Evidence-Based Practice Approaches and Return-To-Work Outcomes, Part 2: Empirical Perspectives for Independent Medical Examiners

Ever since the pioneering study by the Institute of Medicine and their ongoing leadership in the Academies, as well as the landmark work of the Cochran Collaborative, medicine has begun to better understand, appreciate and incorporate evidence-based approaches in informing how to better practice. Our prior issue focused on the first three of a series of five articles on evidence-based approaches to treating injured workers.

This edition’s Special Interest topic area focuses on a set of studies that highlight the importance of examining evidence-based approaches in work conditioning/hardening vis-à-vis the most frequently occurring work-related injuries’ post-treatment outcomes as judged by a patient’s ability to return to work. The articles herein center on the injuries requiring lumbar spine fusions and on those patients undergoing rotator cuff repairs. Our intention is to spotlight promising findings as a focal collection of scientific research articles. Often the literature is absent or provides limited reports on certain areas in disability medicine, and this new Special Interest approach adopted by the Journal of Disability Medicine seeks to remedy this situation.

The philosophies of evidence-based practice (EBP) and evidence-based medicine (EBM) have been established for well over a decade in most healthcare professions; however their use is not evenly distributed, so to say. In fact, some insurers complain that too often clinicians provide “…nonspecific practices, haphazard planning, a lack of goal setting which causes an inability to measure efficacy and accurate progress, and that there is no standard database in the field” (Robinson, 2008). Some may take a bit of offence at such comments, so it is incumbent on specialists in disability medicine to take a leadership role in using the tools that are available in combination with developing evaluative studies in order to maximize patient care and thus clinical outcomes.

We hope you enjoy this innovative series and we welcome your ideas for topics you have interest in for future Special Interest sections.

As the Journal of Disability Medicine 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.

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Return-to-Work Outcomes in Lumbar Fusion Cases Following An Evidence-Based Post-surgical Rehabilitation Program

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Abstract:

Background: There is evidence that there has been a marked increase in the frequency of spinal fusions performed in the United States over the past three decades, with the costs for spinal implants and devices to be approximately $2 billion per year. This figure is further compounded when considering that lumbar fusions resulting from workplace injuries and the concomitant wage loss amounts to an estimated additional annual deficit of $28 billion. Current controversy exists in lumbar fusion outcomes as well. Studies investigating workers' compensation (WC) patients show that this population tends to have even poorer outcomes than the general patient population, but few of these articles examine the outcomes of lumbar fusions conducted in WC populations who had undergone an evidence-based work-condition/work-hardening program as part of their post-operative rehabilitation protocol.

Purpose: The purpose of this work is to investigate a sample of WC patients who had undergone lumbar fusion to determine whether the patients who participated in an evidence-based sports performance work conditioning/work hardening (EbSpWC/WH) program would show a higher frequency of returning to work and return to work in a rapid manner.

Study Design: This is a retrospective, case series, observational study which took place at a large, multisite rehabilitation practice in the Midwest and East Coast between February 2009 and December 2011.

Methods: A blinded review of a data-run based on the inclusion and exclusion criteria was conducted. Subjects in this study had undergone Level 1, 2 or 3 lumbar fusions and postoperative rehabilitation and were also workers’ compensation cases. There were a variety of conditions that led subjects to agree to surgery, including but not limited to acute, chronic, traumatic, radicular symptoms, and postural deficits. They were at least three months postoperative. The surgeons were a heterogeneous group made up of 41 different specialists in either sports medicine or spinal surgery. Physical demand level (PDL) of the patient’s job (pre-injury) and post-treatment PDL were collected as the primary outcome measures. Following completion of physical therapy, patients underwent an evidence-based, sports performance-based work conditioning/hardening (EbSpWC/WH) program 5 hours a day, 5 days a week.

Results: Of the 62 patients, 39 were able to achieve their same level of pre-injury work, thus accounting for a 63% return to work rate at the same/prior physical demand level. The time it took to achieve their maximum medical improvement, the mean average was 6.26+/-2.55 months.

Conclusion: This study found that conventional PT augmented with an EbSpWC/WH program is shown to return a wide range of patients to their pre-injury PDL. With the absence of a consensus on the optimal surgical approach and PT intervention for appropriate lumbar spine surgical candidates, the use of an EbSpWC/WH program may help to improve the ability to function at or close to their previous PDL.

Keywords: Lumbar fusion; Return to work, Evidence-based, Work conditioning; Work hardening; Physical demand level; Workers’ compensation.

Introduction

There is evidence that there has been a marked increase in the frequency of spinal fusions performed in the United States over the past three decades.1-10 The growth rate seems to be continuing unabated at 18 to 20 percent annually with the costs for spinal implants and devices to be approximately $2 billion per year.11 This figure is further compounded when considering that lumbar fusions resulting from workplace injuries and the concomitant wage loss amounts to an estimated additional annual deficit of $28 billion.12-13 Current controversy exists in lumbar fusion outcomes.14 Mirza and Deyo’s15 investigation of randomized clinical trials for their systematic review of lumbar fusion outcomes when compared to non-surgical outcomes was inconclusive, and Soegaard and Christensen’s16 systematic review of the literature on lumbar fusions led them to conclude that such
procedures have questionable cost effectiveness. The current literature has even fewer published findings when examining the outcomes of injured workers undergoing lumbar fusions.\textsuperscript{14,17-20} Of these studies, fewer still examine the outcome the patient's ability to return to work.\textsuperscript{14,18,20} 

As other researchers studying this population may look at post-operative rehabilitation outcomes, revision surgeries, infection rates or other such outcome measures, no published studies could be found that investigated the outcomes of workers’ compensation cases having undergone a lumbar fusion and followed-up with a post-rehabilitation evidence-based sports performance-based work conditioning/work hardening (EbSpWC/WH) program. Cole et al\textsuperscript{21} examined such a sample but in the context of physiological and functional measures of strength development. Their study made the point that while other studies report the outcome measure of return to work (RTW), they generally do not also consider the physical demand level (PDL) of the job to which they are returning. Similarly, Nguyen et al\textsuperscript{14} noted that the inability to RTW at any PDL was the criteria for unsuccessful outcomes in these patients. More recent studies have now begun to consider these more crucial aspects when examining workers’ compensation cases’ outcomes.\textsuperscript{22}

In spite of a successful surgical procedure and post-operative physical rehabilitation, some patients continue to have physical limitations that prevent them from being able to return to work or to be able to return to the same job as they had prior to the injury, or at the same physical demand level. Traditional work conditioning or work hardening programs help to improve patients’ independent functioning in their daily lives (unassisted dressing, grooming, feeding, ambulating, etc.) and re-establishing their work-related functioning.\textsuperscript{20}

Work conditioning programs are generally comprised of a “single-disciplinary treatment approach to address physical or functional needs using physical conditioning and functional activities related to work.” Work hardening programs are defined as multidisciplinary models of care designed to address physical, functional, behavioral, and vocational needs, and uses real or simulated work activities. Both of these approaches generally evaluate outcomes via RTW results. Again, there is a paucity of research findings on the consequences of undergoing such programs\textsuperscript{21} and what has been investigated found contradictory evidence.\textsuperscript{23}

The evidence-base for the program used herein was developed based on expert consensus from a multidisciplinary group that included orthopedic surgeons, physical therapists, athletic trainers, exercise physiologists, and bio-mechanists as well as a systematic review of the literature for available randomized control trials and meta-analytic survey findings in order to inform the design of the return-to-work program. In the development of the EbSpWC/WH program (formally known as Functional Integration of Rehabilitation and Strength Training, FIRST\textsuperscript{TM}), research was conducted to examine the hypothesis that improving lifting abilities in injured workers translated into improved return to work performance. In a 2002 study\textsuperscript{24} of WC patients who were assessed at both 1-year and 2-years post-program completion indicated that 97\% of those patients went back to work, with half being able to return back to their prior occupation and concomitant PDL. Additionally, re-injury rates were assessed for these patients two years following program completion and were found to be rare and occurred less frequently with greater physical demand jobs.\textsuperscript{25}

Also absent from the literature is an investigation of the outcome of patients who have had lumbar fusions and postoperative rehabilitation who then participated in an EbSpWC/WH program on RTW outcomes in the context of prior-to-injury PDLs. The authors investigated a sample of workers’ compensation patients who had undergone Level 1, 2 or 3 lumbar fusions and postoperative rehabilitation followed by successfully attending and participating in at least 10 sessions of an EbSpWC/WH program based upon the body part that was injured. The hypothesis was that such WC patients would show a higher level of returning to work and return to work more quickly (at their prior PDL) than those patients described other studies’ findings that did not complete an EbSpWC/WH program.
Patients and Methods

Study Design

An uncontrolled, multicenter, retrospective, observational study of WC patients who completed an EbSpWC/WH program was conducted at a large, multisite rehabilitation practice in the states of Illinois and Wisconsin. A blinded review of a data-run based on the inclusion and exclusion criteria was conducted.

Patient Population

Subjects in this study had undergone Level 1, 2 or 3 lumbar fusions and postoperative rehabilitation and were also workers’ compensation cases. There were a variety of conditions that led subjects to agree to surgery, including but not limited to acute, chronic, traumatic, radicular symptoms, and postural deficits. They were at least three months postoperative and had completed an EbSpWC/WH program during the period of time between February 2009 and December 2011. The surgeons were a heterogeneous group made up of 41 different specialists in either sports medicine or spinal surgery.

Inclusion criteria

1. Workers’ compensation case,
2. At least one lumbar level surgically fused,
3. Completion of traditional physical therapy,
4. Physician referral for work conditioning or work hardening,
5. Approval of coverage from workers’ compensation insurance, and
6. No previous lumbar fusion surgery.

Exclusion criteria

1. Non-compliance or inability to perform program at least 4 h/d, 4–5 days/wk,
2. Inability to complete at least 4 weeks full attendance in the EbSpWC/WH program,
3. Incomplete data, or
4. No longer had a job to return to.

Medically, exclusion criteria were:

1. Prior lumbar surgery,
2. Cauda equina syndrome,
3. Vertebral fractures,
4. Spine infection or tumor,
5. Inflammatory spondyloarthropathy,
6. Pregnancy,
7. Comorbid conditions contraindicating surgery,
8. Over a year’s time between the injury and surgery date,
9. Over 100 days between surgery and start of therapy, and
10. The inability or unwillingness to have surgery within 6 months.

Collected data and outcome measures

The organization’s practice is to collect a standardized set of data that includes patient demographic information (e.g., age, sex, BMI, etc.), WC status, a detailed medical history that includes acuity or chronicity of comorbidities, occupation, physical demand level of the patient’s job (pre-injury) and post-treatment PDL. PDL is based on the US Department of Labor’s Dictionary of Occupational Titles, and include Sedentary Work, Light Work, Medium Work, Heavy Work, and Very Heavy Work. (Definitions for these categories appear in Table 1.) The authors adapted the table to include Light/Medium and Medium/Heavy categories to better classify work demand level. And lastly, the results of Functional Capacity Evaluations when conducted were also included.

Treatment

According to the American Academy of Orthopedic Surgeons (AAOS) there are four “approaches” used in performing lumbar fusion: anterior, posterior, posterolateral, and minimally invasive. Each of these attempts to achieve the same goal, provide stability to effected lumbar segments that usually have failed conservative management. The approach used is at the surgeon’s discretion, and all were
included in this study.

Following the lumbar fusion procedure, subjects followed surgeon specific instructions which likely included relative rest with use of a shell for immobilization and ADL performance with walking for cardiovascular endurance. After this, generally a period of 4 to 12 weeks, the patient initiated rehabilitative physical therapy. General criteria used to determine when patients were ready for transition to the EbSpWC/WH program are as follows: floor to waist lift of 20#, overhead lift 10#, carry total of 20-30# 100feet, and complete pushing/pulling activities of 30-50#. When they met these criteria, they then underwent an EbSpWC/WH program, which is a rehabilitation program that employs the principles of sports performance training to improve WC patients’ physical lifting capacity. The program is individualized, based primarily around the injured worker’s presenting level of function, with an identified return-to-work end-goal in mind. Patients come to the program Mondays through Fridays for approximately 5 hours a day in order to both mimic the demand of having to be accountable and on time, as well as having a fairly demanding routine set of expectations on what is to be accomplished each day. Being engaged in this process represents a patient’s full participation. Depending on the idiopathic needs and progress of the patient, this generally is five weeks in duration, and less for patients in less physically demanding job classifications.

Outcomes were defined as returning to work and at what level, and the time period between the surgery and maximum medical improvement (MMI) in order to return to work. The determination for returning to work was based on a formal evaluation (functional capacity evaluation) or by meeting their target PDL in the RTW program. The authors herein believe this to be a more strict method in which to determine functional outcome of the patient and provides the physician with objective data to determine RTW criteria. Other studies have based the decision for the patient to return to work on the more subjective opinion of the physician. Work level was defined via physical demand level (e.g., Sedentary Work, Light Work, Medium Work, Heavy Work, and Very Heavy Work).

**Statistical Analysis**

Arithmetic means and standard deviations were the descriptive statistics used in the case of continuous data while discrete data were represented by frequency count and percentages. Welch’s t-test was performed to determine differences between groups and non-parametric Chi Square for within groups. The criterion was p<0.05 for statistical significance. Statistical analyses that were not performed by hand used Microsoft Excel or SPSS for Windows 16.0 (SPSS, Inc., Chicago, IL).

**Results**

From February 2009 to December 2011, 62 consecutive patients who met the inclusion and exclusion criteria and were under workers’ compensation for their lumbar spine injury, having had a 1, 2, or 3 level lumbar fusion were examined. The details of this sample’s demographic and historic characteristics are detailed in Table 2. The mean average age of the sample was 41.11 +/- 8.78 years (range, 20 to 60 years). Males comprised 87.0% (n=54) and 13.0% (n=8) were female. There were no patients at the sedentary level while and 8 were at light levels of work prior to injury. Prior to incurring the injury, 11 patients were employed at a light/medium level of work and 24 patients had been at a medium work level. Medium/heavy work levels accounted for 8 patients, five were at the heavy level, and the remaining six were at a very heavy level of work. Of the 62 patients, 39 were able to achieve their same level of pre-injury work, thus accounting for a 63% return to work rate at the same/prior physical demand level. When examining the time it took to achieve their maximum medical improvement, the mean average was 6.26 +/- 2.55 months. During this time, the average number of physical therapy sessions was 33.87 +/- 13.75 and the average number of evidence-based work conditioning/hardening program sessions was 28.82 +/- 11.55. Details as to time differences between good and bad outcome groups and then number of fusions are provided in Table 3.

When examining patient outcomes by work classification, it was found that there were no statistically significant differences between the categories (Fig 1). PDL was not found to significantly impact either return to work or time to recovery.
**Table 1. Physical Demand Definitions**

<table>
<thead>
<tr>
<th>Work Category</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>S-Sedentary Work</td>
<td>Exerting up to 10 pounds of force occasionally (Occasionally: activity or condition exists up to 1/3 of the time) and/or a negligible amount of force frequently (Frequently: activity or condition exists from 1/3 to 2/3 of the time) to lift, carry, push, pull, or otherwise move objects, including the human body. Sedentary work involves sitting most of the time, but may involve walking or standing for brief periods of time. Jobs are sedentary if walking and standing are required only occasionally and all other sedentary criteria are met.</td>
</tr>
<tr>
<td>L-Light Work</td>
<td>Exerting up to 20 pounds of force occasionally, and/or up to 10 pounds of force frequently, and/or a negligible amount of force constantly (Constantly: activity or condition exists 2/3 or more of the time) to move objects. Physical demand requirements are in excess of those for Sedentary Work. Even though the weight lifted may be only a negligible amount, a job should be rated Light Work: (1) when it requires walking or standing to a significant degree; or (2) when it requires sitting most of the time but entails pushing and/or pulling of arm or leg controls; and/or (3) when the job requires working at a production rate pace entailing the constant pushing and/or pulling of materials even though the weight of those materials is negligible. NOTE: The constant stress and strain of maintaining a production rate pace, especially in an industrial setting, can be and is physically demanding of a worker even though the amount of force exerted is negligible.</td>
</tr>
<tr>
<td>M-Medium Work</td>
<td>Exerting 20 to 50 pounds of force occasionally, and/or 10 to 25 pounds of force frequently, and/or greater than negligible up to 10 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Light Work.</td>
</tr>
<tr>
<td>H-Heavy Work</td>
<td>Exerting 50 to 100 pounds of force occasionally, and/or 25 to 50 pounds of force frequently, and/or 10 to 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Medium Work.</td>
</tr>
<tr>
<td>V-Very Heavy Work</td>
<td>Exerting in excess of 100 pounds of force occasionally, and/or in excess of 50 pounds of force frequently, and/or in excess of 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Heavy Work.</td>
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* According to the Physical Demand Definitions from the Dictionary of Occupational Titles (US Department of Commerce)

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**Table 2. Demographic and Historic Characteristics of Lumbar Fusion Cohort**

<table>
<thead>
<tr>
<th>Category (n=62)</th>
<th>Characteristic</th>
<th>Mean age by end of program (n=62)</th>
<th>Sex</th>
<th>Sex</th>
<th>Comorbidities</th>
<th>Work Level</th>
<th>Return to Work at Pre-Injury Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Outcome (n=39)</td>
<td></td>
<td>41.11 +/- 8.78</td>
<td></td>
<td></td>
<td>High Blood Pressure, 20.51% (n=8)</td>
<td>Sedentary</td>
<td>Yes, 63%</td>
</tr>
<tr>
<td>- Outcome (n=23)</td>
<td></td>
<td>40.69 +/- 9.45</td>
<td></td>
<td></td>
<td>Smoking, 17.95% (n=7)</td>
<td>Light</td>
<td>No, 43%</td>
</tr>
<tr>
<td>Mean age by end of program</td>
<td></td>
<td>41.83 +/- 7.64</td>
<td></td>
<td></td>
<td>Recent Fracture, 12.82% (n=5)</td>
<td>Light/Medium</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td>Male</td>
<td>87.0% (n=54)</td>
<td>High Blood Pressure, 21.74% (n=5)</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td>90% (n=35)</td>
<td>Smoking, 13.04% (n=3)</td>
<td>Medium/Heavy</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td>Female</td>
<td>10% (n=4)</td>
<td>Recent Fracture, 17.39% (n=4)</td>
<td>Heavy</td>
<td></td>
</tr>
<tr>
<td>Allergies, 12.82% (n=5)</td>
<td></td>
<td></td>
<td></td>
<td>17% (n=4)</td>
<td>Allergies, 17.39% (n=4)</td>
<td>Very Heavy</td>
<td></td>
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<tr>
<td>Work Level</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Sedentary</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light</td>
<td>13.0% (n=8)</td>
<td>5% (n=2)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Light/Medium</td>
<td>18.0% (n=11)</td>
<td>10% (n=4)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Medium</td>
<td>39.0% (n=24)</td>
<td>44% (n=17)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Medium/Heavy</td>
<td>13.0% (n=8)</td>
<td>13% (n=5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Heavy</td>
<td>8.0% (n=5)</td>
<td>13% (n=5)</td>
<td></td>
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</tr>
<tr>
<td>Very Heavy</td>
<td>10.0% (n=6)</td>
<td>15% (n=6)</td>
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</table>
When examining the 23 patients that were not able to return to work at their previous levels following their lumbar fusion procedure and evidence-based rehabilitation, there were no obvious pathognomonic indications noted that may have contributed to their suboptimal clinical outcomes. Inferential statistical analyses were conducted in order to examine if any differences manifest between the patient groups who achieved their target, preoperative work level and those that did not, and none were significant. When examining the most frequently occurring comorbidities (high blood pressure, smoking, recent fracture, and allergies) it was found that the two groups did not significantly differ (p>0.05). Similarly, when comparing on demographic variables of sex or age, no statistically significant differences were found.

**Discussion**

Fusion surgery can be a critically necessary yet costly intervention in the treatment course of lumbar injuries. Previous reports have indicated a low level of patients that return to work following this type of surgical intervention. For example, Nguyen et al. found only 26% RTW two years post-operatively\(^{14}\) and 41% of subjects RTW in a study by DeBerard.\(^{18}\) This study, however, showed successful return to work in 63% of the patients on average 7 months following surgery. Furthermore, these patients achieved their pre-injury PDL as opposed to the above mentioned studies which included return to work at any PDL.

The selected population is largely generalizable, which is one of the strengths of this study, along with the large n of 62. There is no bias toward a specific surgeon, type of surgical approach, or number of fused levels. We also included a wide range of dates from injury to surgery, with the majority being from 91-365 days (Table 3). One interesting finding that deserves further research is that those in the 0-90 day range had an 80% success rate. This raises the question, what is the optimal window to consider surgical intervention with the best likelihood for return to work at previous PDL? Also, as noted in the Table 3, the data on time to start PT following surgery encompassed a large range. Outside of the 0-90 days between injury and surgery, the other mentioned data did not clearly indicate positive or negative outcome.

In Table 2 one can see that there are no obvious links between specific co-morbidities and outcome. Nor were there any association between gender or age and return to work outcome. However, when looking at the PDL levels and return to work outcome you can see that the higher PDL (i.e. Medium/Heavy, Heavy, Very Heavy) tended to have better outcomes following use of the EbSpWC/WH program (84% positive and 16% negative).

This study leaves the door open for further research as well. A few questions that would help to determine optimal course of treatment for this patient population are: What is the best fusion approach? Along with this, what PT interventions are most appropriate and in what time interval both before and after surgery? Are the current criteria for entrance into the EbSpWC/WH program correct and is there a more appropriate progression of exercise within the program to lead to more successful outcomes?

**Limitations**

We were unable to control for a surgeon restrictions and precautions, which may have limited progression into and within the EbSpWC/WH program. There was also no way to completely control the intervention provided during conventional PT, both those sessions after surgery and any potential visits before surgery. One final limitation to this study is the ability to determine true return to work. These patients were deemed successful if they met the demands of their job during the EbSpWC/WH program or during a structured FCE. However, there was no follow up.
completed to confirm that they returned to the job of injury.

**Conclusions**

In order to decrease the compounding costs of these surgeries, in specifically the workers’ compensation population, we have developed a program that utilizes an evidence-based approach with sport performance-based principles to best return workers to their pre-injury PDL. This study shows that conventional PT augmented with an EbSpWC/WH program is shown to return a wide range of patients to their pre-injury PDL. With the absence of a consensus on the optimal surgical approach and PT intervention for appropriate lumbar spine surgical candidates, the use of an EbSpWC/WH program may help to improve the ability to function at or close to their previous PDL. More specifically, those operating in the Medium/Heavy and above PDL before injury will benefit from completion of an EbSpWC/WH program. The results of this study are mostly generalizable and applicable to a large segment of the rehabilitation population.

**References**


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Earlier Return-to-Work in Post-Arthroscopic Rotator Cuff Repair Patients Following an Evidence-Based Rehabilitation Program

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Abstract:

Purpose: Full-thickness tears of the rotator cuff are a well-recognized cause of shoulder pain in injured workers. Few studies have explored the functional outcomes and post-operative physical demand levels of workers’ compensation populations after arthroscopic repair of these types of injuries.

Methods: This study was a retrospective investigation of 158 workers’ compensation patients who had undergone arthroscopic rotator cuff repair of full-thickness tears and who were enrolled in an evidence-based work conditioning/hardening rehabilitation program with goals oriented to the physical demands of the injured worker. Exploration of the injured workers’ demographics and the various techniques of rehabilitation in determining successful return to work timeframes, prior levels of function, and patient satisfaction were investigated. Descriptive statistics were used for continuous data and described in frequency counts and percentages. Inferential analyses used were independent t-tests, Pearson’s Chi Squared Test for Association, Pearson Product-Moment correlation Coefficients, and Fisher’s Exact Test. Statistical significance was set at p<0.05.

Results: The mean average age of the participants was 48.66±8.69 years old. There were 112 males and 46 females who were included in the study. Physical demand levels of these participants varied from light through heavy, with 150/158 (94.9%), p=0.064 of them returning to their pre-injury work levels after surgical intervention, rehabilitation, discharge from an evidence-based work conditioning/work hardening program. Maximum medical improvement and return to work duration took a mean average of 6.36±2.13 months. Of the eight patients who were unable to return to work, there were only some details available for four of them regarding their reasons for poor or undesired outcomes.

Conclusion: Arthroscopic intervention of full-thickness rotator cuff tears, post-operative rehabilitation, and evidenced-based work conditioning/work hardening program implementation all have a positive effect on return to work rates. Both formal functional capacity evaluations and physician opinions of the return to work criteria are recommended.

Clinical Relevance: Evidence-based work conditioning/work hardening program, coupled with arthroscopic surgical interventions of rotator cuff repairs returns injured workers back to work at pre-injury physical demand levels.

INTRODUCTION

Studies of workers’ compensation patients as a category have uniformly found patients to have poorer clinical outcomes, be less satisfied with their surgery, be less likely to return to work in strenuous professions, experience less reduction in pain, be less likely to return to full duty, and show less improvement in work ability.1,2 More specifically, patients suffering injuries to their shoulder as a result of a work related incident and requiring surgical intervention generally have lesser outcomes than their non-workers’ compensation cohort.3,4,5,6,7,8 It is only recently that researchers have begun to investigate the outcomes of workers’ compensation patients that have undergone arthroscopic rotator cuff repair (ARCR).4,6,9 The literature reports generally good to excellent outcomes following arthroscopic rotator cuff repair.10,11,12 Yet, arthroscopic rotator cuff repairs in workers’ compensation (WC) patients demonstrates poorer results.4,6 A recent study by Bhatia et al9 was in fact the first to investigate, as a primary outcome measure, postoperative work level, which in the domain of workers’ compensation is the true litmus test of efficacy.

Because proper rehabilitation and the ability to return work are important factors regarding these outcomes, the authors sought to evaluate the impact of an evidence-based work conditioning/work hardening program on work level outcomes following arthroscopic rotator cuff repair. The authors investigated a consecutive series of WC patients who had undergone arthroscopic rotator cuff repair and participated in a specific work conditioning/work hardening
program postoperatively. It was hypothesized that WC patients who participated in an evidence-based work conditioning/work hardening rehabilitation program following arthroscopic rotator cuff repair would return more quickly and at an overall higher level of work, based on physical demand levels from Functional Capacity Assessments, than previous historic controls who did not complete an evidence-based rehabilitation program.

METHODS

For the study, the authors enrolled 158 of consecutive WC patients who were at least 3 months postoperative from a primary arthroscopic repair of a full-thickness rotator cuff tear and had completed an evidence-based work conditioning/work hardening rehabilitation program during the period of time between January 2009 and June 2011. The surgeons were a heterogeneous group made up of 72 different specialists in either sports medicine or orthopedic shoulder surgery. The authors excluded revision surgeries and the presence of contralateral shoulder pathology, spine surgery, or other non-shoulder injuries that would have impacted the WC patient’s ability to return to work.

The findings of this study were based on the above inclusion and exclusion criteria from a group of WC patients seen by a multisite rehabilitation practice in the states of Illinois and Wisconsin. The rehabilitation practice prospectively collects a standardized set of data which includes patient demographic information (age, sex, side of shoulder tear, etc.), WC status, medical history, occupation, physical demand level (PDL) of the patient’s job (pre-injury) and post-treatment PDL based on the US Department of Labor’s Dictionary of Occupational Titles, and include Sedentary Work, Light Work, Light/Medium, Medium Work, Medium/Heavy, Heavy Work, and Very Heavy Work. (Definitions for these categories appear in Table 1.) And lastly, the results of Functional Capacity Assessments (FCAs) when conducted were also included. The examiner who enrolled the patients by the above inclusion and exclusion criteria was blinded to patient outcomes including PDL and the FCA results. All subjects herein had received post-operative physical therapy from the same organization and had completed the evidence-based, sports performance-based work conditioning/hardening (SPWC/H) program.

Following the arthroscopic procedure, 4 to 8 weeks of immobilization, patients averaged 48.01 +/- 18.99 physical therapy sessions and concluded with participation in an evidence-based, sports performance-based work conditioning/hardening (SPWC/H) program which employs the principles of sports performance training to improve WC patients’ physical lifting capacity. The average duration of this was 27.29 +/- 12.74 visits.

The evidenced-based SPWC/H program was developed with the assistance of orthopedic surgeons, physical therapists, athletic trainers, exercise physiologists, and bio-mechanics experts as well randomized control trials available in the literature. The evidence-based program is a rehabilitation program that employs the principles of sports performance training to improve patients’ physical lifting capacity. The program model used herein was developed with input from orthopedic surgeons, physical therapists, athletic trainers, exercise physiologists, and bio-mechanists in order to create an optimal, evidence-based approach in building a return-to-work program. In the development of the program, research was conducted to validate the theory that improving lifting abilities in injured workers matters.

The program is individualized, based primarily around the injured worker’s presenting level of function, with an identified return-to-work end-goal in mind. Patients came to the program Mondays through Fridays for approximately 5 hours a day. Depending on the occupational demands and progress of the patient, the program generally is five weeks in duration, and less for patients with less physically demanding job classifications.

Outcomes measured included the ability to return to previous employment, physical demand level (PDL) upon return and time to return to work. The ability to return to work was determined by a formal evaluation (functional capacity evaluation) and whether or not their target PDL was achieved. The functional capacity evaluation also was used to define the physical demand level (e.g., Sedentary Work, Light Work, Medium Work, Heavy Work, and Very Heavy Work). The time to return to work was defined as the time period between the surgery and maximum medical improvement (MMI).
Descriptive statistics of arithmetic means and standard deviations were used for continuous data while discrete data were represented by frequency count and percentages. Inferential analyses included Fisher’s Exact Test, independent samples T-test, Pearson $\chi^2$ Test for Association, and Pearson Product-Moment Correlation Coefficients with $p<0.05$ as the criterion for statistical significance. All descriptive and analytic statistical examinations were conducted by hand or performed using SPSS 16.0 (SPSS, Inc., Chicago, IL).

RESULTS

From January 2009 to June 2011, 158 consecutive workers’ compensation patients were enrolled in the study following arthroscopic rotator cuff repair. The details of this sample’s demographic and historic characteristics are detailed in Table 2. The mean average age of the sample was $48.66 \pm 8.69$ years (range, 73 to 28 years). Males comprised 70.9% ($n=112$) of the group and 29.1% ($n=46$) were female. Patient-subjects represent a heterogeneous group having their ARCR done by one of 72 different orthopedic surgeons. This was followed by 4 to 8 weeks of sling immobilization. Physical therapy followed this and lasted an average of $48.01 \pm 18.99$ visits. The average number of evidence-based work conditioning/hardening program sessions was $27.29 \pm 12.74$.

Prior to incurring the injury, one patient was employed at a sedentary level of work and 8 patients had been at a light work level. Light/medium work levels accounted for 4 patients, 74 were at the medium level. Twenty-seven were at medium/heavy and 35 were classified at a heavy work level, and the remainder, 9 were at a very heavy level of work. Of the 158 patients, 150 were able to reach their same level of pre-injury work, thus accounting for a 94.9% return to work rate at the same physical demand level. When examining the time it took to achieve their maximum medical improvement, the mean average was $6.36 \pm 2.13$ months. When examining patient outcomes by work classification, it was found that there were no statistically significant differences between the preoperative work-level categories (Fig 1).

When examining the 8 patients that were not able to return to work at their previous levels following ARCR and evidence-based rehabilitation, some details were available for four of the patients with poor outcomes. In this subgroup, it was found that one patient was an outlier with a Body Mass Index of 50.9 (67” tall and weighing 325lbs) that was the likely cause of failure. Another patient had a Functional Capacity Assessment (FCA) recommended but it was not completed. One patient, who had not achieved his target PDL had a functional capacity assessment in which he fell short. As a result he was recommended to continue with the rehabilitation program, but was nevertheless did not continue with care. And the final patient for whom there was additional anecdotal data available, it was noted that while he did not achieve his goal PDL in the program there were no subjective or objective issues noted. He was released to return to work and the discharge note indicated a poor outcome and thus was categorized as such.

DISCUSSION

This study was conducted to examine the hypothesis that improving lifting abilities in injured workers translated into improved return to work performance. In a 2002 study of WC patients who were assessed at both 1-year and 2-years post-program completion indicated that 97% of those patients went back to work, with half being able to return back to their prior occupation and concomitant physical demand

Figure 1. Percentage of patients returning to work at the same physical demand level as prior to injury (NS, $p=0.779$)
Table 1. Physical Demand Definitions*

<table>
<thead>
<tr>
<th>Work Category</th>
<th>Definition</th>
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<tbody>
<tr>
<td>S-Sedentary Work</td>
<td>Exerting up to 10 pounds of force occasionally (Occasionally: activity or condition exists up to 1/3 of the time) and/or a negligible amount of force frequently (Frequently: activity or condition exists from 1/3 to 2/3 of the time) to lift, carry, push, pull, or otherwise move objects, including the human body. Sedentary work involves sitting most of the time, but may involve walking or standing for brief periods of time. Jobs are sedentary if walking and standing are required only occasionally and all other sedentary criteria are met.</td>
</tr>
<tr>
<td>L-Light Work</td>
<td>Exerting up to 20 pounds of force occasionally, and/or up to 10 pounds of force frequently, and/or a negligible amount of force constantly (Constantly: activity or condition exists 2/3 or more of the time) to move objects. Physical demand requirements are in excess of those for Sedentary Work. Even though the weight lifted may be only a negligible amount, a job should be rated Light Work: (1) when it requires walking or standing to a significant degree; or (2) when it requires sitting most of the time but entails pushing and/or pulling of arm or leg controls; and/or (3) when the job requires working at a production rate pace entailing the constant pushing and/or pulling of materials even though the weight of those materials is negligible. NOTE: The constant stress and strain of maintaining a production rate pace, especially in an industrial setting, can be and is physically demanding of a worker even though the amount of force exerted is negligible.</td>
</tr>
<tr>
<td>M-Medium Work</td>
<td>Exerting 20 to 50 pounds of force occasionally, and/or 10 to 25 pounds of force frequently, and/or greater than negligible up to 10 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Light Work.</td>
</tr>
<tr>
<td>H-Heavy Work</td>
<td>Exerting 50 to 100 pounds of force occasionally, and/or 25 to 50 pounds of force frequently, and/or 10 to 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Medium Work.</td>
</tr>
<tr>
<td>V-Very Heavy Work</td>
<td>Exerting in excess of 100 pounds of force occasionally, and/or in excess of 50 pounds of force frequently, and/or in excess of 20 pounds of force constantly to move objects. Physical Demand requirements are in excess of those for Heavy Work.</td>
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* According to the Physical Demand Definitions from the Dictionary of Occupational Titles (US Department of Commerce)

Table 2. Demographic and Historic Characteristics of Arthroscopic Rotator Cuff Repair (ACCR) Cohort

<table>
<thead>
<tr>
<th>Category (n=158)</th>
<th>Characteristic + Outcome (n=150)</th>
<th>- Outcome (n=8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age by end of program</td>
<td>48.66 +/- 8.69</td>
<td>48.32 +/- 8.67</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>70.9% (n=112)</td>
<td>73% (n=109)</td>
</tr>
<tr>
<td>Female</td>
<td>29.1% (n=46)</td>
<td>27% (n=41)</td>
</tr>
<tr>
<td>Work Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sedentary</td>
<td>1% (n=1)</td>
<td>1% (n=1)</td>
</tr>
<tr>
<td>Light</td>
<td>5% (n=8)</td>
<td>5% (n=8)</td>
</tr>
<tr>
<td>Light/Medium</td>
<td>3% (n=4)</td>
<td>2% (n=3)</td>
</tr>
<tr>
<td>Medium</td>
<td>47% (n=74)</td>
<td>47% (n=71)</td>
</tr>
<tr>
<td>Medium/Heavy</td>
<td>17% (n=27)</td>
<td>17% (n=26)</td>
</tr>
<tr>
<td>Heavy</td>
<td>22% (n=35)</td>
<td>21% (n=32)</td>
</tr>
<tr>
<td>Very Heavy</td>
<td>6% (n=9)</td>
<td>6% (n=9)</td>
</tr>
<tr>
<td>Return to Work at Pre-Injury Level</td>
<td>Yes, 94.9% (n=150)</td>
<td>No, 4.9% (n=8)</td>
</tr>
</tbody>
</table>
level. Additionally, re-injury rates were assessed for these patients two years following program completion and were found to be rare and occurred less frequently with greater physical demand jobs.

The findings of this study were compared to that of Bhatia et al., with respect to whether the participants were able to return to work by the end of the study, as well as the recovery time required for them to do so. As the raw data for Bhatia’s results were unavailable, the comparisons were made based on provided descriptive statistics. Fisher’s Exact Test was used for comparison of whether the injured workers were able to return to work. Of the 158 candidates in this study, 150 (94.9%) were able to return to work, while Bhatia et al. observed a return rate of 69 of 78 (88.4%). The results of this test approached statistical significance (p=0.064), it did not achieve the α = .05 level of significance. This suggests that participation in an evidence-based program did not result in a statistically significant increase in the proportion of employees returning to work, albeit a higher level, and quite close to strict statistical significance.

Time to return to work was compared between the findings of this study and the Bhatia et al. results using independent samples T-test, based on the means and standard deviations. This analysis involved reduced samples, as only candidates who returned to work could be included. The participants in the evidence-based program had a faster mean return to work time than the comparison group (M=6.36, SD=2.13 months vs. M=7.60, SD=1.87, respectively). This analysis achieved statistical significance, t(149) = –4.36, p<0.001, suggesting that the evidence-based program was beneficial for reducing the amount of recovery time needed.

The second set of analyses examined the impact of candidate characteristics on the two criteria of interest. Sex, age, and physical demand level (PDL) of the job were included as comparisons; due to differences in levels of measurement, a variety of analyses must be used. A Pearson χ² Test for Association identified a significant interaction between sex and returning to work, χ²(1) = 4.551, p=0.033. However, these results should be interpreted with care, as the small number of subjects who were unable to return to work resulted in a violation of the assumptions of the test. An inverse correlation was also found between returning to work and age, r=−0.17, p=0.033, suggesting that older workers are less likely to return to work after arthroscopic rotator cuff repair and rehabilitation. PDL was not found to significantly impact either return to work or time to recovery. That is, there was no indication of a differential impact on returning to work based on how physically demanding the pre-injury job demands were, or the speed in which they returned to work following completion of the evidence-based program.

While other recent work has initiated inquiry as to the largest case series of ARCRs conducted a population of injured workers, the examination herein is the largest to date case series of a similar population of workers’ compensation patients having had ARCR, but in addition, completed an evidence-based rehabilitation program. In this study of a 158 patients, the findings indicate a 94.9% return to work at their prior level of functioning within 6.19 months postoperatively, regardless of surgeon, tear size, or comorbidity.

Surgery is a critically necessary albeit costly intervention in the treatment course of full-thickness tears of the rotator cuff. Arthroscopic procedures have benefits of decreased post-operative infection rates and fasten healing time. It would seem that the role of arthroscopic procedures in the repair of shoulder injuries is also well supported in the literature, however it is the pioneering work of researchers like Bhatia, et al that bring the examination into the domain of the injured worker population. Their findings also suggest that such beneficial outcomes of getting WC patients back to work in their same job classification can occur more quickly and for more patients following ARCR, and these superlative outcomes can be further augmented if an evidence-based post-operative rehabilitation program is employed.

Indeed, in this work at hand, it would appear that enhanced results can occur that are agnostic to surgeon-based factors of expertise or seniority, as long as the procedure is arthroscopic. Heterogeneity of the surgeon performing the procedure actually adds to the generalizability of the findings of the efficacy of ARCR augmented by an evidence-based rehabilitation program.

It has been noted in the literature that when investigating the population of workers’ compensation patients, that the outcome of returning to work co-varies with a number of other aspects. They can include what state a worker is employed in (due to differences in the law), regional practice pattern variations, levels of family income, available social support to the patient, economic factors such as unemployment and recessionary periods, psychological...
aspects (e.g., fear-avoidance, substance abuse, mood disorders), and so on.²³ All of these factors conspire to limit the overall generalizability of any study’s findings, and thus should be kept in mind. Having noted this it is nevertheless important in the differential therapeutic decision making process for healthcare providers and case managers alike to be well informed as to the state of the literature on relevant outcomes when making treatment decisions as well as informing the injured worker (and perhaps employer) and establishing appropriate treatment expectations.

Additional limitations in studies such as this include the fact that there was not a comparison group of patients with like-injuries and treatment but who were not injured workers. However, such is not directly appropriate, as by definition, that cohort would not undergo a return to work rehabilitation program. The best comparison comes from the recent literature in the study by Bhatia, et al⁹ which served as a model for this study. The fundamental difference being that the study herein augmented the ARCR procedures with the addition of an evidence-based work rehabilitation program.

A unique aspect of this study was that it was the first of its kind to examine a population of workers’ compensation patients having had both ARCR procedure and undergone an evidence-based rehabilitation program. Our results indicate that such a group has a 94.9% return to work rate within 6.19 months. And again, the authors herein recommend that the decision for the patient to return to work be based on a formal evaluation process such as a functional capacity assessment or evaluation rather than the more subjective opinion of the physician.

This study has avoided contamination that could be present vis-à-vis patient expectations or biases of patient self-selection. Albeit a retrospective design with the concomitantly associated weakness, it is believed that such an approach is the most fitting and has the least amount of drawbacks.

**CONCLUSION**

A rapid return to work at a like-level of physical demand and ability for workers experiencing a torn rotator cuff seems highly probable if they undergo an arthroscopic rotator cuff procedure. Complications and infection rates are also mitigated by this approach. Furthermore, if an evidence-based rehabilitation protocol is instituted post-operatively, there can be additional beneficial gains expected such as potentially higher return to work rates that occur in a shorter amount of time.

While not directly addressed in this study, it is also important to note in WC populations delays in accessing surgical intervention or other aspects of care or the premature or arbitrary discontinuation of care, can result in iatrogenic exacerbations of symptoms that lead to poor outcomes, increased costs, and worsened disability.

When there is a scientific literature that suggests that there are indeed optimal approaches that exist that benefit all parties involved in workers’ compensation (injured employee, employer, attorneys, case managers, etc.) it is of critical import that it informs care direction and case management.

**REFERENCES**

CONTINUED FROM PAGE 9


CME QUESTIONS FILE

THE FOLLOWING QUESTIONS ARE BASED ON THE FORGOING ARTICLES:
Return-to-Work Outcomes in Lumbar Fusion Cases Following An Evidence-Based Post-surgical Rehabilitation

Please pick the best answer of the 4 possible answers from the following.

1. The annual growth rate in spinal fusion procedures performed in US over the past 3 decades is:
   a) 5-10%
   b) 20-25%
   c) 18-20%
   d) 16-18%

2. The benefit of EbSpWC/WH program for the injured WC patients of lumbar fusion is:
   a) To return to work.
   b) To improve the ability to function at the previous PDL
   c) To manage daily living
   d) To get the ability to RTW at any PDL

3. The % of WC patients who could return to work at the prior PDL after participating in EbSpWC/WH program is:
   a) 63%
   b) 68%
   c) 64%
   d) 82%

4. Work Hardening program is:
   a) Single disciplinary treatment approach to address physical needs
   b) Multi disciplinary model of care to address physical, functional, behavioral and vocational needs.
   c) Single disciplinary treatment approach to address functional needs
   d) Bi-disciplinary treatment approach to address physical and functional needs

5. Minimum number of sessions of EbSpWC/WH program to be attended to achieve a higher and faster level of RTW at the prior PDL is:
   a) 2
   b) 6
   c) 10
   d) 12

6. General criteria used to determine when patients are ready for transition to EbSpWC/WH program are:
   a) Carry 20-30# to 100 ft
   b) Lift 20# from floor to waist level
   c) Overhead lift 10#
   d) Do all the above

Earlier Return-to-Work in Post-Arthroscopic Rotator Cuff Repair Patients Following an Evidence-Based Rehabilitation Program

Please pick the best answer of the 4 possible answers from the following.

1. Which of the following will have a positive effect on return to work rate:
   a) Arthroscopic intervention of full-thickness rotator cuff tears
   b) Post-operative rehabilitation
   c) Evidenced-based work conditioning/work hardening program implementation
   d) All of the above

2. A rapid return to work at a like-level of physical demand and ability for workers experiencing a torn rotator cuff seems highly probable if they:
   a) keep taking acetaminophen or ibuprofen for 3-month
   b) keep making a hot compress at home for 6-month
   c) undergo an arthroscopic rotator cuff procedure
   d) Unknown, there is little in the literature on this aspect.
3. When examining the patients who were not able to return to work at their previous level following ARCR and evidence-based rehabilitation, which of the following could be the likely cause of failure:
   a) A high-outlier BMI 
   b) Somnipathy 
   c) Type II Diabetes 
   d) Alcohol dependence

4. Out of 158 patients who were enrolled in the study of “arthroscopic rotator cuff repair” the % of those who could return to work at the same PDL is:
   a) More than 98% 
   b) More than 90% 
   c) Less than 85% 
   d) Less than 75%

5. In the study on arthroscopic rotator cuff repair, the factor found that does not have significant impact on ability to RTW or the time to recovery is:
   a) Sex 
   b) PDL 
   c) Age 
   d) None of the above

6. In the study on arthroscopic rotator cuff repair the findings indicate that, regardless of surgeon, tear size, or comorbidity the post operative time taken by most of the patients to RTW at their original PDL is:
   a) 3 months 
   b) 5 months 
   c) 7 months 
   d) 2 weeks

**ANSWER KEY FOR CME QUESTIONS FROM DISABILITY MEDICINE VOL 9, #1**

**Questions on page 3: Return-to-Work Outcomes in Non-operative Lumbar Cases Following an Evidence-Based Post-surgical Rehabilitation Program**
1. B, 2, C, 3, B, 4, C, 5, A, 6, B, 7, D, 8, C

**Questions on page 26: AMA Guidelines and The 2011 Amendments To The Illinois Workers’ Compensation Act**
1, D, 2, B, 3, D, 4, B, 5, C, 6, C

**Questions on page 10: An Evidence-Based Approach to Improved Return-To-Work Outcomes in Cervical Disk Fusions in a Workers’ Compensation Population**
1, B, 2, A, 3, B, 4, C, 5, B, 6, D

**Questions on page 16: Return-to-Work Outcomes in Anterior Cruciate Ligament Reconstruction Cases Following an Evidence-Based Post-surgical Rehabilitation Program**
1, A, 2, C, 3, B, 4, D, 5, C, 6, D
1. Exercise Benefits vs. Joint Concerns

Abstract

**Background:** Mechanical joint stress imposed by high body mass index (BMI) is associated with increased risk of knee and hip osteoarthritis. This prospective study investigated the independent and joint association of BMI and physical exercise on risk of knee and hip osteoarthritis.

**Methods:** The study includes 15,191 women and 14,766 men in the Norwegian HUNT Study without pain or physical impairment at baseline. Occurrence of self-reported physician-diagnosed osteoarthritis was assessed at 11 years of follow-up.

**Results:** BMI was positively related to risk of knee osteoarthritis (Ptrend<0.001), with an RR of 4.37 (95% CI 3.01 to 6.33) in women and 2.78 (95% CI 1.59 to 4.84) in men, comparing obese and normal weight persons. No clear association was observed for hip osteoarthritis. Obesity increased the risk of severe activity-limiting osteoarthritis, with an RR of 2.30 (95% CI 1.68 to 3.15) and 2.50 (95% CI 1.56 to 4.03) in women and men, respectively. Physical exercise did not modify the above associations (Pinteraction>0.34). Exercise intensity was not associated with risk of osteoarthritis in any BMI category; that is, obese persons reporting high-intensity exercise had an RR of 1.28 (95% CI 0.59 to 2.79) for severe osteoarthritis compared with inactive persons.

**Conclusion:** High BMI increases the risk of knee osteoarthritis and severe osteoarthritis. Physical exercise does not increase the risk of osteoarthritis at any level of BMI, suggesting that exercise could be encouraged also among individuals with excessive body mass, without concern for an increased risk of osteoarthritis.

**URL:** http://jch.bmj.com/content/early/2012/04/16/jech-2011-200834.abstract


2. Nitroglycerin and Bones

Abstract

**Context:** Nitroglycerin stimulates bone formation and inhibits bone resorption, is inexpensive, and is widely available. Its effects on bone density, bone structure, and bone strength are unknown.

**Objectives:** To determine if nitroglycerin increases lumbar spine bone mineral density (BMD) and to evaluate changes in hip BMD, bone geometry, and density at the radius and tibia, and markers of bone turnover.

**Design, Setting, and Participants:** A single-center, double-blind, placebo-controlled randomized trial conducted in Toronto, Ontario, Canada, for 24 months starting in November 2005 and completed in March
2010, of 243 postmenopausal women with lumbar spine T scores of between 0 and −2.0 who completed a 1-week run-in period taking nitroglycerin ointment.

**Intervention:** Nitroglycerin ointment (15 mg/d) or placebo applied at bedtime for 24 months.

**Main Outcome Measures:** Areal BMD at the lumbar spine, femoral neck, and total hip. Secondary outcomes included indices of bone geometry and strength at the distal radius and tibia, and biomarkers of bone formation (bone-specific alkaline phosphatase) and bone resorption (urine N-telopeptide).

**Results:** At 2 years, women randomized to the nitroglycerin group had significant increases in areal BMD at the lumbar spine (from 1.05 to 1.14 g/cm² vs placebo from 1.06 to 1.08 g/cm²; percentage change, 6.7%; 95% confidence interval [CI], 5.2%-8.2%; P < .001); total hip (from 0.92 to 0.97 g/cm² vs placebo from 0.93 to 0.92 g/cm²; 6.2%; 95% CI, 5.6%-7.0%; P < .001); and femoral neck (from 0.88 to 0.93 g/cm² vs placebo from 0.87 to 0.86 g/cm²; 7.0%; 95% CI, 5.5%-8.5%; P < .001). At 2 years, nitroglycerin also increased volumetric trabecular BMD (11.9% and 8.5%), cortical thickness (13.9% and 24.6%), peristomal circumference (7.4% and 2.9%), polar section modulus (10.7% and 9.8%), and polar moment of inertia (7.3% and 14.5%) at the radius and tibia, respectively (all P < .001); and increased bone-specific alkaline phosphatase by 34.8% and decreased urine N-telopeptide by 54.0% (P < .001). Incidence of serious adverse events did not differ between nitroglycerin (5 [4.2%]) and placebo (5 [4.3%]) groups. Among those women who continued treatment for 24 months, headaches were reported by 40 (35%) in nitroglycerin and 6 (5.4%) in placebo groups during the first month, decreasing substantially after 12 months.

**Conclusion:** Among postmenopausal women, nitroglycerin ointment modestly increased BMD and decreased bone resorption.


### 3. Knee biomarker

**Abstract**

**Background:** Molecular biomarkers associated with knee pain may be useful as diagnostic modalities, prognostic indicators, and surrogate end points for therapeutic trials. The present study describes a novel complex of fibronectin and aggrecan that is present in the affected knee of patients with pain and meniscal abnormality.

**Methods:** The present prospective study included thirty patients with knee pain, mechanical symptoms, and magnetic resonance imaging findings that were positive for a meniscal tear who chose arthroscopic partial meniscectomy after unsuccessful nonoperative management. Synovial fluid was aspirated at the time of surgery and was assayed for the fibronectin-aggrecan complex with use of a heterogeneous enzyme-linked immunosorbent assay (ELISA). The results were compared with knee aspirates from ten asymptomatic volunteers with no pain who underwent magnetic resonance imaging of the knee.

**Results:** The mean optical density (and standard deviation) of the fibronectin-aggrecan complex was significantly greater in synovial fluid from knees undergoing arthroscopic surgery as compared with fluid from asymptomatic controls (13.29 ± 8.48 compared with 0.03 ± 0.09; p < 0.001). The mean age in the study group was significantly greater than in control group (46.0 ± 12.6 compared with 38.5 ± 6.0 years; p = 0.02), but controlling for age did not affect the results. Post hoc, an optical density cutoff value of 0.3 distinguished the study group from the control group with 100% accuracy.

**Conclusions:** A novel fibronectin-aggrecan complex is present in the synovial fluid of painful knees with meniscal abnormality. The fibronectin-aggrecan complex may prove to be useful as a clinical biomarker or therapeutic target. Further research is warranted to correlate functional outcome after surgery with the fibronectin-aggrecan complex and other cartilage biomarkers.

**Level of Evidence:** Diagnostic Level IV. See Instructions to Authors for a complete description of levels of evidence.

4. Damage and compensation for sedentary time biomarker

Abstract

Aims Prolonged sedentary time is ubiquitous in developed economies and is associated with an adverse cardio-metabolic risk profile and premature mortality. This study examined the associations of objectively assessed sedentary time and breaks (interruptions) in sedentary time with continuous cardio-metabolic and inflammatory risk biomarkers, and whether these associations varied by sex, age, and/or race/ethnicity.

Methods and Results: Cross-sectional analyses with 4757 participants (≥20 years) from the 2003/04 and 2005/06 US National Health and Nutrition Examination Survey (NHANES). An Actigraph accelerometer was used to derive sedentary time [<100 counts per minute (cpm)] and breaks in sedentary time. Independent of potential confounders, including moderate-to-vigorous exercise, detrimental linear associations (P for trends <0.05) of sedentary time with waist circumference, HDL-cholesterol, C-reactive protein, triglycerides, insulin, HOMA-%B, and HOMA-%S were observed. Independent of potential confounders and sedentary time, breaks were beneficially associated with waist circumference and C-reactive protein (P for trends <0.05). There was limited evidence of meaningful differences in associations with biomarkers by age, sex, or race/ethnicity. Notable exceptions were sex-differences in the associations of sedentary time and breaks with HDL-cholesterol, and race/ethnicity differences in the association of sedentary time with waist circumference with associations detrimental in non-Hispanic whites, null in Mexican Americans, and beneficial in non-Hispanic blacks.

Conclusion: These are the first population-representative findings on the deleterious associations of prolonged sedentary time with cardio-metabolic and inflammatory biomarkers. The findings suggest that clinical communications and preventative health messages on reducing and breaking up sedentary time may be beneficial for cardiovascular disease risk.

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
JDM Manuscript Submission Guidelines

The Journal of Disability Medicine (JDM) is 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. The journal includes articles and commentaries on topics of interest in disability medicine and related areas of law and policy. It also addresses issues in disability medicine research and education and a broad range of other related topics, providing authoritative and comprehensive coverage of the growing field of disability medicine.

Manuscripts must not be under simultaneous consideration by any other publication, before or during the peer-review process. Articles published in the JDM may not be published elsewhere without written permission from the publisher.

Manuscripts should cite any other work by one or more of the co-authors that is relevant to the subject matter of the current submission or that used any of the same subjects, being reported in the current submission. This includes manuscripts that are currently under preparation, are being considered by journals, are accepted for publication, or already published. In any of these cases, the relationship to the current submission should be made clear.

Articles intended for the “Current Perspectives” section of the JDM are solicited by the acquisitions editor, Chris E. Stout, PsyD, (chris.stout@atipt.com). Please do NOT submit articles for this section without prior approval of the topic by Dr. Stout; a query letter should be sent to Dr. Stout regarding proposed material, guest editors, or suggestions for this section.

Submissions

Authors should submit manuscripts to Dr. Stout at chris.stout@atipt.com

When manuscripts have been received by the editorial office, the corresponding author will be sent an acknowledgment giving an assigned manuscript number, which should be used with all subsequent correspondence for anything related to that particular manuscript.

The following items are required for submission:

1. Blinded manuscript including the abstract and figures legends. No identifying information should appear in this manuscript. Please remove author names, initials, and institutions.

2. Journal Contributor Publishing Agreement and the JDM Author Disclosure Statement. These forms are available by request from Dr. Stout. The corresponding author must complete the forms and return them to JDM by e-mail.

3. A copy of the IRB or other agency approval if human subjects or health information were used.

Cover letter, acknowledgments, and suggested reviewers are optional. If a paper has more than 5 authors, a cover letter detailing the contributions of all authors should be included. Only those involved in writing the paper should be included as coauthors. Others should be listed as a footnote or acknowledgment. While there is no limit on the number of authors, no more than 12 will be listed on the masthead of the published article; additional authors will be listed at the end of the article.

Manuscript Formats

Manuscript pages should be double-spaced with consecutive page numbers and continuous line numbers. The abstract should be included with the manuscript. Manuscripts should be 6000 words or fewer (including abstract and references). There are also limitations on figures, tables, and references; see guidelines below. Word format is preferred.

Manuscript Preparation

Abstract: Abstracts should summarize the contents of the article in 350 words or less. The abstract should be structured in the following format:

Background: In one or two sentences, summarize the scientific body of knowledge surrounding your study
and how this led to your investigation.

**Hypothesis/Purpose:** State the theory(ies) that you are attempting to prove or disprove by your study or the purpose if no hypothesis exists.

**Study Design:** Identify the overall design of your study. See list below.

**Methods:** Succinctly summarize the overall methods you used in your investigation. Include the study population, type of intervention, method of data collection, and length of the study.

**Results:** Report the most important results of your study. Only include positive results that are statistically significant, or important negative results that are supported by adequate power. Report actual data, not just P values.

**Conclusion:** State the answer to your original question or hypothesis. Summarize the most important conclusions that can be directly drawn from your study.

**Clinical Relevance:** If yours was a laboratory study, describe its relevance to disability medicine.

**Key Terms:** Provide at least 4 key words for indexing.

**What is known about the subject:** Please state what is currently known about this subject to place your study in perspective for the reviewers.

**What this study adds to existing knowledge:** Please state what this study adds to the existing knowledge.

The last two items are for reviewers only and are not included in the word count, but should appear at the end of the abstract in the uploaded text.

**Study Designs**

**Meta-analysis:** A systematic overview of studies that pools results of two or more studies to obtain an overall answer to a question or interest. Summarizes quantitatively the evidence regarding a treatment, procedure, or association.

**Systematic Review:** An article that examines published material on a clearly described subject in a systematic way. There must be a description of how the evidence on this topic was tracked down, from what sources and with what inclusion and exclusion criteria.

**Randomized Controlled Clinical Trial:** A group of patients is randomized into an experimental group and a control group. These groups are followed up for the variables/outcomes of interest.

**Crossover Study Design:** The administration of two or more experimental therapies one after the other in a specified or random order to the same group of patients.

**Cohort Study:** Involves identification of two groups (cohorts) of patients, which did receive the exposure of interest, and one which did not, and following these cohorts forward for the outcome of interest.

**Case Series:** Describes characteristics of a group of patients with a particular disease or who have undergone a particular procedure. Design may be prospective or retrospective. No control group is used in the study, although the discussion may compare the results to other published outcomes.

**Case Report:** Similar to the case series, expect that only one or a small group of cases is reported.

**Descriptive Epidemiology Study:** Observational study describing the injuries occurring in a particular sport.

**Controlled Laboratory Study:** An in vitro or in vivo investigation in which 1 group receiving an experimental treatment is compared to 1 or more groups receiving no treatment or an alternate treatment.

**Descriptive Laboratory Study:** An in vivo or in vitro study that describes characteristics such an anatomy, physiology, or kinesiology of a broad range of subjects or a specific group of interest. Authors should choose the design that best fits the study.

The Editor will make the final determination of the study design and level of evidence based on the Center of Evidence Based Medicine guidelines.
Text

In general, follow the standard IMRAD (Introduction, Materials and Methods, Results, Discussion) format for writing scientific articles. The author is responsible for all statements made in the work, including copyeditor changes, which the author will have an opportunity to verify. **Papers including human subjects must include a statement of approval by appropriate agencies in the text, and a copy of the approval letter must be uploaded with the submission.** The institution should not be mentioned in the blinded manuscript, but should be added on acceptance.

Use generic names of drugs or devices. If a particular brand was used in a study, insert the brand name along with the name and location of the manufacturer in parentheses after the generic name when the drug or device is first mentioned in the text.

Use metric units in measurements (centimeter vs. inch, kilogram vs. pound).

Abbreviations should be used sparingly. When abbreviations are used, give the full term followed by the abbreviation in parentheses the first time it is mentioned in the text, such as femur-ACL-tibia complex (FATC).

Use of a CONSORT flow diagram is recommended to illustrate the grouping and flow of patients in all clinical studies, whether randomized clinical trials or otherwise. See www.consort.com for further details.

Statistical methods should be described in detail. Actual P values should be used unless less than .001. Reporting of 95% Confidence Intervals is encouraged.

Acknowledgment

Type the acknowledgments in the box provided on the submission page. Give credit to technical assistants the professional colleagues who contributed to the quality of the paper but are not listed as authors. Please briefly describe the contributions made by persons being acknowledged.

References

References should be double-spaced and comply with the AMA manual. Check style in the 10th edition. Except for review articles, references should be limited to 60. When author entries are the same, alphabetize by the first word of the title. In general, use the Index Medicus form for abbreviating journal titles and the AMA Manual of Style (10th ed) for format. Note: References must be retrievable. Do not include in the reference list meeting presentations that have not been published. Data such as presentations and articles that have been submitted for publication but have not been accepted must be put in the text as unpublished data immediately after mention of the information (for example, “Smith and Jones (unpublished data, 2000) noted…”). Personal communications and other references to unpublished data are discouraged. For review purposes, unpublished references that are closely related to the submitted paper or are important for understanding ti should be uploaded as supplemental files.

References will be linked to Medline citations for the reviewers. To ensure that the references are linked correctly please provide the PMID number from Medline at the end of the reference.

For further help with AMA style please look at the following websites:

http://healthlinks.washington.edu/hsl/style-guides/ama.html
http://www.docstyles.com/amastat.htm

Generally, references should not be older than five years. Try to limit references to 25 because of space constraints. Use primary references whenever possible. Do not use reference material available only online and only by subscription; most readers will not be able to access it without paying a fee. If you use an article that appears in a subscription journal that is available both online and in print, include both the URL and the print reference information ac-
according to AMA style (see reference examples below). That way, readers without a subscription can access the article without cost at a library. Number the footnotes consecutively in the text. Once a citation has a number, it keeps it throughout the narrative, and it should correspond to the numeric order of the reference list. For examples of this style see the following:

**Reference Guidelines**

**General Rules**

1. Use AMA style. (Refer to AMA Manual of Style, 10th edition.)

2. List footnoted citations under a "Reference" heading. Number citations consecutively in the text. Once a citation has a number, it keeps it throughout the narrative.

3. List general references not specifically cited in the text under a "Bibliography" heading.

4. Abbreviate journal names according to AMA style. (i.e., according to the National Library of Medicine abbreviations. For more information go to www.nlm.nih.gov/pubs/factsheets/constructitle.html).

**Examples of Citations**

- Up to six authors, list all

- More than six authors, list first three, et al.

- Books

- Books (chapter in edited book)

  - CDs, Audiotapes, videotapes

  - Online material
    In citing data from a website, include the following elements (if available) in the order shown: Author(s), if given (often no authors are given). Title of the specific item cited (if none is given, use the name of the organization responsible for the site). Name of the website site. URL [provide URL and verify that the link still works as close as possible to publication]. Published [date]. Updated [date]. Accessed [date].

    - Examples of online material:
      **Online journals**

      **Websites**

      - Dissertation or master’s thesis

      - Newspapers
        Include author (if given), title, name of newspaper, date of newspaper, section (if applicable), and pages. Newspaper titles are not abbreviated:
Steinmetz G. Kafka is a symbol of Prague today; also, he’s a T-shirt. Wall Street Journal. October 10, 1996; A2, A6.

• Poster

Clawson LL. Treatment and research perspectives in amyotrophic lateral sclerosis: implications for nurses. Poster presented at: American Association of Neuroscience Nurses Annual Meeting, 1997, Houston, TX

Figures and Tables

Figures and tables should not exceed 3 journal pages. One journal page equals 1 large table or figure, 2 medium-sized tables or figures, or 4 small tables or figures. Medium-sized tables and figures will be a page width and half the length of the page; small tables and figures are 1-column width and take up half the length of the page or less. Any materials that is submitted with an article that has been reproduced from another source (that is, has been copyrighted previously) must conform to the current copyright regulations. It is the author’s responsibility to obtain written permission for reproduction of copyrighted material and for providing the editorial office with that documentation before the material will be reproduced in the Journal.

Be sure to include figure legends in the text, to include figure legends in the text. The figure legend should include descriptions of each figure part and identify the meaning of any symbols or arrows. Terms used for labels and in the legend must be consistent with those in the text.

All figures such as bar graphs and charges should be submitted in black and white.

Figures for papers accepted for publication must meet the image resolution requirements of the publisher. Files for line-based drawings (no grayscale) should ideally be submitted in the format they were originally created.

Charts and graphs can be submitted in the original form created (e.g., Word, Excel, or PowerPoint). Photographs or scanned drawings embedded in Word or PowerPoint are not acceptable for publication. If figures are embedded in the submitted manuscript for ease of reading they should also be submitted as separate files for use in the publication process.

All photographs of patients that disclose their identity must be accompanied by a signed photographic release granting permission for their likeness to be reproduced in the article. If this is not provided, the patient’s eyes must be occluded to prevent recognition.

Tables should be numbered consecutively and have a title that describes the content and purpose of the table. Tables should enhance, not duplicate, information in the text.

Accepted Manuscripts

Once an article is accepted and typeset, authors will be required to carefully read and correct their manuscript proofs that have been copyedited by the publisher. Any extensive changes made by authors on the proofs will be charged to authors at the rate of $2 a line. Authors are responsible for ordering reprints of their articles; a reprint order form is provided with the page proofs. Completed articles will be published on our website before print publication.

NIH-Supported Studies

Authors of studies funded by grants from the National Institutes of Health can deposit a copy of their accepted final peer-reviewed manuscript and associated figure/table files (pre-typeset versions) to the NIH database after a 12-month embargo period from the time their article is published in the JDM.

Levels of Evidence

Evidence-based practice is a conscientious, problem-solving approach to clinical practice that incorporates the best evidence from well-designed studies, patient values and preferences, and a clinician’s expertise in making decisions about a patient’s care. Unfortunately, no standard formula exists for how much these factors should be weighed in the clinical decision making process. However, there are a variety of rating systems and hierarchies of evidence that grade the strength or quality of evidence generated from a research study or report. Being knowledgeable about evidence-based practice, and levels of evidence, is important to every clinician as clinicians need to be confident about how much emphasis they should place on a
study, report, practice alert or clinical practice guideline when making decisions about a patient’s care.

**Gannett Education’s Rating System:**

The levels of evidence listed here have been developed with the help of nurse experts and other industry resources. We thank those who have contributed to making our system relevant and applicable to determining the levels of evidence that support our CE publications.

Evidence-based information ranges from Level A (the strongest) to Level C (the weakest):

**Level A: Evidence obtained from:**

- **Randomized control trials:** the classic “gold standard” study design. In RCTs, subjects are randomly selected and randomly assigned to groups to undergo rigorously controlled experimental conditions or interventions.

- **Systematic review or meta-analysis** of all relevant RCTs. A systematic review is a critical assessment of existing evidence that addresses a focused clinical question, includes a comprehensive literature search, appraises the quality of studies and reports results in a systematic manner. Meta-analysis: a study design that uses statistical techniques to combine and analyze data from many RCTs.

- **Clinical practice guidelines:** based on systematic reviews of RCTs. Evidence based clinical practice guidelines provide the strongest level of evidence to guide clinical practice because they are based on rigorous reviews of the best evidence on specific topics.

**LEVEL B: Evidence obtained from:**

- **Well-designed control trials without randomization:** In this type of study, random assignment is not used to assign subjects to experimental and control groups. Therefore, this type of research is less strong in internal validity because it can’t be assumed the subjects in the study are equal on major demographic and clinical variables at the beginning of the trial. Frequent problems with this type of study include intentional or unintentional bias in sample enrollment; nonblinding, unclear criteria for participant selection; or unreliable or invalid tools.

- **Clinical cohort study:** an examination of groups of people who have common characteristics or exposure experiences to compare outcomes in those exposed vs. outcomes in those not exposed (e.g., development of heart disease after exposure or nonexposure to 10 years of secondhand smoke).

- **Case-controlled study:** use of an observational approach in which subjects known to have a disease or outcome are compared with subjects known not to have that disease or outcome. Subjects are matched on characteristics so that they are as similar as possible except for the disease or outcome. Case-control studies are generally designed to estimate the odds (using an odds ratio) of developing the studied condition or disease and can determine if an associated relationship exists between the condition/disease and risk factors.

- **Uncontrolled study:** studies that do not control participant selection or interventions (e.g., a convenience sample, such as patients on a given unit, may be studied because it’s the only group reasonably available).

- **Epidemiological study:** studies that observe people over a long time to determine risk or likelihood of developing diseases. These studies include retrospective database searches or prospective studies that follow a population over time.

- **Qualitative study/quantitative study:** descriptive, word-based phenomena, such as symptoms, behaviors, culture and group dynamics. Quantitative studies use statistical methods to establish numerical relationships that are correlational or cause and effect.

**LEVEL C: Evidence obtained from:**

- **Consensus viewpoint and expert opinion:** a study that obtains agreement about specific practices from all clinical experts on a review panel. Expert opinion involves obtaining agreement from a majority of clinical experts on a review panel. Note: This level of evidence is used when there are no quantitative or qualitative studies in a particular area.
Meta-synthesis: a systematic review that synthesizes findings from qualitative studies using an interpretive technique to bring small study findings, such as case studies, to clinical application.

Evidence-based Practice Resources:
Agency for Healthcare Research and Quality Evidence-based Practice Centers (www.ahrq.gov/clinic/epc)

The Cochrane Collaboration:
Cochrane Reviews (www.cochrane.org/cochrane-reviews)

Evidence-based healthcare
(www.cochrane.org/about-us/evidence-based-health-care)

National Guideline Clearinghouse:
(www.guideline.gov/index.aspx)

References for EBP:


CME Questions and Answers

JDM provides CME credits based upon scientific articles it publishes. Please provide along with your manuscript six multiple-choice questions with four responses each, with an answer key and an indicator of where the corresponding answers are located in the body of the document.

One to five points of explanation for the correct answer of each of the six exam questions. The points of explanation should not be a restatement of the answer — rather new information related to the content in the module and to what the question is covering. Your explanation points should be succinct.

For example:
1. Three risk factors for suicide include —
   a. Male gender, alcoholism and depression.
   b. Female gender, married and high income.
   c. Female gender, living in a city and on welfare.
   d. Female gender, physical illness and three children.
   Correct answer: a

Explanation/Rationale
1. Males complete suicide at a rate four times that of females.
2. The risk of suicide in alcoholics is 50% to 70%
higher than in the general population.

3. A relationship exists between depression and suicide: The risk of suicide is increased by more than 50% in depressed people.

**Tips for Writing Test Questions**

- Keep the questions and answers brief: a maximum of 350 words total.
- Make all questions multiple choice with four possible options, “a,” “b,” “c” and “d.”
- Remember that test questions should measure mastery of the objectives. After you have written the test, check that it includes questions relating to each objective.
- Make sure the correct option is derived from the narrative and defensible as the best answer.
- Be certain that the three incorrect options are plausible.
- Do not write “multiple-multiple” questions, that is, those that present a list of options, then ask the test taker to choose “a and b,” “a, b and c,” etc.
- Avoid the options “None of the above” and “All of the above”. Also, do not phrase questions in the negative, for example, using “all of the following EXCEPT.”
- Limit yourself to one question that involves statistics, number of cases or the like. Examples: “What percentage of ventilated patients develop ventilator-associated pneumonia?” “How many cases of HIV/AIDS were recorded in the U.S. in 2008?” “What is the prevalence of migraine among U.S. women?”
- Use the same terminology in the test as in the narrative. (For example, if the narrative refers only to “hypertension,” use “hypertension,” not “high blood pressure,” in the test.)
- Be sure the order of questions matches the sequence of information in the narrative, e.g., question No. 1 should correspond to the information appearing in the narrative first.
- Avoid using words in the correct option that are also found in the stem (the first part of the question). Doing so provides “clues” to the correct answer.
- Make sure options are not mutually exclusive. For example, if option “a” reads, “Slows the heart rate,” and option “b” reads, “Increases the heart rate,” these two options are mutually exclusive. The test taker can be reasonably certain that “c” and “d” are extraneous, and that either “a” or “b” is the correct answer.
- Be sure that one or more of your options are not included in another option. For example, if option “a” reads, “Affects the heart rate,” and option “b”
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2013 Education and Certification Examination Schedule

- Orlando, FL   March 20-23, 2014
- Columbus, OH   March 28-29, 2014
- Johannesburg, South Africa   May 3-4, 2014
- Chicago (Bolingbrook), IL   May 16-18, 2014
- Brisbane, Australia   June 6-8, 2014
- Las Vegas, NV   October 23-26, 2014

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