemination of health care education materials and the outcome of these efforts on improvement in health care for consumers.

Methods: Literature review of materials exploring the reasons for low health literacy in the overall population.

Results: The healthcare system is very complex for the average consumer to navigate. The consumer frequently lacks understanding of the language or technology and this lack of understanding leads to poor outcomes. These poor outcomes affect the overall health of the individual. When these issues impact workers’ compensation or disability claims, we find the cost of the claim and likelihood of litigation increase significantly. Overall low health literacy is very costly to consumers and employers alike.

Conclusion: The cost of low health literacy to the U.S. economy is a cost that is a drain on our economy. Low health literacy is recognized as a major public health issue detrimental to the nation’s overall health and healthcare systems. It is our challenge to eradicate low health literacy.

Keywords: Low health literacy, health care information, workers’ compensation, disability

Introduction

Health care information and education are available to consumers from a multitude of media, written and digital communication sources. Despite the availability of these resources, wellness seems an unreachable goal for so many individuals; but, why? There are many reasons but it can be summed up in two words - Health Literacy.

Our healthcare system is very complex. Patients with limited understanding of medical information or how their bodies work are simply overwhelmed. It is challenging to locate an appropriate medical provider, schedule appointments and complete insurance forms. It is difficult to absorb all the information necessary to make an educated decision regarding medical care. Understanding medical instructions and performing unfamiliar skills to take care of oneself or a family member is a challenge. Patients struggle to gain an understanding of the disease or injury, related diagnostic tests, surgical procedures, prescriptions and equipment necessary for recovery. Most patients are unfamiliar and quite likely uncomfortable with their health care. Medical terminology and jargon sounds much like a foreign language. When a family is faced with caring for a severely injured, chronically or terminally ill family member it is all the more difficult to act with limited understanding of health care information. Unfortunately, understanding the information delivered to them, could literally mean life or death in some circumstances.

So what exactly is health literacy and why is it important to positive health care outcomes? According to the U.S. Department of Health and Human Services, “health literacy is the degree to which individuals have the capacity to obtain, process and understand
basic health information and services needed to make appropriate health decisions”.

The first ever National Assessment of Adult Literacy (NAAL) completed in 2003, found only twelve (12) percent of U.S. adults have proficient health literacy. Eighty-eight percent of the population possess intermediate, basic and below basic health literacy proficiency. Health literacy proficiency requires an adult to read instructions such as those provided with prescriptions or for medical test preparation. The adult is also required to read pamphlets that provide information explaining care for a disease or injury, and have the ability to calculate health insurance co-pays, deductibles, and understand health insurance plan benefits.

NAAL also identified there are 14% or approximately 32 million adults in the United States who cannot read. There are an additional 21% who read below fifth grade level; and, 19% of high school students who graduate without the ability to read. These deficiencies affect all ages, race and income levels. The education level attained by the individual does make a difference. Clearly, those individuals with the least amount of education primarily fall into the below basic level of health literacy. However, a higher level of education does not automatically translate into health literacy proficiency. An individual with a post graduate degree in English Literature may have very little knowledge or understanding of health care. This individual could fall into the below basic level of health literacy because of unfamiliarity with medical terms or how their bodies work. This individual may struggle to appropriately interpret risks necessary to make health care decisions; become confused or frightened when faced with a serious illness; or, have the inability to carry out complicated self-care for a complex condition.

The National Patient Safety Foundation (NPSF) has found that most consumers need help understanding health care information. The impact of low health literacy is enormous. According to NPSF, only 50 percent of patients take prescription medications as directed. Patients with chronic diseases such as diabetes, asthma or hypertension do not understand the disease process and how it impacts their life. These patients have a very poor understanding of their treatment or how they can contribute to managing the disease. This lack of understanding places patients with low health care literacy at increased risk of hospitalization. It is easy to see how low health literacy is associated with needless visits to the emergency room or physician, adverse health outcomes, and higher health care costs.

Low health literacy impacts every aspect of the healthcare continuum including workers’ compensation and disability. Employers recognize the challenge of literacy in the workplace. Unskilled workers and workers with limited English skills require increased training and supervision. Valuable work time is used to provide basic skills training to workers. Training is extraordinarily valuable to insure workers can read and interpret basic signs and instructions. A workers misunderstanding of directives may cause errors, slow production or compromise safety. An increased number of workers’ compensation claims may occur as a result of literacy issues in the workplace.

Workers’ Compensation injuries are costly in
many ways. Premiums are based on the frequency, severity and duration of injuries that occur in the workplace. An increase in workers’ compensation claims drives premium cost upward and decreases company profits. The very workers that struggle with literacy in the workplace will also struggle with health literacy related to their injury. A lack of compliance with medical directives may elongate medical treatment and increase health care costs. An increased risk of complications and visits to the emergency room are very probable. Many companies utilize return-to-work programs to minimize expenses related to lost time. It is difficult to return individuals to work when they have difficulty understanding they will not reinjure themselves if they return to work. The employee also has difficulty understanding that workers’ compensation is driven by state regulations. It is not uncommon for an injured worker to interpret an employer’s compliance with workers’ compensation regulations as punitive toward them. When this occurs injured workers seek legal counsel and the cost of the claim increases exponentially.

Co-morbid conditions such as diabetes mellitus, hypertension, hyperlipidemia and obesity further complicate the treatment of workers’ compensation injuries. Injured workers’ with low health literacy tend to poorly manage chronic co-morbid conditions. Poor control of co-morbid conditions adversely impact recovery from work related injuries. An injured worker suffering from chronic disease experiences a slow and complicated recovery from the treatment of industrial injuries. Symptoms arising from the illness make it difficult to accurately diagnose the work related injury. Injured workers with diabetes are more likely to develop adhesive capsulitis or wound healing complications. Diabetic neuropathy makes it difficult to diagnose injuries with nerve related symptoms. Kidney failure, stroke or a heart attack are potentially fatal complications from any of these chronic diseases. The cost of the workers’ compensation claim is immediately higher when an individual has any of these chronic diseases. In order to treat the industrial injury appropriately, these conditions must be stabilized. It may require treatment of the chronic disease along with the work related injury to bring resolution to the claim.

Obesity is especially challenging. At this time, many physicians will no longer agree to treat morbidly obese patients. The risks of surgery are disproportionately high and outcomes are poor or a total failure. Some physicians agree to treat the injured worker with the caveat that weight loss must occur. Compliance with a weight loss program is a difficult for those with low health literacy. A poor understanding of nutrition and the impact of weight loss to their overall health is difficult to grasp. The injured worker simply does not understand the complexities encountered with the provision of medical care for individuals suffering from obesity.

Workers’ compensation regulations provide employers with the ability to control medical care for injured workers. A non-occupational disability claim offers no such provision. The employer cannot impact the direction of medical care and is not privy to medical information due to HIPAA privacy laws. An employer is only able to obtain work restrictions from the medical provider. An employer cannot actively intervene to assist an employee with low health literacy suffering from a complex medical condition filed under disability. The employee must navigate the healthcare system on their own. The employer can expect frequent work absences and low productivity from the employee suffering from a disabling condition. These byproducts of low health literacy affect company productivity and profitability.

As U.S. health literacy levels remain static, medical information and related technology are increasingly complex. The increasing gap in health literacy leaves the door open to disparity and increases the potential for costly errors and poor outcomes. Everyone must understand health literacy is a very expensive problem. The elderly, minorities, individuals who have not completed high school, the non-English speaking and those living in poverty are most at risk. Low health literacy is associated with increased hospitalization, greater emergency care use, higher risk of mortality among seniors and decreased use of health care measures such as preventive screenings and immunization. It is found that individuals with low health literacy have decreased ability to take medications as prescribed, difficulty interpreting labels and health messages, and poor overall health status. Individuals with low health literacy also lack an understanding of the impact of lifestyle choices. Activities such as smoking, alcohol use, substance abuse
and sexual behavior have overall health consequences that individuals with low health literacy don’t understand. Nor do they understand that these same lifestyle choices frequently lead to the development of chronic disease that is progressive and ultimately fatal.

Patients with low health literacy do not necessarily recognize they have a problem. Healthcare providers must be very sensitive when attempting to assist patients. It is important to use plain language and maintain a continual awareness of the patient’s struggle to understand medical information.

Patients learn and absorb information in different ways. Some learn visually, others auditory, and some a combination of both methods. If the method of communication that works optimally for your patient is not utilized there is room for misunderstanding and errors. Most importantly, recognize that low health literacy is not synonymous with illiteracy.

Patients with low health literacy are unlikely to have access to electronic information. Many do not own computers or have access to the Internet. Health care information, in all forms of communication, must be available to assist individuals with low health literacy.

It is important not to make assumptions about what a patient may understand. Directives that are clear to a medical professional may not make sense to the patient. For instance, the directive, take two drops three times a day for earache, is very clear to medical professionals. The individual with low health literacy may struggle with these directives. Their assumption may be the drops are to be taken orally. The directives are not clear. The directives do not instruct the patient to place the drops in the ear.

Organizations must insure their mission and goal is to improve health literacy. Health literacy and cultural sensitivity training that emphasize methods of communication that minimize embarrassing patients is essential training for medical staff. This training is necessary during orientation and ongoing. The teach-back method is effective with patients. Information is provided to the patient. The patient then has to repeat in their own words their understanding of the directives. Clear and simple, easy to read, patient information supplemented with pictures for clarification are found most useful with instructional materials. The materials must be created for the intended age, gender and ethnicity. The availability of multi-lingual staff and medically trained interpreters for non-English speaking patients is necessary. A case manager or an employer’s workers’ compensation coordinator is a resource for patients with work related injuries. Patients enduring disability claims may access Employee Assistance programs for additional assistance.

A 2007 analysis of U.S. national data has estimated the cost of low health literacy to the U.S. economy in the range of $106 billion to $238 billion annually. It is a cost that is a drain on our economy. Low health literacy was addressed for the first time in 2003 by NAAL. Since then, it is recognized as a major public health issue detrimental to the nation’s overall health and healthcare systems.

The federal government has recognized the problem and is taking steps through multiple agencies to create solutions. It is a problem that affects every provider of care. A collaboration of government, employers, patient advocacy groups, health care professionals, community based organizations and healthcare systems are necessary to raise awareness and develop solutions. Eradication of low health literacy is our challenge….

Bibliography


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Total Knee Arthroplasty Patients in Follow-Up Post-Physical Therapy: An Examination of Findings

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Abstract:
Since 1991, total knee arthroplasty (TKA) procedures have increased by 161.5% for those covered by Medicare. As the incidence of TKAs continues to increase due to the aging of the Baby Boomer generation, it is important to consider value of post-surgical rehabilitative measures. The issue is controversial, as some professionals support intensive physical therapy after TKA and others doubt the efficacy of such rehabilitative programs. The purpose of this article, then, is to determine the effectiveness of physical therapy for post-TKA patients. This is a treatment follow-up study in which researchers mailed 500 Knee Outcome Surveys to discharged patients. 219 surveys were returned and completed. Of the 219 returned surveys, 207 (94.52%) had favorable outcomes. This group had an average of 19.68 (SD=+6.06) physical therapy visits, an average BMI of 31.49, (SD=+6.09), an average age of 67.66 years (SD=+8.55), and an average self-rating of 83% (SD=+14). Although previous studies have indicated that there are no significant benefits to outpatient physical therapy following a TKA, the findings of this study show that such rehabilitative measures are highly beneficial and result in significant improvement rates.

INTRODUCTION

Patients who present with knee pain is secondary to the severely damaging result of arthritis or an injury, may additionally experience difficulty in executing many activities of daily living such as walking or climbing stairs. For some patients pain is experienced while sitting or reclining. Additionally, chronic knee inflammation and swelling that does not improve or knee deformity (e.g., bowing in or out of the knee) may also be present.

In a study investigation, the lifetime risk of symptomatic knee osteoarthritis, of the sample from Johnston County (NC) it was found that nearly half of those individuals developed knee osteoarthritis by age 85. Osteoarthritis typically affects elderly adults, but there also are a surprising proportion of patients between the ages of 30 and 50 who also suffer from this condition. The following graph depicts their findings looking at prevalence rates in the United States.

Furthermore, Helmick and Renner et al. predict a dramatic increase in the incidence of OA in females by the quarter century. Their forecast is depicted in the following graph.

If nonsurgical alternatives (e.g., analgesics, cortisone injections, lubricating injections, supports) have failed to adequately remedy these conditions, then frequently total knee arthroplasty (TKA) is considered. A surgical candidate’s age and weight do not, per se, affect their candidacy for the procedure. The decision is more so based on the disability and pain level experienced. The typical age range for patients having a total knee replacement is between 50 to 80 years of age.

In the first study to evaluate trends and outcomes of patients having total knee replacement, the findings have indicated that among older adults, since 1991 knee replacement procedures have increased 161.5% for those covered by Medicare. The annual cost associated with this increase is $5 billion. These numbers are expected to continue to climb as today’s 77 million Baby Boomers age. Medicare pays approximately $15,000 per procedure.

The first knee replacement procedure occurred in 1968. During the ensuing years, much more has been learned about the knee, many advancements have been developed in both surgical materials (polyethylene...
and ceramics) used in the manufacturing process of the prosthesis, as well as refinement of orthopedic techniques.\(^5,6\)

The American Academy of Orthopaedic Surgeons (AAOS) acknowledge some controversy in their evidence-based consensus guidelines that physical therapy interventions (e.g., range of motion/flexibility exercises, patellar taping, etc.) may be preferable to most patients rather than undergoing TKA in the case of osteoarthritis of the knee.\(^7\) More specifically, the AAOS recommends against performing arthroscopy with debridement or lavage in patients with a primary diagnosis of symptomatic osteoarthritis (OA) of the knee with a Level of Evidence at I and II, and Grade of Recommendation of A. similarly, their systematic review suggested against using a free-floating interpositional device for patients with symptomatic unicompartmental OA of the knee.\(^8\)

It is felt that the literature was insufficient to recommend for or against an osteotomy of the tibial tubercle for patients with isolated symptomatic patello-femoral osteoarthritis, while there was sufficient support for arthroscopic partial meniscectomy or loose body removal as an option in patients with symptomatic OA of the knee who also have primary signs and symptoms of a torn meniscus and/or a loose body. Realignment osteotomy is also considered an option for active patients with symptomatic unicompartmental OA of the knee with malignment.\(^8\)

The issue of post-TKA physical therapy effectiveness is controversial. Some professionals\(^9\) support intensive physical therapy after TKA and argue that it improves outcomes; however, others doubt the efficacy of such rehabilitative programs. Contrary to Rajan et al. (2004), who write that there are no significant benefits to outpatient physical therapy following a TKA, our findings show that such rehabilitative measures are highly beneficial and result in significant improvement rates.\(^10\)

**Method**

These findings represent ATI’s first treatment follow-up study. Researchers mailed a survey form and the Knee Outcome Survey\(^11\) to 500 consecutively discharged patients from Illinois and Wisconsin during 2011, along with a cover letter explaining the study and a self-addresses, stamped return envelope). The response rate of completed and returned surveys was 43.8% (n=219). Good outcomes were based on patient self-report as being able to function at a level consonant with their pre-injury level of functioning or better.

**Subjects**

A total of 219 former patients responded with completed datasets. Of this 207, or 94.52%, reported having a good outcome as defined by functioning at a level similar to their pre-injury level of functioning, or better. The mean average age of this group was 67.66 years with a SD= +/- 8.55. The mean average age of all respondents was 67.72 years (SD= +/- 8.65). Within the 219 patients, 94.56% (139 out of 147) female respondents reported a good outcome, 94.44% (68 out of 72) male respondents reported a good outcome. The Body Mass Index (BMI) was calculated for all respondents, and was found to yield a mean average of 31.28 (SD= +/- 6.05).

**Results**

Findings indicate that 94.52% (n=207) of respondents had favorable outcomes. The mean average number of physical therapy visits this group has was 19.68 (SD= +/- 6.06), compared to a mean of 19.68 (SD= +/- 6.04) for the entire sample, and a mean of 19.75 (SD= +/- 5.82) sessions for the poor outcome group. Using an independent-samples equal variance t-test, the result indicated there was no significant difference of average number of PT visits between the good and poor outcome groups (t-value=0.04, P=0.9673). As for BMI, the good outcome group’s mean average was higher than those in the poor outcome group (31.49, SD= +/- 6.09 versus 27.73, SD= +/- 3.87, respectively). The result from an independent-samples unequal variance t-test indicated there was a significant difference of average BMI between two outcome groups (t-value=3.16, P=0.0068).

Mean average age of the good outcome group was 67.66 years (SD= +/- 8.55) versus the poor outcome cohort’s average of 68.67 (SD= +/- 10.66). By using an independent-samples unequal variance t-test there was no significant differences of average age between
two outcome groups (t-value=0.39, P=0.6967). When looking for any significant differences between outcomes for men and women using a Pearson Chi-square test, $\chi^2=0.0012$, $P=0.9724$ suggests that sex did not influence outcomes however, since there were only 4 males having a poor outcome, this conclusion may be not reliable.

Those with good outcomes report low levels of knee pain, stiffness, swelling, buckling, weakness or limping. This is in contrast with poor outcome individuals’ experience, and is significant. Those with good outcomes also report few limitations in walking, going up or down stairs, kneeling, squatting, sitting with a bent knee, or rising from a chair. Again, these findings are superior to those with poor outcomes, and when conducting an independent-samples unequal variance t-test, with an α level of 0.05 on the Total Score of the KOS, the t-value=3.67 was significant with $P=0.0003$. A tabular summary of findings appears in Table 1.

Lastly, patients were asked to rate their current functioning with 100% being perfect. The good outcome cohort reported a mean average of 83% (SD=+/− 14), which again is significantly better than those with poor outcomes. Differences between two outcome groups on the KOS Percentage Functioning were significant (t-value=5.45, $P<0.0001$), by using an independent-samples equal variance t-test. Similarly, when analyzing the subscales of the KOS, it was found that the good outcome group’s scores were all statistically significantly better—Symptom Scores (t-value=3.61, $P=0.0004$), ADL Scores (t-value=2.92, $P=0.0039$), and Total Score (t-value=3.67, $P<0.0001$).

Discussion

Studies anticipate that the incidence of TKA procedures as a result of knee pain will continue to escalate as the Baby Boomer generation ages.4 Consequently, it is in the interest of both patients and the medical community to understand which post-TKA rehabilitative steps result in the best outcome. Although a 2004 study found that there were no significant benefits to outpatient physical therapy following a TKA,10 the findings of this current study indicate that such rehabilitative measures are highly beneficial and result in significant improvement rates.

The difference in findings of this study versus the 2004 study may be due to those researchers not using objective measures. They instead relied upon a physical exam focused on flexion rather than a more comprehensive standardized instrument (i.e., Knee Outcome Survey).

In fact, this current study found that 94.52% of patients reported favorable outcomes when their post-operative treatment included outpatient physical therapy rehabilitation. These results are similar to other published retrospective findings but with an older cohort of patients (75 years of age and older)12 and exceeded other TKA follow-up studies that had reported a range between 75-89% of patients who had outcomes they were happy with.13, 14

While this study’s findings suggest that participation in outpatient physical therapy is helpful following TKA in order to be able to return to the same (or higher) level of function as was achieved prior to the injury, one weakness or limitation to the study is that there are no pre-treatment Knee Outcome Survey scores to compare to the patients’ self-reported post-treatment scores. Future studies should consider adding a pre-treatment survey as well.

The findings herein have indicated that satisfaction does not seem to vary as a function of a patient’s sex, age, or number of physical therapy visits. It is a curious finding that the BMI of the good outcome cohort was statistically significantly different (higher) than the poor outcome comparison. This was a counterintuitive finding as one would more likely suspect that higher BMI would portend a poorer outcome. In fact, the AAOS’ evidence-based osteoarthritis of the knee treatment recommendations for “…patients with symptomatic OA of the knee, who are overweight (as defined by a BMI>25), should be encouraged to lose weight (a minimum of five percent (5%) of body weight) and maintain their weight at a lower level with an appropriate program of dietary modification and exercise.”8 Such a recommendation seems wise nevertheless, but perhaps in this study, in spite of, rather than because of, a higher BMI, post-operative rehabilitation was beneficial and should be considered.

Conclusions

It is important to consider how patients are
doing following their completion of not just surgical interventions, but also their post-operative rehabilitation after they have completed it, not just upon discharge. This study provides optimistic results for patients considering such a procedure, but idiosyncratic patient factors should always be considered in differential therapeutic selection and in properly managing expectations.

Future studies should examine complete episodes of care—preoperative, non-operative, post-operative and post-rehabilitation, using standardized instruments. Thus is a difficult challenge considering the differing providers that provide care but may not be within the same practice. In consideration of real-world limitations and practicalities, clinicians and researches should strive to collect the most data possible in order to better understand post-discharge from care outcomes.

Table 1. Summary of Findings

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<td>12 (5.48%)</td>
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<td>68.67 +/- 10.66</td>
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<td># of PT visits</td>
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<td>74.82 +/- 18.26</td>
<td>59.17 +/- 13.69</td>
<td>58.83 +/- 16.18</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Total Score*</td>
<td>77.48 +/- 17.04</td>
<td>58.64 +/- 15.67</td>
<td>58.43 +/- 15.67</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>%age Function Scores**</td>
<td>83.08 +/- 14.40</td>
<td>58.64 +/- 15.67</td>
<td>58.43 +/- 15.67</td>
<td>&lt;0.0001</td>
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</table>

<table>
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<tr>
<th></th>
<th>All (N=219)</th>
<th>Males (n=72)</th>
<th>Females (n=147)</th>
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<tr>
<td># of PT visits</td>
<td>19.68 +/- 6.04</td>
<td>19.46 +/- 6.69</td>
<td>19.79 +/- 5.71</td>
</tr>
<tr>
<td>Good Outcome</td>
<td>207 (94.52%)</td>
<td>94.44% (n=68)</td>
<td>94.56% (n=139)</td>
</tr>
<tr>
<td>Poor Outcome</td>
<td>12 (5.48%)</td>
<td>5.56% (n=4)</td>
<td>5.44% (n=8)</td>
</tr>
</tbody>
</table>

*Scores from the Knee Outcome Survey, higher score = better outcome
**Self-rating from 0 – 100 improvement relative to knee now versus prior to treatment

REFERENCES


CONTINUED TO PAGE 18
Multiple Hazards as a Basis for Complex Disability in Electrical Injury Survivors

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Abstract:
Background: Occupational electrical injury can result in trauma, burns, and complex disability.

Purpose: The purposes of this study are first, to report recent research observations about return to work following trauma and burns as a context for considering work disability subsequent to occupational electrical injury; and second, to relate hazards and possible injury mechanisms with the potential to result in trauma and burns associated with occupational electrical injury.

Methods: Recent prospective and retrospective research findings on post-injury return to work are briefly summarized. Specific engineering and physical measurements regarding electrical hazards are presented.

Results: Recent prospective reports show 20-33% of patients studied did not return to work following injury, trauma and burns. Specific return to work data are not available referable to occupational electrical burns or trauma. Measured engineering and physical characteristics of electrical hazards demonstrate the magnitude and forms of hazardous energy with the potential to result in trauma, burns, and risk of fatality.

Conclusion: Variations in the nature and magnitude of the hazardous energy forms released during an electrical failure offer an explanation in part for the spectrum of trauma, burns, and complex disability observed in occupational electrical injury. Observed patterns of return to work in trauma and burns serve as a basis for understanding employment disability in occupational electrical injury.

Keywords: Disability, impairment, return to work, electrical injury, burns, blast, traumatic brain injury.

INTRODUCTION

Occupational electrical injury can result in trauma, burns, and complex disability. Clinical research has often focused on outcomes such as mortality with limited information available regarding return to work. Moreover, systematic analyses of disability drivers have been hampered by limited data availability relevant to the actual injury events and survivor employment, especially with regard to industrial, commercial, and military work. Few reports of return to work following trauma and burns have specifically addressed the hazards of occupational electrical injury.

BACKGROUND

Electrical Energy

In the 21st Century, occupational success is powered by the generation, transmission, distribution, and use of electrical energy. Electrical installations, devices, and lighting are pervasive in work, personal, educational, recreational, and military environments. Innovation has enabled a greater range of fossil and alternative fuel choices, and options for decentralized and more local electrical energy production from wind, solar, gas and biomass have expanded. Under controlled circumstances electrical energy can be transformed and transferred to do productive work, often with electrical devices as simple as a plug and or battery pack. By far, this is the most common experience employees have of electricity: Electrical energy helps people get their jobs done.

However, the use of electrical power during work can lead to injuries, illness, or fatality. Specifically, during an unintentional or accidental electrical exposure, there is a loss of energy control due to lapses in either of the engineered systems around the electrical source, the human systems, or both. With system lapses and loss of energy control, available electrical energy can be transformed and transferred into potentially destructive releases leading to physical harm to people and the surrounding environment. The severity of the potential destruction depends significantly on how much energy flows, how long the accidental event lasts and how the energy is imparted to the affected employee and nearby surroundings.
Occupational Electrical Injuries

While the total number of US occupational electrical injury cases is low, the risk of mortality and morbidity is disproportionately high. The Electrical Safety Foundation International used statistics from the US Bureau of Labor Statistics compiled by Cawley and Brenner for the period 2002 – 2009, showing there were 64,858 US cases of nonfatal electrical injuries involving days away from work in private industry and 4,931 fatalities (13% of 38,124 for all causes in the US during this time). In their 2012 study, these authors reported the high risk occupational groups of construction trades, including electricians, as well as laborers, tree trimmers/pruners, managers, truck drivers, agricultural workers, roofers, painters, carpenters, and landscapers.

Occupational Electrical Injury Etiology

With regard to the etiology of occupational electrical injuries, Lombardi, Matz and colleagues reviewed a large US insurer’s workers compensation claims routinely collected over a 1-year period. For 2002, of 586,567 claims reported, electrical-related injuries accounted for 1282 (0.22%) of nonfatal claims and 15 fatalities (1.2% of all electrical claims reported). Nonfatal injuries were attributed to electrical shock (48.8%), burns (19.3%), and other causes (31.9%), including strain/sprain, contusion, inflammation, laceration, sprain, syncope, foreign body, fracture, hearing loss, stress and other health effects. For about half the cases, the details about the injury mechanism were minimal, described as “shocked, n.e.c. (not elsewhere classified)”. Contact with an unprotected source of electricity was most frequently noted (20.5% cases).

The major retrospective study by Santaniello et al. reviewed all burn and trauma patients admitted between 1990 and 2000 at an American Burn Association/American College of Surgeons Level 1 trauma and burn center, and considered the primary outcome of mortality. This study categorized patients into three groups: burns only, trauma only, and combined burns/truma. With similar total body surface area (TBSA) burn, combined burn/truma patients had higher mortality, longer length of stay, and higher incidence of inhalation injury than patients with burns alone. The authors suggested mechanism of injury might explain in part the observations, in particular with regard to inhalation injury.

The absence of robust associations between etiology, injury mechanism, clinical endpoints, and the rehabilitative outcome of return to work after injury has been a gap that arguably hampers progress in workers compensation claims management. For a clinician or case manager who may not have evaluated many electrical injury patients, mechanistic insights based on engineering and physical measurements can serve as a foundation for adapting established burn care, blunt force trauma, brain injury, and PTSD care approaches to electrical injury survivors.

METHOD

First, recent prospective and retrospective research findings on post-injury return to work are briefly summarized as a context for considering work disability subsequent to occupational electrical injury. Next, specific engineering and physical measurements regarding electrical hazards are reviewed.

RESULTS

Post-Injury Return to Work

Retrospective research on post-injury outcomes has often focused on factors associated with specific diagnoses, clinical and rehabilitative course, and pre-morbid individual health and social characteristics. Recent prospective studies offer additional insights.

Trauma

In their prospective study of return to work after major trauma, Holtslag et al. considered complete or near complete (>80%) return to former full-time employment as a primary outcome. They quantified the prevalence of return to work for severely injured patients who were employed at the time of their injury with interviews at initial assessment and at 12-15 months post-injury. Of 214 patients in the study group assessed at 1-year post injury, 58.4% were able to return to their former job full time. Additionally, 21.5% of the patients were working part-time. The unemployed comprised 20.1% of the study group. Permanent impairment rating using AMA guidelines, limitations in activities of daily living, cognitive complaints, injury severity, and discharge to home were significant determinants.
in return to work at follow up 12-15 months post-injury, while spinal cord injury, length of hospital stay, discharge destination, and age were most significant based on initial patient assessments in the study.

Langley et al. prospectively evaluated a cohort of 2,856 persons injured and registered in a national no-fault insurance program treated by primary and secondary healthcare services as in- and out-patients. At 3-months post injury, 62% of participants admitted as inpatients had problems performing usual activities and while 50% of non-admitted participants similarly reported problems. Healthcare access trouble was predictive of poorer outcomes. In a separate report by Lilley et al. of 2,626 participants from the same registry, 27% reported not working at 3-months post injury, with the most important pre-injury predictors identified in multi-dimensional modeling as: low or unknown income, financial insecurity, physical work tasks, temporary employment, long week schedules, obesity, perceived threat to life, and hospital admission.

**Burns**

Prospective research studying return to work after burns by Oster and Ekselius evaluated 58 consecutively admitted adult burn patients who were employed at the time of their injury, with a study design of enrollment interview at time of admission, interval assessment at 12 months, followed then by a structured interview at 2-7 years after burn injury. On average at 4.5 years after burn, 67% patients were returned to work with 22% of these patients doing modified or new work tasks; the health related quality of life (HRQoL) for these individuals was comparable to the general population. For the 33% who did not return to work, predictors were: length of stay, diagnosis with any anxiety disorder, and diagnosis with any substance abuse disorder prior to the burn. The generic and burn-specific HRQoL indicators for those who did not return to work were lower and more psychiatric illness was identified in this group.

Earlier reports of burn center experience echo these recent prospective findings. Brych et al. in their two-center series comparison of time off and return to work after burns for 303 patients enrolled in a Burn Injury Rehabilitation Model System (BIRMS) program of the National Institute on Disability and Rehabilitation Research (NIDRR) showed 66% of survivors had returned to work at 6 months, increasing to 90% at 24 months. For those returned to work with more data available, only 37% returned to the same job with the same employer without accommodations. The need for task or job adjustments was taken by the authors as an indication of significant job disruption.

### Burns Including Electrical

Retrospectively Schneider et al. studied employment rates and barriers to return to work for patients burned at work compared to those burned outside of work during treatment follow up at a single burn center outpatient clinic. During the period 2001 to 2007, 197 patients met study inclusion criteria, including 24 patients injured by an electrical source. Fifty percent of the group was injured at work, with 100% of the electrical injuries occurring at work. Return to work at one year was found in 66% of those burned at work and 78% of those burned outside of work. The reported logistical regression analysis examining significant predictors of unemployment at 12 months for all study subjects identified significant predictors of unemployment as: burn at work, pain, inpatient rehabilitation, impaired mobility, and medical problems.

In their literature review of published studies on return to work after burn injury from the period 1970 – 2011, Mason et al. evaluated 26 reports that met their inclusion criteria (including the mentioned study here by Schneider et al.) from a pool of 216 publications. The cross-sectional data showed after 3.3 years, 72.03% of previously employed participants had returned to some form of full- or part-time work.

### Engineering and Physical Measurements

Recent reviews showcase the biomedical and biophysical studies regarding effects of electricity. Human sensitivities to electrical current have been well-documented with attention to how tissues respond to electrical forces. Medical knowledge gained through foundational research has advanced trauma treatment at the cellular and molecular level as well as guided the prescription of intentional electrical exposures in medical procedures such as with electrical stimulation for wound healing, electro-
convulsion therapy (ECT) for depression, cardiac defibrillation for arrhythmias, and electroporation for gene transfer and medication administration.

While clinicians have increased their awareness of how the body reacts to electrical exposure, recognition of the behavior of electricity as a hazard in and of itself has lagged. Electrical devices may be part of a facility that generates, transmits or distributes electricity; connected to a facility through a plug; or operating from a battery supply. Failures in an electrical device’s control of electrical energy can lead to energy release from its intended path to the device surfaces, creating a shock hazard. In addition, electrical device failure can also release energy into the spaces surrounding the equipment leading to multiple hazardous effects of heat, pressure, noise, and radiation along with the electrical shock hazard. In this domain, specific engineering and physical measurements are reviewed next to characterize hazards associated electrical energy.

Electrical Shock Hazards

Before electrical devices can be used commercially, medically, or as consumer products, specific engineering and physical measurements documenting electrical shock hazards are required. Measurement methods are outlined in consensus documents referred to as codes and standards published by non-governmental organizations such as the Underwriters Laboratories (UL), National Fire Protection Association (NFPA), and the International Electrotechnical Commission (IEC). These metrics are designed to identify leakage of electrical current flow onto exposed surfaces or chassis of devices, components, or medical technologies. If contacted by a user, technician, or patient, leakage current may cause electrical shock injury or fatality. For example, the UL standard number 101 (UL 101), UL Standard for Safety Leakage Current for Appliances, the standard applies to cord- and plug-connected household and similar appliances rated for 20 amperes or less with consumer power supplies of 50-60 Herz (Hz) frequency with electrical force in the supply circuits less than 150 volts to ground. The leakage of current flow above the level of 1-3 thousandths of one ampere (1-3 Milliamperes or ma) is identified as potentially hazardous, while current flows of 120 ma is identified as extremely lethal.

Another example is the National Fire Protection Association’s (NFPA) Standard for Health Care Facilities. This standard differentiates between patient care areas or vicinities and non-patient care areas, such as business offices or waiting rooms. For equipment intended to be used in the patient care vicinity, electrical device internal framework and surfaces should not demonstrate leakage currents above 5 ma for permanently wired appliances and 0.3 to 0.5 ma for portable equipment.

Measurements of Multiple Hazards

To increase awareness of the hazards in electrical equipment [Jones, 2000] Jones et al. staged tests in electrical equipment commonly used in commercial and industrial power delivery in controlled laboratory experiments with work scenarios. They monitored current, temperature, and pressure in electrical failures with a total of 38 tests lasting 0.1 second. For 10 of the 38 tests, temperature data was obtained. Sound and pressure data was recorded in 17 of 38 tests. Infrared and high speed photography also documented the results. Variability in data collection was seen with destruction of sensors in some experiments. Measured temperatures ranged from 20°C to over 200°C on infrared measurement of the mannequin workers’ clothing surfaces while sensors recorded 90% of temperature rise on the mannequin workers’ extended hand in 10-400 ms. Significant acoustic forces were noted, ranging from 0.25 pounds per square inch (psi) to greater than 15 psi. (One pound per square inch equals 144 pounds per square foot.) Sound measures were recorded ranging 1.27 to 45.10 decibels (dB).

Illustrating the results, the staged test number 4 is shown in Figure 1 with stop-action images adapted from the high speed video recording during the experiment. The test scenario was assumed to be that two workers approached a problem panel. The first mannequin worker was positioned as if he opened the panel door holding a screwdriver to the panel with his right hand. The second mannequin worker was positioned about 4 feet away as if to observe the troubleshooting task. The image sequence shows the moment immediate before the test, the electrical failure, combustion and fire effects of the electrical failure, and the post failure condition of the
mannequins and the equipment after a 0.1 sec elapsed period.

**Figure 1.** Illustration of staged electrical equipment test with 2 mannequin workers

**Figure 2** illustrates the measurements from this test converted to Fahrenheit and pound per square foot units. A separate analysis of the outward movement of the first mannequin worker’s head showed between time 0 and 0.2667s, average acceleration on the mannequin head weighing 15 lbs. was 2.3 m/s² (7.5 ft/s²)²¹.

**Figure 2.** Temperature, sound, and acoustic pressure measured in electrical equipment test

**DISCUSSION**

Occupational electrical injury can result in trauma, burns, and complex disability. Systematic analysis of disability drivers to date has been hampered by limited data relevant to the actual injury events in industrial, commercial, and military work. The nature of electrical hazards as revealed by specific engineering and physical measurements can be used as the basis for future evaluation of possible injury mechanisms and their implications for return to work. Moreover, where injury mechanisms overlap with better understood clinical entities, such as thermal burns or blast, the case management can be informed by established clinical practices.

Measurements developed to prevent electrical shock give an indication of how little an amount of electrical current exposure can be potentially fatal. The scale of the hazardous current “dose” is on the order of thousandths of one ampere. Once there is a lapse of electricity control, energy transfer and transformation can occur, as shown in staged testing of industrial facilities reviewed here. As a general guide, the potential destructive effects of 1 megawatt (1 MW) of electrical energy converted to joules, the standard unit of work (equal to 1 watt of power radiated or dissipated for one second), is approximately equivalent to the potential destructive effects of 1 stick of dynamite²¹.

The foundational work of injury researchers James Gibson and William Haddon noted that an injury was the specific result of a specific type of energy exchange²². Haddon particularly emphasized the understanding of the phenomena of energy damage processes, wherein energy is transferred in such ways and amounts, and at such rapid rates, that inanimate or animate structures are damaged²³.

From the viewpoint of post injury care, a central challenge for survivors of electrical accidents is recognition of the multiple hazardous conditions at the electrical event. Possible energy flows can be from

- **Electrical Energy**
- **Mechanical Energy**
  - Active impact
  - Passive impact
  - Interference with air exchange
  - Tool and machine forces
  - Machine failures
Weapons effects

- Thermal Energy
- Radiant Energy
- Acoustic Energy
- Chemical Energy

Beside the uncertainties in recognizing what kind and how much energy were in an electrical event, the speed of the events can be so fast that memories as to what energies may have been “imparted” to the survivor may not be reliable or retrievable from the patient or witnesses.

Additionally, the energy transfer may have been “invisible”. Consider that electricity, temperature, pressure, infra-red and ultraviolet radiation are not visual entities. Only the results may be “detectable” by the clinical observer if the observer is aware of what to look for, given that the trace of energy transfer may be at the tissue, cellular or molecular level. In this regard, Figure 3 shows the hazardous forms of electrical energy that can be released during a lapse of energy control and their possible effects. Organ and tissue vulnerabilities are also indicated.

![Image](image.png)

**Figure 3.** Observed hazards in electrical equipment test associated with vulnerable organ and tissues

![Image](image.png)

**Figure 4.** Injury response processes following electrical mishap

**Figure 4** summarizes the injury response processes that follow an electrical mishap involving a worker. Obviously fires and explosions from an electrical source can produce burns and trauma. Yet the mechanisms of electrical trauma absent burns, and the difficulty clinicians often face in documenting trauma associated with sub-lethal explosions, complicate full recovery. Return to work is a benchmark in an employee’s successful evaluation, treatment, and rehabilitation after an electrical injury. With greater appreciation of the multiple hazards that may create an injury in an electrical failure and yet not be fully recognized or documented in the patient’s file, case management has a rational basis for adoption of well-established trauma survivor chronic care strategies, including

- Neuro-psychological and psychiatric post traumatic treatment,
- Vocational assessment and retraining, and
- Accommodations on work re-entry.

**References**


CONTINUED FROM PAGE 11


CME QUESTIONS FILE

THE FOLLOWING QUESTIONS ARE BASED ON THE FORGOING ARTICLES:

Health Literacy and Occupational Disability: The Barrier to Positive Health Care Outcomes (page 3)
Please pick the best answer of the 4 possible answers from the following.

1. In 2013, the National Assessment of Adult Literacy (NAAL) found only ____ of U.S. adults have proficient health literacy.
   a) 10%
   b) 8%
   c) 20%
   d) 12%

2. A 2007 analysis of U.S. National data has estimated the annually cost of low health literacy to the U.S. economy in the range of:
   a) $56 Billion to $108 Billion
   b) $106 Billion to $238 Billion
   c) $242 Billion to $416 Billion
   d) $405 Billion to $498 Billion

3. The Nation Patient Safety Foundation (NPSF) has found that most consumers need help understanding health care information, only ____ of patients take prescription medications as directed.
   a) 40%
   b) 20%
   c) 50%
   d) 30%

4. A lack of compliance with medical directives may:
   a) Elongate medical treatment
   b) Increase health care cost
   c) Increase risk of complications
   d) All of the above

5. Poor control of co-morbid conditions adversely impact recovery from work related injuries. Injured workers with diabetes are more likely to develop:
   a) Adhesive capsulitis & wound healing complications
   b) Asthma & pneumonia
   c) Bone fracture & anemia
   d) Esophagitis & gastric ulcer

6. To help the patients with low health literacy, healthcare provider should:
   a) Provide patients electronic information
   b) Let the patients recognize they have a problem
   c) Use plain language and maintain a continual awareness of the patient’s struggle to understanding medical information
   d) Make assumptions about what a patient may understand

Total Knee Arthroplasty Patients in Follow-Up Post-Physical Therapy: An Examination of Finding (page 8)
Please pick the best answer of the 4 possible answers from the following.

1. According to study in Johnston County (NC), nearly ____ adults are at risk of osteoarthritis by age ____.
   a) 20%; 75 years
   b) 30%; 75 years
   c) 40%; 85 years
   d) 50%; 85 years

2. Total Knee Arthroplasty (TKA) is considered when nonsurgical alternatives have failed. The typical age range for patients having a total knee replacement is:
   a) Between 50 to 70 years of age
   b) Between 60 to 80 years of age
   c) Between 50 to 80 years of age
   d) Between 60 to 70 years of age

3. Since 1991, total knee arthroplasty (TKA) procedures have increased by ____ for those covered by Medicare.
   a) 161.5%
   b) 61.5%
   c) 261.5%
   d) 116.5%

4. The first knee replacement procedure occurred in:
   a) 1986
   b) 1956
   c) 1968
   d) 1978

5. About the issue of Post-TKA physical therapy effectiveness, which following statement is correct?
   a) All professionals support intensive physical therapy after TKA and agree that it improves outcomes
   b) All professionals agree that there are no significant benefits to outpatient physical therapy following a TKA.
   c) It’s controversial. Some professionals support and some doubt the efficacy of such rehabilitative programs.
   d) There is no concern about this issue.

6. A finding of this study indicates that the BMI of outcome cohort was ____ the poor outcome comparison.
   a) Not statistically significantly different from
   b) Statistically significantly higher than
   c) Statistically significantly lower than
   d) Unknown, since the study didn’t compare the BMI between two outcome groups
An Multiple Hazards as a Basis for Complex Disability in Electrical Injury Survivors  (page 12) 
Please pick the best answer of the 4 possible answers from the following.

1. What can be the hazards of Occupational electrical injury?
   a) Trauma  
   b) Burns  
   c) Trauma, Burns and other associated complex disabilities.  
   d) Disfiguration

2. Return to work in the employees surviving occupational energy injuries is:
   a) Impossible  
   b) Not uniform  
   c) Almost successful  
   d) Assured

3. The severity of the destruction in electrical injuries depends on:
   a) How much energy flows 
   b) How the energy is imparted to the affected 
   c) How long the accidental event lasts 
   d) All the above

4. The potential destructive effects of one MW of electrical energy is approximately equivalent to the potential destructive effects of: 
   a) stick of dynamite 
   b) sticks of dynamite 
   c) sticks of dynamite 
   d) sticks of dynamite

5. The benchmark in an employee’s successful evaluation after an electrical injury is:
   a) Cure of burns  
   b) Ability to return to work 
   c) Psychological adjustment  
   d) Neurological cure

6. Measurements developed to prevent electrical shock give an indication of: 
   a) What type of electrical energy is tolerated 
   b) How little an amount of electrical current exposure can be potentially fatal. 
   c) What type of weapons can cause injury 
   d) What is the passive impact caused due to electrical shock.

7. The scale of the hazardous current dose is on the order of:
   a) Amperes  
   b) Hundredths of one ampere  
   c) Decimals of one ampere  
   d) Thousandths of one ampere

8. According to James Gibson and William Haddon, the injury is the specific result of:
   a) Specific amount of energy exchange 
   b) Specific time of energy exchange 
   c) Specific type of energy exchange 
   d) Specific type of the person to whom energy is exchanged.

9. The loss of energy control during accidental electrical exposure is due to lapse in:
   a) The atmospheric control 
   b) The engineered systems around the electrical source 
   c) The human systems around the electrical source 
   d) Both B & C

10. In U.S when compared to the total number of Occupational electrical injury cases their risk of mortality & morbidity is:
    a) Proportionately equal 
    b) Disproportionately low 
    c) Disproportionately high 
    d) Uncertain

11. At what level the leakage of the current flow is identified as potentially hazardous?
    a) Above the level of 5-6 Milli amperes 
    b) Above the level of 1-3 Milli amperes 
    c) Above the level of 1-3 amperes 
    d) At any level

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**ANSWER KEY FOR CME QUESTIONS FROM DISABILITY MEDICINE VOL 9, #2**

Questions on page 3: Return-to-Work Outcomes in Lumbar Fusion Cases Following An Evidence-Based Post-surgical Rehabilitation Program

Questions on page 10: Earlier Return-to-Work in Post-Arthroscopic Rotator Cuff Repair Patients Following an Evidence-Based Rehabilitation Program
As the Journal continues to grow and add new and beneficial recurring sections, we are pleased to announce the advent of “Research Digest.” The busy practitioner generally finds him/herself not having the time to keep up with the literature. This new section of the Journal seeks to remedy this by providing succinct updates from relevant and recently published peer review articles of interest or our readership. We will make selections from various journals for each issue in order to provide as much breadth and exposure as possible. We hope you find this new enhancement to be of benefit to your work.

1. Medical costs were raised rapidly, driven by facility cost increases

The latest report from WCRI shows medical costs in Indiana have been rising rapidly over the last few years, driven by facility cost increases. As facilities’ increasing leverage and ability to raise prices has been affecting comp in many states: Virginia, New Jersey, and Sunshine State too.

Over the last few years, medical inflation, as reported by NCCI has been pretty much under control. It certainly looks as if those days are over.

URL:
http://www.joepaduda.com/2012/12/comp-medical-costs-rise/
http://www.wcrinet.org/result/bmscope_multi13_IN_result.html

2. CA CHSWC Releases Study on Identifying Risky Opioid Prescribing Practices

Oakland, CA – The Commission on Health and Safety and Workers’ Compensation (CHSWC) is pleased to announce that the DRAFT report “Identifying Risky Opioid Prescribing Practices” and a related DRAFT Memo “Evaluation of Opioid Prescribing Guidelines Using AGREE II” have been released for posting and public comment.

In California and nationally, policymakers and individual physicians are striving to attain an elusive goal: balancing adequate pain control while minimizing the risk associated with prescription pain medication. Overdoses due to prescription opioid medication are leading to an increasing number of emergency department visits.

The report assesses screening for higher-risk prescribing practices within the workers’ compensation system, as well as information on opioid prescribing that can be used to inform the development of screening criteria for assessing opioid-prescribing risk. The ten-page memo summarizes additional evaluation of guidelines for the use of opioids to treat pain that were not included in the main report.


3. Fatal Falls Among Older Construction Workers

Abstract
Objective: This study examines recent trends and patterns in fall fatalities in the U.S. construction industry to determine whether fatal falls among older workers are different from younger workers in this industry

Background: Falls are the leading cause of fatalities in the U.S. construction industry. Given the increasingly aging workforce in construction, it is important to assess the risk of falls among older construction
Methods: Fatality data were obtained from the Census of Fatal Occupational Injuries for the years 1992 through 2008. Denominators for death rates were estimated from the Current Population Survey. Stratified and multivariate analyses were performed to examine whether there are differences in fatal falls between older workers (≥55 years) and younger workers (16-54 years). Fatal falls in nonconstruction industries were excluded from this study.

Results: Older workers had higher rates of fatal falls than younger workers; results were significant in 11 of 14 construction occupations. Regression analysis indicated that older decedents had a higher likelihood that work-related death was caused by a fall, after controlling for major demographic and employment factors (odds ratio = 1.50, confidence interval [1.30, 1.72]). Falls from roofs accounted for one third of construction fatal falls, but falls from ladders caused a larger proportion of deadly falls in older decedents than in younger decedents.

Conclusions: Older workers have a higher likelihood of dying from a fall. Roofs and ladders are particularly risky for older construction workers.

Application: As the construction workforce ages, there is an urgent need to enhance fall prevention efforts, provide work accommodations, and match work capabilities to job duties.


4. Quick News Briefs for work comp folks

First up, another round of applause for the good folks at the Accident Fund - their use of predictive analytics combined with medical management expertise to identify and intervene in workers comp claims with potentially inappropriate opioid usage was one of the top ten innovations in the entire insurance industry – group, life, property casualty, and reinsurance. (Accident Fund is an HSA consulting client). Kudos to Jeffrey Austin White, Pat Walsh, Paul Kauffman, and their colleagues and co-workers. This is EXACTLY the kind of project work comp carriers should – and can – be doing to attack this issue.

A reviewer for Best’s Review put it this way:

“the idea of using predictive analytics informed by medical subject matter experts with workers compensation claims management software in order to identify – and pro-actively facilitate early intervention when appropriate – cases where injured workers might be reliant on opioids…strikes me as particularly innovative…”

In a related bit of news, makers of so-called “tamper-resistant” opioids are losing a battle to prevent generic versions from hitting the market – this means workers compensation will be charged lower as they won’t have to pay the premium price charged for branded drugs. While manufacturers Endo and Purdue claim their new formulations are primarily designed to increase patient safety, the timing of their introduction – just as their current brand drugs’ patent protection expires – indicates profits may be the primary motive…

A great summary of the components of the fiscal cliff deal was put together by the National Priorities project. In chart form, it tells what happened, what it means, and what’s next. Read it during lunch…

One of the key components of the deal was the extension of current Medicare reimbursement for physicians. Under SGR, reimbursement was slated to drop 26.5%, however the deal extends current rates for the rest of the year. As most WC doc fee schedules are tied indirectly to Medicare, in some states this has a direct impact on WC; in all it as an indirect impact as a cut in reimbursement would likely have led to even more cost shifting to comp…

Of note, there are several deals still working in the...
**Methods:** We conducted a case-control study of 21,663 workers’ compensation claimants in California with impairment ratings under the AMA Guides, fifth edition. Earnings losses represented the percent difference between the earnings of cases and controls 3 years after disability onset.

**Results:** Impairment ratings were strongly associated with earnings losses; losses for ratings of 1, 10, and 20 were 9.0%, 21.9%, and 34.6%, respectively (P < 0.01).

Losses differed significantly across body regions. For example, losses were 21.0% for spine impairments compared with 18.4% overall (P = 0.014).

**Conclusions:** Impairment ratings are accurate predictors of disability severity on average, but their ability to measure disability could be improved with additional information on how the relationship between ratings and earnings loss varies according to patient and injury characteristics.

Call for Submissions

The Journal of Disability Medicine (JDM) has long been the respected voice of both the American Board of Independent Medical Examiners and the American College of Disability Medicine—as an internationally circulated journal acclaimed for bringing pragmatic insights to bear upon the practice of physicians and others who regularly confront impairment, disability assessment and medical-legal issues. It has been considered a leader in the field.

We have revised our Author’s Guidelines and are looking for high-quality manuscript submissions, book reviews and opinion pieces for subsequent editions of the Journal. In fact the new Author’s Guidelines appear in this edition of the Journal and will be on our website at http://www.abime.org/node/17. We also have instituted a new, formal Author’s Agreement Statement and an Author’s Disclosure Statement to ensure continuing high-quality ethical standards in scientific publishing as well. Authors that have articles that are accepted following our peer review process will be provided with a new and very helpful formatting template to use that will aid to speed the getting-into-print process. Be on the lookout for special topics issues and special invited articles as well in upcoming editions.

We are seeking high-quality submissions in the following areas:
• Original Articles
• Case Studies
• Critical Reviews
• Guidelines
• Book Reviews
• Letters to the Editor
• Conference Proceedings
• Surveys
• Opinions/Guest Editors
• Special Interest Issues

The Journal of Disability Medicine will also soon have an International Standard Serial Number (ISSN). The ISSN is a unique eight-digit number used to identify a print or electronic periodical publication. JDM’s ISSN will then be registered in an international database which is accessible through the ISSN Portal and is considered to be the world catalogue of serials. It is the most comprehensive and authoritative source for the identification of serial publications world-wide, and JDM will soon be listed and searchable. The ISSN is a key access and a control tool that facilitates automated document management. It has a significant interest for publishers, subscription agencies, booksellers, librarians, information scientists, and researchers. It is a necessary reference in the complex world of publications and we are proud to soon be a part of it.

Likewise, JDM will for the first time be listed in PubMed. PubMed is one of the largest scientific and medical databases in existence, accessing primarily the MEDLINE database of references and abstracts on life sciences and biomedical topics. The United States National Library of Medicine (NLM) at the National Institutes of Health maintains the database as part of the Entrez information retrieval system. PubMed comprises more than 21 million citations for biomedical literature from MEDLINE, life science journals, and online books. Again, being listed and searchable adds to the value of being published in JDM as well as being a reader.

The Journal will continue to seek articles and commentaries on topics of interest in disability medicine and related areas of law and policy. We will continue to address issues in disability medicine research and education and a broad range of other related topics, providing an even more authoritative and comprehensive coverage of the growing field of disability medicine.

We invite and welcome your submissions and look forward to your feedback on how we can continue to grow and evolve.

Chris E. Stout, PsyD
Acquisitions Editor, Journal of Disability Medicine
Director, Department of Research and Data Analytics, ATI
Clinical Professor, University of Illinois, College of Medicine
Associate Professor, Northwestern University
Feinberg School of Medicine
The National Institute of Neurological Disorders and Stroke (NINDS) has defined traumatic brain injury, also called acquired brain injury or simply head injury, as the injury that occurs when a sudden trauma causes damage to the brain. The two most widely accepted classifications of traumatic brain injury (TBI) are based on the Glasgow Coma Scale (GCS) score or the Ommaya & Gennarelli. The purpose of a TBI grading system is to allow physicians to quickly and reliably communicate the depth and duration of disturbed consciousness as well as the duration of posttraumatic amnesia (PTA) classification. The Glasgow coma scale was proposed in 1974 as a means to triage head injured patients upon arrival at an emergency room. It is based on the patient's best motor response, best verbal response, and ability to open their eyes. Individuals with a GCS score between 13 and 15 have mild TBI whereas those with a GCS score between 9 and 12 have moderate TBI and those with a GCS score of eight or less have suffered a severe TBI (table 1). The classification proposed by Ommaya and Gennarelli is based on the observations from head trauma in experimental animals (table 2). This classification is based on the individual’s level of consciousness as well as the presence of confusion and amnesia.

The Ommaya & Gennarelli classification of TBI ranges from Grade I to VI as noted in table 2.

The two TBI classifications are often merged such that the GCS score as well as the level of consciousness and presence of amnesia create a single grading system (table 3).

**Concussion Definition:** The term mild traumatic brain injury (MTBI) is synonymous with concussion. Although there are numerous definitions found within the scientific literature, the most widely accepted definition of concussion was proposed by the Congress of Neurological Surgeons in 1964. It stated a “concussion is a clinical syndrome characterized by the immediate and transient post-traumatic impairment of neural function”. More recently, the American Academy of Neurology (AAN) defined a concussion as “an alteration of mental status due to biomechanical forces affecting the brain”. The definition proposed by the American Medical Association is “a clinical syndrome characterized by

---

**Table 1.** Classification of TBI based on the Glasgow coma scale score.

<table>
<thead>
<tr>
<th>Severity</th>
<th>Mental Status</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Confusion</td>
<td>No LOC, no confusion; no amnesia</td>
</tr>
<tr>
<td>II</td>
<td>Confusion &amp; Amnesia</td>
<td>No LOC, confusion &amp; PTA</td>
</tr>
<tr>
<td>III</td>
<td>Confusion &amp; Amnesia</td>
<td>No LOC, confusion, AGA &amp; PTA</td>
</tr>
<tr>
<td>IV</td>
<td>Coma</td>
<td>LOC, confusion with PTA &amp; AGA</td>
</tr>
<tr>
<td>V</td>
<td>Coma</td>
<td>Persistent vegetative state</td>
</tr>
<tr>
<td>VI</td>
<td>Death</td>
<td>Fatal Injury</td>
</tr>
</tbody>
</table>

**Table 2: Ommaya & Gennarelli classification of TBI.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS score</td>
<td>13 - 15</td>
<td>9 - 12</td>
<td>&lt;8</td>
</tr>
<tr>
<td>LOC or altered awareness</td>
<td>&lt; 20 min</td>
<td>20 min – 36 hours</td>
<td>&gt; 36 hours</td>
</tr>
<tr>
<td>Amnesia</td>
<td>&lt; 24 hours</td>
<td>1 – 7 days</td>
<td>&gt; 7 days</td>
</tr>
</tbody>
</table>

**Table 3.** TBI classification based on the GCS score, level of awareness and duration of posttraumatic amnesia.
the immediate and transient post-traumatic impairment of neural function such as alteration of consciousness, disturbance of vision or equilibrium etc. due to brainstem involvement.

The criteria utilized to diagnose a concussion represent a consensus of the Ad Hoc Committee to Study Head Injury Nomenclature of the Congress of Neurological Surgeons: Guidelines for Cerebral Concussion, the Cantu Grading System, the Sports Medicine Committee of the Colorado Medical Society, the Quality Standards Subcommittee of The American Academy of Neurology; Practice Parameter: The Management of Concussion in Sports, and the Mild Traumatic Brain Injury Committee of the Head Injury Interdisciplinary Special Interest Group of the American Congress of Rehabilitation Medicine. There are three primary criteria and two secondary criteria which are:

1. an alteration in the level of consciousness or awareness ranging from confusion to loss of consciousness of less than thirty minutes;
2. a period of post-traumatic amnesia (PTA), usually lasting from minutes to a few hours but not over 24 hours, and
3. the Glasgow Coma Scale (GCS) score recorded within 30 minutes of the event, without subsequent deterioration.

The two minor clinical criteria are:

4. a non-focal neurological examination and
5. normal “structural” brain imaging studies.

The various states of altered level of consciousness or awareness as well as their clinical characteristics may be summarized as follows:

1. Confusion: a deficit in attention, with disorientation to time, person, and/or place. The alertness is usually normal.
3. Stupor: Can be aroused by vigorous stimuli, decreased reaction to external stimuli.
4. Akinetic Mutism: No spontaneous motor activity however; the patient seems alert.
5. Minimally Conscious State: The patient might follow some simple commands inconsistency; variable neurological status. Decreased reaction to external stimuli.
6. Vegetative State: Some eye opening, no response to commands, some sleep-wake cycles, preserved autonomic functions, unable to interact with environment.
7. Coma: Cannot be aroused, no response to external stimuli, no voluntary movements.

The nonspecific term "dazed" represents different things to different individuals. It may suggest “I had no warning and everything happened so fast” to disorientation to time, place or person. Hence, the term dazed is not accepted as a term used to describe an alteration in level of consciousness or awareness. Confusion and obtundation, less often stupor or coma, are the typically encountered states of consciousness or awareness immediately following a concussion.

The AAN Guidelines for Management of Sports Concussion has recommended dividing concussions into those that are mild, moderate, or severe based on whether or not there has been a LOC as well as the duration of confusion (table 4). It is well accepted that a diagnosis of concussion does not require loss of consciousness.

**Post Concussion Syndrome Definition:** A syndrome may be defined as a group of symptoms that collectively indicate or characterize a disease, psychological disorder, or other abnormal condition. A post concussion syndrome (PCS) refers to the persistence of the concussive symptoms after an arbitrary point in time. The diagnostic criteria of a post concussion syndrome have been set forth within the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) as well as the Classification of Mental and Behavioral Disorders of the International Classification of Diseases (ICD-10) published by the World Health Organization.

The diagnostic criteria set forth within the DSM-IV-TR include:

1. A history of head trauma that caused significant cerebral concussion. The manifestations of a concussion include loss of consciousness, posttraumatic amnesia and, less commonly, posttraumatic onset of seizures
   a. Although the threshold for the severity of the head trauma has not been defined it has been suggested that two out
of three of the following criteria are necessary:

i. The period of unconsciousness should last over 5 minutes

ii. The period of posttraumatic amnesia should last over 12 hours

iii. The new onset of seizures 6 months after the closed head injury.

2. Neuropsychological evidence of difficulty in attention or memory.

3. Three or more of the following:
   a. Becoming fatigued easily
   b. Disordered sleep
   c. Headache
   d. Vertigo or dizziness
   e. Irritability or aggression on little or no provocation
   f. Anxiety, depression or affective lability
   g. Changes in personality
   h. Apathy or lack of spontaneity

4. The symptoms in 1 and 2 have their onset or are worse after the head trauma.

5. The disturbances cause a significant impairment in social or occupational function and represent a significant decline from the previous level of functioning.

6. The symptoms are not better accounted for by an alternative DSM-IV diagnostic condition.

The DSM-IV diagnostic criteria for a PCS are quite restrictive. By definition, irrespective of the duration of subjective complaints following the concussive injury, not every concussed individual may qualify for a PSC. The concussion must be of the severity that consciousness is lost preferably for over five minutes. If consciousness is lost but the duration is less than five minutes, the duration of PTA must be over 12 hours and the individual must develop a seizure disorder.

The diagnostic criteria within the ICD-10 include:

1. History of head trauma (usually sufficiently severe to result in loss of consciousness) preceding the onset of symptoms by a period of up to four weeks (objective EEG, brain imaging, or oculonystagmographic evidence for brain damage may be lacking).

2. At least three of the following:
   a. Complaints of unpleasant sensations and pains, such as headache, dizziness (usually lacking the features of true vertigo), general malaise, excessive fatigue, or noise intolerance.
   b. Emotional changes, such as irritability, emotional lability, both easily provoked or exacerbated by emotional excitement or stress, or some degree of depression and/or anxiety.
   c. Subjective complaints of difficulty in concentration and in performing mental tasks, and of memory complaints, without clear objective evidence (e.g. psychological tests) of marked impairment.
   d. Insomnia.
   e. Reduced tolerance to alcohol.
   f. Preoccupation with the above symptoms and fear of permanent brain damage, to the extent of hypochondriacal over-valued ideas and adoption of a sick role.

The ICD-10 criteria, similar to the DSM-IV-TR criteria, are quite restrictive and not all concussed patients qualify for a PCS despite the chronicity of their symptoms. According to the ICD-10 criteria, the head trauma should be sufficient severity to result in the loss of consciousness.
A diagnosis of post concussion syndrome, as implied
the term “post concussion”, requires that a concussion
has occurred. Failure to meet the diagnostic criteria
of a concussion will always exclude the diagnosis of a
post concussion syndrome, irrespective of the criteria
used (i.e. ICD-10 versus DSM-IV-TR). Without a
concussion, a diagnosis of post concussion syndrome
is erroneous. With a concussion, a post concussion
syndrome may or may not occur. An individual whose
head trauma meets the criteria for a concussion might
not meet the criteria for a post concussion syndrome.
An individual whose concussive diagnosis is based on
transient confusion following head trauma will not meet
the PCS diagnostic criteria irrespective of the duration
of their symptom complex.

When discussing the diagnosis of PCS the ICD-10
cautions that “Some patients become hypochondriacal,
embark on a search for diagnosis and cure, and may
adopt permanent sick role. The etiology of these
symptoms is not always clear, and both organic and
psychological factors have been proposed to account for
them. The nosological status of this condition is thus
somewhat uncertain.”

**Concussion Symptom Complex:** The
complaints which may follow a concussive head injury
fall into three general categories: cognitive, behavioral,
and somatic. Frequently encountered cognitive
complaints include difficulty paying attention, reduced
memory, and difficulty processing information, being
in a fog or confusion. The common behavioral
complaints consist of anxiety, insomnia, irritability,
short-tempered, jitteriness, and depression. Somatic
complaints include headache, dizziness, fatigue, nausea,
and light or noise sensitivity. Immediately following a
concussion the most commonly encountered complaints
are somatic — headache and dizziness. By the seventh
day headache remains the most common complaint with
fatigue and drowsiness the next most frequent (Table
5). In the office somatic and behavioral symptoms are
routinely identified by the physician’s history or through
completion of a symptom checklist. The cognitive
deficits associated with a concussion may be identified
via neuropsychological testing.

The various somatic, behavioral, and cognitive
complaints which may follow a concussion are neither
unique nor specific to this diagnosis. They may occur
with other traumatic injuries (i.e. cervical or lumbar
strains and sprains), with psychological diagnoses (i.e.
anxiety and depressive disorders), in patients with
chronic pain syndromes, in non-TBI injured patients,
and are frequently encountered in healthy, normal
individuals (Table 6).

In 1997, Iverson et al concluded post concussive
symptoms were not unique sequelae of mild
concussions as individuals with chronic pain reported
similar symptoms to individuals who had sustained
a concussion. Chan, in 2001, studied the base
rate of post concussive symptoms in 85 individuals
between the ages of 18-45 without head injury. He
observed a high proportion of normal individuals
reported symptoms similar to those in patients with a
concussion. Based on the findings, the author noted
“The onset of concussive-like symptoms may not be
associated with daily cognitive failures ...”.

In 2004, Kashluba et al reported three-month
follow-up data on symptom complaints in 110 mild
concussion and 118 control patients. In the control
population, the commonest endorsed complaints
included: headaches: 59%, anxiety/tension: 58%,
forgetfulness: 50%, difficulty finding the right word:
48%, irritability: 47%, complaining about things:
47%, bored easy: 43%, distractibility: 42%, sleep
disturbance: 40%, and apathy: 40%. The authors
concluded “The current results indicate that the MTBI
patient group improved from baseline to follow-up, a
finding consistent with previous research showing that
substantial improvement in MTBI symptoms typically
occurs within 3 months of the injury”. These studies,
as well as several others, have demonstrated that
post concussive symptoms are routinely found in the
normal population (Table 7).

This observation serves to explain why the diagnosis
of a concussion is not made retrospectively on
the presence or absence of somatic, behavioral, or
cognitive complaints.

**Recovery:** One of the early studies, by Russell et
al, demonstrated the incidence of PCS was 42% at
6 weeks and 54% at 6 months. One-third of the
cohort demonstrated a reversal of the recovery curve.
The authors observed the behavioral and somatic
complaints following a concussion often exhibit a paradoxical or inverse correlation with the severity of the injury—they were more pronounced in less severely injured individuals. A paper by Alexander reported “…at one year after injury approximately 15% of MTBI patients still have disabling symptoms”. Alexander relied on two sources for this observation. One reference was a study by Rutherford et al published in 1979 and the second was a study published by McClean et al published in 1983.

Upon closer scrutiny of the reference article it is evident that Alexander’s conclusions are seriously flawed. The paper by Rutherford et al analyzed the results of 131 out of an initial study of 145 concussed individual’s one-year post event. Nineteen out of 131 or 13.4% of individual’s studies had persistent complaints after one year. However, within the population of 19 symptomatic individuals, 8 (42%) were involved in

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Time frame</th>
<th>Immediate</th>
<th>3 days</th>
<th>7 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td></td>
<td>80 – 90</td>
<td>30 – 40</td>
<td>10 – 20</td>
</tr>
<tr>
<td>Nausea</td>
<td></td>
<td>30 – 40</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Vomiting</td>
<td></td>
<td>0 – 10</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Dizziness</td>
<td></td>
<td>70 – 80</td>
<td>10 – 20</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Fatigue</td>
<td></td>
<td>50 – 60</td>
<td>20 – 30</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Drowsiness</td>
<td></td>
<td>40 – 50</td>
<td>20 – 30</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Light / noise sensitivity</td>
<td></td>
<td>50 – 60</td>
<td>10 – 20</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Sadness</td>
<td></td>
<td>20 – 30</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Nervousness</td>
<td></td>
<td>30 – 40</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Numbness / Tingling</td>
<td></td>
<td>0 – 10</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Slowed Mentation</td>
<td></td>
<td>60 – 70</td>
<td>10 – 20</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Mental Fog</td>
<td></td>
<td>60 – 70</td>
<td>10 – 20</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Poor Concentration</td>
<td></td>
<td>60 – 70</td>
<td>10 – 20</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Memory Problems</td>
<td></td>
<td>50 – 60</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>0 – 10</td>
<td>0 – 10</td>
<td>0 – 10</td>
</tr>
</tbody>
</table>

Table 5. Percent of specific complaints immediately following a concussive head injury as well as on the 3rd and 7th day in a metaanalysis of 600 concussed individuals.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Group</th>
<th>Headache</th>
<th>Dizziness</th>
<th>Irritability</th>
<th>Memory Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td>College Students</td>
<td>36%</td>
<td>18%</td>
<td>36%</td>
<td>17%</td>
</tr>
<tr>
<td>Headache</td>
<td>Chronic Pain</td>
<td>80%</td>
<td>67%</td>
<td>39%</td>
<td>33%</td>
</tr>
<tr>
<td>Headache</td>
<td>Depression</td>
<td>37%</td>
<td>20%</td>
<td>52%</td>
<td>25%</td>
</tr>
<tr>
<td>Headache</td>
<td>Non-TBI injured</td>
<td>77%</td>
<td>41%</td>
<td>63%</td>
<td>46%</td>
</tr>
<tr>
<td>Headache</td>
<td>MTBI</td>
<td>42%</td>
<td>26%</td>
<td>28%</td>
<td>35%</td>
</tr>
</tbody>
</table>

Table 6. Incidence of specific complaints in various populations.

<table>
<thead>
<tr>
<th>Complaint</th>
<th>Incidence</th>
<th>Complaint</th>
<th>Incidence</th>
<th>Complaint</th>
<th>Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatigue</td>
<td>50.0%</td>
<td>Decreased concentration</td>
<td>44.3%</td>
<td>Depression</td>
<td>34.3%</td>
</tr>
<tr>
<td>Anxiety</td>
<td>47.7%</td>
<td>Irritability</td>
<td>43.6%</td>
<td>Easily lose temper</td>
<td>30.1%</td>
</tr>
<tr>
<td>Headache</td>
<td>46.0%</td>
<td>Memory difficulty</td>
<td>39.3%</td>
<td>Dizziness</td>
<td>22.8%</td>
</tr>
<tr>
<td>Light sensitivity</td>
<td>45.5%</td>
<td>Insomnia</td>
<td>35.9%</td>
<td>Noise sensitivity</td>
<td>19.6%</td>
</tr>
</tbody>
</table>

Table 7. Incidence of complaints found in a metaanalysis of 6 studies consisting of over 400 individuals taken from either normal control populations or studies evaluating normal populations.
litigation, six (32%) were thought to be malingering after six weeks, and ten (50%) endorsed a symptom at one year that was not present at six weeks. In the paper by McLean et al twenty concussed individuals underwent neuropsychological testing and a symptom checklist after 3 days and again at one month. There was no data at one-year post concussion. Of the 20 patients studied, nine (45%) had a Glasgow coma scale score below 13 – 15 and an additional seven (35%) had either a skull fracture or an abnormal CT scan of the brain. Hence, at least nine and potentially 16 of the 20 patients studied should have been disqualified as they failed to meet the diagnostic criteria for a concussion or MTBI. McLean reported there was no statistically significant evidence of neuropsychological difficulties after one month although subjective complaints persisted when compared to the normal cohort. As is obvious from careful scrutiny of the references sited by Alexander, the opinion that 15% of MTBI patients still have disabling symptoms one year post concussion lacks scientific basis. The results of these reports served as the impetus for more rigid scientific study.

During the past 15 - 20 years several large prospective controlled studies have analyzed the natural history and recovery profile of a concussion. With the use of standardized concussion symptom checklists with baseline and repeated neuropsychological tests, concussed individuals were compared to matched controls in order to analyze the natural history of recovery. These studies were primarily obtained in high school, college, and professional athletes where analysis of baseline function and subsequent serial neuropsychological evaluations of injured and control populations are possible. Obviously, similar studies are inherently impossible in vehicular or work-related concussive populations. To date, symptom analysis has not demonstrated a significant difference in the clinical complaints or neuropsychological findings in concussed individuals related to the cause of their concussion.

One of the earliest prospective studies was published by Leven et al.\textsuperscript{19} The authors compared the neurobehavioral functioning of 57 patients one week, one month, and three months post concussion to matched controls. The data demonstrated that although nearly all concussed patients reported cognitive, somatic complaints, and emotional malaise, all of the problems had substantially resolved by the three-month evaluation. The authors concluded “The data suggest that a single complicated minor head injury produces no permanent disabling neurobehavioral impairment in the great majority of patients who are free of preexisting neuropsychiatric disorder or substance abuse”.

In September 1996, Macciochi et al published their results of a prospective, controlled study comparing 183 athletes who sustained a mild concussion to gender, age, and education-matched controls.\textsuperscript{20} The study concluded that the neuropsychological deficits and subjective complaints related to a single concussion were of a relatively short duration.

Hinton-Bayre et al reported the results of their study of 222 participants from the Australian Rugby League, twenty of whom sustained a mild concussion as defined by the Committee on Head Injury Nomenclature of the Congress of Neurological Surgeons.\textsuperscript{21} The data demonstrated that after a concussion, patients will recover from the subjective complaints and the neuropsychological and cognitive impairment within five weeks post injury. Collins et al reported the post concussion recovery profile in a study of 129 college football players who sustained a single concussion.\textsuperscript{22} Neuropsychological testing was administered to the concussed patients and matched controls. The authors concluded a history of one concussion did not appear to result in long-term cognitive impairment.

Echemendia et al performed a post concussion checklist and administered neuropsychological testing 2 hours, 48 hours, 1 week, and one-month post injury to 29 concussed and 20 non-injured college athletes in a prospective, controlled study.\textsuperscript{23} The data demonstrated post concussive complaints resolved within 48 hours and the neuropsychological sequelae resolved within one month. The authors observed “At one month post injury, a statistically significant difference was found on one measure with the injured athletes marginally outperforming controls”.

In May 2002, McCrea published the results of a study involving 91 varsity football players from 30 high schools and 15 colleges who sustained a mild concussion based on the definitions of the American Academy of Neurology and the American Congress
of Rehabilitation Medicine. This study was the first to prospectively measure the immediate neurocognitive effects of a concussion, correlate the severity of the neurocognitive impairment with the occurrence of loss of consciousness and amnesia, and illustrate the early course of recovery. The data demonstrated the natural history of recovery from the neurocognitive effects of a concussion occurred within 48 hours.

Delaney et al published a retrospective survey of 201 Canadian university soccer and 328 Canadian university football players in an attempt to define the duration of concussive symptomatology. Based on returned questionnaires, the authors noted that in 100% of the soccer players and 98.6% of the football players, the concussive symptom duration was less than one month.

Erlanger et al administered the Concussion Resolution Index (CRI), an internet-based neurocognitive assessment battery, to 1603 athletes. Forty-seven of the athletes later sustained a concussion and these athletes repeated the CRI until all of their signs and symptoms had resolved or returned to baseline values. In this prospective study, the mean duration of the neurocognitive symptoms following a concussion was 6.02 ± 4.82 days (± SD) with all post concussion symptoms disappearing by the sixteenth day.

In November 2003, McCrea et al published the results of the National College Athletic Association’s Concussion Study of the immediate effects and natural recovery course relating to the symptoms, cognitive functioning, and postural stability following sport-related concussion. The study demonstrated the concussive symptom (identified by the Concussive Symptom Checklist) and the signs of cognitive dysfunction (identified by the Standardized Assessment of Concussion scores) improved to baseline levels within seven days post concussion. The Standardized Assessment of Concussion (SAC) was specifically designed with the intention of measuring the immediate neurocognitive effects of a concussion.

Neuropsychological testing demonstrated that the mild impairments in cognitive processing and verbal memory resolved by the seventh day post concussion. There were no significant differences in symptoms or functional impairments in the concussion and control groups 90 days post concussion.

More recently, Pellman et al reported on neuropsychological testing of National Football League (NFL) players between 1996 and 2001 who sustained a mild concussion. Within a few days of the concussive event, the MTBI group did not display significant neuropsychological dysfunction relative to their baseline, preconcussive scores. The authors concluded “The data show that MTBI in this population is characterized by a rapid return to function in the days after injury”.

In 2004, Mickevičiene et al performed a controlled prospective study of post concussion syndrome outside of the medical legal context. A cohort of three hundred concussed individuals and controls were evaluated a three months and one year post injury. Based upon questionnaire responses, the incidence of headache, fatigue, irritability, nausea, phonophobia, sleep problems, tendency to cry, depression, anxiety, neck pain, worry about complaints or brain injury or alcohol intolerance did not differ significantly between concussed and non-head-injured individuals at 3 months and at one year post event. After one year there was a slightly significant increase in memory problems, concentration, difficulty, dizziness, and tiredness consistent with the “expectation as etiology” hypothesis. The authors concluded “It seems impossible to document that post-traumatic headache related to a concussion lasts more than 3 months” and “In the present study, more subjective cognitive dysfunction in patients with concussion compared with controls 1 year after concussion seems to be related to sociodemographic factors and awareness of persisting symptoms caused by repeated questionnaires rather the persisting effects of mild traumatic brain injury.”

In the most detailed and largest concussion study to date, McCrea analyzed the data from three large, multicenter, prospective studies:

1. **NCAA Concussion Study** (NCAA) sponsored by the National Collegiate Athletic Association followed 4251 individuals of which 196 sustained a concussion.

2. **Concussion Preventative Initiative** (CPI) sponsored by the National Center for Injury Prevention and Control and the Injury Prevention Research Center of the U of North Carolina followed 9094 individuals of which 375 had a concussion.

3. **Project Sideline** (PS) sponsored by the Milwaukee,
WI school district consisted of 3279 individuals of which 87 had a concussion. Of the total group of 16,624 individuals 658 had a concussion as defined by the American Academy of Neurology. Each individual sustaining a concussion was tested with a graded symptom checklist, the Balance Error Scoring System (BESS), the Standardized Assessment of Concussion (SAC), and a neuropsychological test battery. The natural history of recovery from a concussion is summarized in Table 8. The data demonstrated over 85% of concussed individuals exhibited a complete recovery in seven days and over 97% recovered within 30 days.

In summary, numerous randomized controlled studies have provided convincing evidence that recovery from the cognitive deficits as well as the behavioral and somatic complaints following a mild concussive head injury occurs around the third month post event.

In discussing trauma and impaired consciousness Dr. de Ribaupierre indicated "After recovery, the patient can experience acute postconcussive symptoms that can last from a few hours to a few days, including headaches, visual disturbances, nausea, vomiting, and amnesia. More subtle symptoms (chronic headaches, sensibility to noise or light, memory and attention deficits, irritability) can last for months".8

A recent special committee of the Institute of Medicine (IOM) was unable to find enough quality research to evaluate the effectiveness of cognitive rehabilitation therapy for traumatic brain injury.32 The IOM committee attempted to assess whether cognitive rehabilitation therapy was effective in mild, moderate, and severe traumatic brain injury in the acute, subacute, and chronic phases of recovery period the authors concluded that current evidence provided limited support for the effectiveness of cognitive rehabilitation therapy and was not get sufficient to develop definitive guidelines for health professionals on how to apply cognitive rehabilitation therapy in clinical practice. Their conclusions supported the earlier findings of Rohling et al who performed a met analysis and concluded cognitive rehabilitation therapy provided little benefit for any traumatic brain injury other than the most serious cases.33

Recently, the Department of Defense adopted new guidelines for the identification and management of mild traumatic brain injuries (concussions).34 Mild traumatic brain injury was the fine as a “confused or disoriented state which lasted less than 24 hours; loss of consciousness for up to 30 minutes; memory loss lasting less than 24 hour; and structural brain imaging (MRI or CT scan) yielding normal results”. Individual with a concussion were screened using the Military Acute Concussion Evaluation (MACE) which consisted of a set of history questions, a screening neurological exam, and a 10-minute cognitive test which measured orientation, immediate memory, concentration, and memory recall. The MACE was modeled after the Standard Assessment of Concussion (SAC). Any military personnel diagnosed with a concussion was allowed to fully recover before returning to duty. Between January-December 2011, 8,700 concussions were identified from Afghanistan and Iraq. In those members of the military who had a single concussion, 99.7% fully recovered and were able to return to the prior duties and responsibilities.

### Factors Predisposing to Chronic Symptomatology:

When symptoms following a concussion continue far longer than expected based on the natural history demonstrated by numerous scientific studies, an alternative explanation must be considered. An analogous situation would be the association of a cough in the midst of a flu-like illness. For the initial week or two, all would agree that the flu is the most likely reason for the cough. If the cough persists for a month and all other flu symptoms have resolved it might be reasonable to relate the cough to the prior flu, but questions may arise. After 3 - 6 months, if the cough persists and all other signs and symptoms have

<table>
<thead>
<tr>
<th>Recovery course</th>
<th>NCAAA</th>
<th>CPI</th>
<th>PS</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>&lt; 1 day</td>
<td>28.3%</td>
<td>17.4%</td>
<td>21%</td>
<td>21.1%</td>
</tr>
<tr>
<td>&lt; 1 but &lt; 7 days</td>
<td>60.4%</td>
<td>68.1%</td>
<td>55.6%</td>
<td>64.3%</td>
</tr>
<tr>
<td>&gt; 7 but &lt; 30 days</td>
<td>9.6%</td>
<td>11.7%</td>
<td>18.5%</td>
<td>11.9%</td>
</tr>
<tr>
<td>&gt; 30 days</td>
<td>1.6%</td>
<td>2.7%</td>
<td>4.9%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Table 8. The natural history of recovery following a concussion in 658 individuals reported by McCrea.
been gone for months it is appropriate to reassess the relationship and evaluate the patient for other causes. After a year all would agree that a relationship is no longer valid and that there must be an alternative etiology (i.e. cancer, foreign body, amyloid, etc.) to account for the persistent cough. The same thought process must be applied to individuals with persistent complaints long after the occurrence of a concussive head injury.

To accept the premise that self-reported complaints following a specific injury is evidence of an impairment related to that specific injury one must accept the assumption that the complaints are not produced by factors other than the specific injury. One must believe that the individual would not have had these complaints had it not been for the specific injury. The frequent occurrence of post concussive complaints in normal control populations as well as individuals with psychological diagnoses and non-concussive injuries raises an obvious concern.

Almost 25 years ago, Rimel proposed three arguments to explain the existence of persistent problems in concussive patients: (1) residuals of organic brain damage produced by the injury (i.e. the diagnosis of “mild” traumatic brain injury is incorrect), (2) psychological reactions to the injury, or (3) a quest for secondary gain.

If the diagnosis is correct then only two of the options proposed by Rimel remain. It has long been proposed that the early symptoms of a concussion are related to organic factors, but that psychological factors account for the persistence of the symptoms. The longer the PCS lasts, the less likely the symptoms are due to brain injury. Lishman concluded that prolonged symptoms following a concussion are perpetuated by complex psychogenic factors and noted the longer the symptoms last, the more likely it is that non-organic factors play a significant role. Consideration of some of the pre-existing and post-injury factors may serve to better understand persistent post concussive symptomatology.

Pre-injury Factors: Not only is the frequency of prior alcohol abuse elevated in individuals with mild concussions, alcohol and substance abuse are prognostic factors in the rate of recovery from a concussion. Age has an adverse effect on recovery from post concussion symptomatology. Lower education and poor job satisfaction are associated with greater number of post concussive complaints. Occupations requiring greater education and skills usually attract individuals with higher-level cognitive abilities and the ability to work under pressure, both of which may be taxed when returning to work after a concussive head injury. Stambrook et al were able to demonstrate that individuals who worked in lower-status occupations experienced the greatest delay in returning to their prior job.

Pre-existing personality traits have a significant influence on the recovery from concussive injuries. Certain personality characteristics render an individual more susceptible to develop PCS. Dikmen et al proposed that certain personality characteristics are common in high-symptom reporters including low self-esteem, ineffective coping, low social competence, and negative labeling of stressful events. Therefore, those individuals who develop PCS are unable to deal with the distress from their transient cognitive difficulties. Individuals with a history of prior concussions demonstrate a delay in their pace of recovery.

Post-injury Factors: The impact on employment and finances present a major concern to the family. Dealing with the threat to the family’s security may worsen the PCS symptomatology and increase the time to recovery. Compensation claims and financial factors have been noted to influence the PCS recovery process. One study of concussion individuals found that the group that did not file compensation claims was off work an average of 23.9 days while those that did file claims were off work an average of 87.9 days.

It is important to be extra careful when compensation claims are based on PCS as the primary complaint. Studies have demonstrated that cognitive deficits can easily be simulated and how poorly routine neuropsychological tests are able to detect malingering. Without specific validity tests to verify the reliability of a neuropsychological profile, questions concerning the legitimacy of their conclusions will always remain.

Rutherford prospectively analyzed the factors associated with prolonged symptomatology following a concussive injury and observed ongoing litigation, low socioeconomic status, female sex, a prior concussion,
headaches, and serious associated systemic injuries accounted for some of the cases of persistent post concussive symptomatology.

Additional explanations for the lingering post concussive complaints include a concomitant medical diagnosis, an unrecognized psychological diagnosis (i.e. somatoform or bipolar disorder, etc.), an imaginary diagnosis in which normal variations found on a neuropsychological profile are deemed pathological and blamed on a specific event, and issues of secondary gain.

**Summary:** The purpose of this review is to present well-designed scientific evidence with data from large prospective, controlled studies, and not to offer anecdotal opinion based on one’s personal experience or observations. It is widely accepted that a minor or mild concussion is defined by the occurrence of an alteration in one’s level of consciousness, a period of posttraumatic amnesia lasting less than one hour, and a Glasgow coma scale score between 13 and 15. Being “in shock” due to the emotional upset accompanying an accident or being “dazed” because “Everything happened so fast I didn’t realize what happened” are not synonymous with an alteration in one’s level of awareness or posttraumatic amnesia. The complaint of being “dazed” is too nebulous, has no specific neuologic significance, and often represents the time it takes for an individual to realize what happened when involved in an accident without warning. A concussion is not a diagnosis made in hindsight or based on the presence (or absence) of subjective complaints. The presence of cognitive, behavioral, or somatic complaints no more confirms the diagnosis of a concussion than the absence of such complaints excludes the diagnosis. More so, the complaints which often follow a concussion are nonspecific and routinely encountered in normal individuals as well as individuals with trauma which did not involve the head. A post-concussion syndrome, based on ICD-10 or DSM-IV criteria, requires either (1) a loss of consciousness, or (2) posttraumatic amnesia lasting 12 or more hours with development of a posttraumatic seizure disorder. The diagnosis of a post-concussion syndrome should not be made in a patient who bumped their head and complains of headache or dizziness but did not lose consciousness, suffer from loss of awareness, or exhibit amnesia following the event.

The prognosis and natural history of a concussion must be based on data derived from well-designed, large, reproducible scientific studies. Fortunately, such studies are available for review. When evaluating an individual who has sustained a mild concussion, whether at home, in the athletic arena, at the job site, or as a result of a motor vehicle accident, a physician can confidently advise the patient, spouse, family, or any other interested party, that the somatic, behavioral, and cognitive difficulties will resolve in approximately three months. When encountering an individual whose complaints have persisted for significantly longer than expected based on the natural history, an alternative explanation must be explored. The various factors and diagnoses requiring consideration have been reviewed.

**Endnotes**

18 Rutherford WH, Merrett JD, McDonald JR. Symptoms at one year following concussion from minor head injury. Injury. 1979;10:225-30


46. Wiley TF and Ruff RM. Detection of simulated malingering on simulated tests. Poster session presented at the 18th annual meeting of the International Neuropsychological Society, Orlando FL 1990


CME Questions:

1. The Glasgow Coma Scale score provides a basis to triage head-injured patient’s upon arrival at the emergency room. Which of the following characteristics are not considered in the Glasgow Coma Scale score?
   a) motor response
   b) verbal response
   c) repetition
   d) open eyes on command

2. Moderate traumatic brain injuries are characterized by
   a) A Glasgow coma score of 9 - 12
   b) Amnesia lasting more than 36 hours
   c) A skull fracture and/or cerebral contusion
   d) A brief loss of consciousness lasting less than 1 minute

3. Which of the following are a primary criterion for a concussion
   a) An alteration in the level of consciousness
   b) Amnesia lasting less than 24 hours
   c) A Glasgow Coma Scale score of 13-15 without subsequent deterioration
   d) All of the above

4. A diagnosis of postconclusion syndrome requires the patient to demonstrate the following:
   a) Headache, dizziness, and fatigue
   b) A concussion
   c) No loss of consciousness
   d) Loss of consciousness

5. The complaints encountered in a cohort with a postconcussion syndrome:
   a) May also be encountered in college students, individuals with chronic pain syndrome, and non-traumatic brain injured individuals
   b) Often include the triad of headache, dizziness, and fatigue
   c) Nonspecific and may occur in normal individuals
   d) All of the above

6. Studies on postconcussion syndrome have demonstrated:
   a) A direct relationship with the severity of injury.
   b) A sound basis to the observation that 15% of patients following minimal traumatic brain injury have disabling symptoms at one year
   c) An 88-90% recovery rate within one month
   d) None of the above

7. Factors not associated with chronic symptomatology following a concussion include:
   a) Lower education and poor job satisfaction
   b) Lack of coping skills
   c) Alcohol and substance abuse
   d) Marriage at a young age
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