OCCUPATIONAL HEALTH

SPECIAL INTEREST GROUP

Greetings OHSIG Members!

A FEW EXCITING UPDATES FROM THE OCCUPATIONAL HEALTH SIG

Opportunity for Member Participation

We hope some of you responded to the survey that was sent asking for participation for authors with expertise in occupational health and an interest in writing a monograph to be included as part of an independent study course produced by the Orthopedic Section, APTA. The course will be comprised of a total of 6 monographs.

A survey was sent to all OHSIG members. We hope this was of interest to some of you. Responses were to be sent to OHSIG VP/Ed Chair, Lorena Pettet Payne, lpettet@aol.com.

Thank you to Rick Wickstrom, PT, DPT, CPE, CDMS

A huge thank you to Rick Wickstrom, OHSIG, for his passion and involvement with the OIDAP over the past several months. The OIDAP provided a summary report in light of the disbandment of the task force. Rick has attended meetings on our behalf and has played a key role with many stakeholders. In addition Rick provided feedback on behalf of the OHSIG to APTA related to the inclusion of work information in the electronic health record (EHR). The NIOSH, CDC, and HHS are requesting public comments on the potential inclusion of work information in the electronic health record (EHR). Karen Jost reached out to the OHSIG and feedback was provided.

Are you able to attend the First International FCE Research Meeting in the Netherlands?

The First International FCE Research Meeting will be in Haren, The Netherlands and will take place October, 25, 2012. This is a great opportunity to participate with top researchers and others in the area of FCE and a great opportunity to collaborate with colleagues from around the world.

A brief look at the agenda and speakers:

- New research
  1. Does test evaluator's fear of injury influence maximal lifting capacity? A triple blind RCT. Sandra Jorna-Lakke
  2. Cost-benefit of work-related multidisciplinary rehabilitation for patients with MSDs: Does employment status matter? Marco Streibelt
  3. Can submaximal physical and functional capacity be detected in patients with chronic pain? A systematic review. Suzan van der Meer
  4. Reliability, agreement and safety of FCE in patients with WAD. Maurizio Trippolini
- Pros/Cons for normative values for FCE. A debate Remko Soer and Paul Kuijer
- FCE as outcome
  1. Gender differences in capacity ratings predicting RTW for patients with MSDs. Marco Streibelt
  2. Decline of functional capacity in healthy aging workers. Remko Soer
  3. Longitude assessment of physical capacity in a cohort study on early osteoarthritis of the hip and the knee. Andre Bieleman
  4. Does the performance of an FCE lifting test differ between employees on sick leave due to MSDs in physically demanding work and their health counterparts? Paul Kuijer
  5. Deconditioning in workers with chronic MSD pain: does work matter? Remko Soer
  6. Client's perspective on the utility of FCE for the assessment of physical work ability, prognosis for work participation and advice on RTW. Willemijin Pas
- Pre-employment FCE
  1. Pre-employment functional assessments predict MSD injury risk associated with manual handling in coal miners. Jenny Legge
  2. Job-specific FCE protocols for household waste collectors: development and reproducibility. Vincent Gouttebarge
- One for all, or all for one?
  1. Debate
  2. Generic or specific FCE protocols? Vincent Gouttebarge and Doug Gross
- Where do we go from here?
  1. Open discussion
  2. FCE research agenda. Doug Gross and Michiel Reneman

Note: Details on the program, directions to our rehab center, and dinner are posted on our website: http://www.umcg.nl/NL/UMCG/AFDELINGEN/CENTRUMVOORREVALIDATIE/RESEARCHONDERWIJS/POSTWDPIMEETING-FCE/Pages/default.aspx

Announcing Second Scientific Conference on Work Disability Prevention and Integration; Healthy Aging in a Working Society

October 22-24, University Medical Center Groningen, The Netherlands

The FCE Research Meeting will follow the WDPI meeting. For more information on WDPI, go to the following: http://wencke4.housing.rug.nl/documenten/medici/Internationale_Conferenties/WDPI%202012/WDPI_2012.htm

Announcing Human Factors and Ergonomics Society Annual Meeting

The Human Factors and Ergonomics Society announce the 56th Annual Meeting to be held October 22-26, 2012 at the Westin Boston Waterfront in Boston, MA. Additional details are at http://www.hfes.org//Web/HFESMeetings/2012annualmeeting.html.

OHSIG Election

The office of President is up for election later this fall. The term is 2013-2016. If you are interested in running, contact Jill Galper, Nominating Committee Chair at Jill.Galper@imxmed.com.

Thank you to John Levene, DPT, OCS, CMT, MS, for his article in this issue of OPTP on pre-placement testing.

In his article John discusses the evidence that supports a pre-placement functional testing program. Pre-placement testing has been shown to reduce injury rates and employment costs for employees performing heavy physical demanding jobs. Thanks to John for a look at the benefits of such a program.

OHSIG BOD Members

As always, your BOD members are listed on the Orthopaedic Section Web site. We welcome your feedback!

Professional Regards,
Margot Miller PT
OHSIG President

The Effects of Functional Pre-employment Testing on Work Injuries and Workers' Compensation Costs

John Levene, MS, PT, OCS, CMT
SVP, National Therapy Director, Concentra, Brookfield, WI

INTRODUCTION

In order to remain competitive in today's global marketplace, United States employers must manage all aspects of their expenses including employment related costs such as workers' compensation. Workers' compensation costs have increased at an alarming rate in the past 20 years.[1] Multiple strategies have been adopted in order to control costs such as aggressive case management of medical expenses and lost time related to workers' compensation cases. Ergonomic programs have been implemented to abate potential job hazards and reduce injuries. Such ergonomic programs have been successful in making jobs safer; however, it is not possible to engineer out the physical requirements of many jobs. In order to better match employees to the physical requirements of a job, employers have implemented pre-placement functional testing based on the concept that employees who are physically matched to their job are less likely to experience a job-related injury. In theory, employees may benefit from such pre-placement tests as they will have less risk of harm, improved job satisfaction, and career longevity.

Programs to test job applicants' strength to perform a specific job were first reported by Chaffin et al[2] and Keyserling et al[3] who reported that the incidence of musculoskeletal injuries reduced as employees' isometric strength exceeded the requirements of the job. This led some employers to adopt discriminatory hiring practices by setting artificially high applicant strength qualifications that far exceeded the actual requirements of the job. In 1991 the Americans with Disabilities Act (ADA) established guidelines for employers on nondiscriminatory practices in screening individuals for jobs. The ADA requires that employers must hire applicants with or without impairments or functional deficits who are otherwise qualified if they can perform the essential functions of the job. Employers may not perform tests that tend to screen out certain individuals and tests must be a valid representation of the physical essential job functions and consistent with business necessity. As a result of the ADA, pre-employment tests must be job specific and test for the applicant's ability to perform the essential job functions.[4]

To date, scientific data to support the effectiveness of pre-employment tests is minimal. Controlled studies on employers implementing pre-employment testing programs is rare because employers are most often implementing multiple cost control strategies simultaneously, consequently confounding the effects of a pre-employment test alone. Employment issues and work environment limit the ability to have a true control group and therefore limit the possibility of a randomized controlled trial. Employment and cost data collection is challenging due to multiple parties involved. Employment data resides with human resources departments and workers' compensation cost data often reside with third party payers. Extracting costs related to subjects involved in a study from workers' compensation cases is an administrative burden. As a result, most evidence to support pre-placement testing is in the form of quasi-experimental or case studies. The purpose of this analysis is to review the evidence that supports the effectiveness of pre-placement functional testing programs on reducing work place injuries and employment related costs.

METHODS

The initial search was conducted on 11-1-08 using PubMed at the College of St Scholastica's academic library. Search terms used were "pre-placement or pre-work and testing AND functional." Limits used were English language and human. The search yielded 61 related articles. Inclusion criteria consisted of: (1) studies conducted after 1991; (2) test methods were ADA compliant; (3) test methods screened for the ability to perform the essential job functions with specific pass and fail criteria; (4) tests were not dependent upon specific commercial equipment and could be replicated in multiple locations. Eight articles were selected for review by scanning the titles and abstracts. Two articles by Reimer et al[5] and Rosenblum et al[6] used isokinetic equipment to measure strength and predict function; they were both excluded because they did not test essential job functions. One article by Scott[7] was actually a descriptive article with a case study and not a scientific investigation, and therefore excluded as well. The remaining 5 studies met the inclusion criteria and were included in this analysis.

REVIEW OF THE LITERATURE

Littelton M. Cost effectiveness of a pre-work screening program for the University of Chicago physical plant. *Work*. 2003; 21(3): 243-250.

Littelton[8] conducted a study to examine the effect of a post-offer pre-placement physical screen test on the frequency and severity of work related musculoskeletal injuries and overall workers' compensation costs. Subjects were 712 new hire employees grouped into 18 separate job classifications at the physical operations department for the University of Illinois Chicago between 3-1-98 and 2-28-01. Subject demographics

were not disclosed. A job site analysis was performed by a physical or occupational therapist to identify the key essential job functions and critical physical demands. Functional physical screens were developed for each job classification based on the Physical Work Performance Evaluation developed by Lechner et al.[9] Each physical screen consisted of 5 to 7 functional tasks with specific pass or fail criteria. Subjects were required to pass all functional tasks components of the screen in order to be eligible for employment.

A quasi-experimental, retrospective design was used to analyze the cost effectiveness of the screening program. Three job classifications comprising 87% of the total screens completed were used for data analysis. The number of subjects screened for each of the remaining job classifications was too small for analysis. The study compared the incidence rate of injury and workers' compensation costs for a control group of all new employees hired into the same job classifications without completing the physical screen from 3-1-95 to 2-28-98 to the experimental group who completed the physical screen from 3-1-98 to 2-28-01.

The authors noted an 18.5% reduction in the incidence of injury for the experimental group. They determined that the incidence reduction was not significant but did not disclose their statistical analysis. Workers' compensation costs were reduced by 79% for the experimental group which was considered statistically significant, but again no statistical analysis was disclosed other than data tables. Failure rate was 22% for the most physically demanding job but much lower percentage in lesser physically demanding positions. The authors concluded that the pre-placement physical screen was effective in reducing the incidence of injuries, mean cost per injury, and a cost benefit ratio of $18 saved for each dollar expended on the screening program.

Although the cost reduction appeared profound, not all of the reduction may be accounted for by the physical screen. In 2001 there was a change in approach by the university for handling workers' compensation claims that may have deemed some cases noncompensable, where similar cases may have been compensable prior to 2001. The authors also excluded certain "outlier" high dollar workers' compensation cases from the experimental group, but not the control group which certainly would affect the cost difference between the groups. Despite these limitations, the reduction in injuries and costs between the groups was impressive and support the effectiveness of pre-placement physical screens, particularly for jobs with high physical demands. A more in depth statistical analysis would have made the study more credible.

Harbin G, Olson J. Post offer, pre-placement testing in industry. *American Journal of Industrial Medicine.* 2005;47:296-307.

The purpose of this two-part study by Harbin et al[10] was to determine if a pre-placement functional screen test could be used to predict the incidence of work injury and to evaluate the effectiveness of a pre-placement functional screen in reducing employment related costs. The first phase of the study included 1435 male and 1038 female working age subjects who were tested in the order they were hired during a 3-year period from 1989 to 1991 in a food manufacturing plant. Jobs at the plant were analyzed for physical demands and categorized into one of 5 Dictionary of Occupational Titles (DOT) job classifications ranging from sedentary to very heavy work.[11] The screen consisted of 20 different anthropometric, fitness, strength, and lifting tests as outlined by the American Physical Therapy Association Functional Capacity Evaluation guideline. Results of the screen indicated which level of DOT job classifications each subject had the physical capacity to perform. Subjects were monitored for incidence of injury and job performance for a 3-year period post hire. For data analysis subjects were divided into strong, above mean strength, and weak, below mean strength groups based on results of dynamic lifting and isometric strength tests. A two sample t-test yielded no significant difference in injury incidence between the strong and weak groups indicating that strength or physical capacity alone cannot be used to predict injury. Subjects were then divided into matched and mismatched groups based on their assessed DOT classification level as matched to the DOT classification of their job. The odds ratio of injury was much higher for the mismatch group ranging from 15.6 for the lumbar spine to 58.0 for the wrist. Chi Square analysis for difference between matched and mismatched groups was significant at P equal to less than .0001.

The second phase of the study implemented a post-offer pre-placement physical screen based on results of the first study. All new hires from 1993 to 1998 were required to complete and pass a screen that demonstrated that they had the physical ability to perform the job requirements based on the DOT classification system and were monitored for injury until 2002. Neither the number of subjects hired during this period nor was a statistical analysis disclosed. The authors reported that the overall injury rate did not appear to decline, but severity of injury as measured by the cost of medical care reduced from $70,000 to $10,000 annually, and lost work days reduced from 700 to 7 annually.

The authors concluded that strength tests alone cannot be used as a sole predictor of workplace injury, however the incidence rate of injury increases for subjects who cannot demonstrate the physical ability to perform the essential functions of a job. It was further concluded that a pre-placement physical screen, which is matched to the essential job functions, is effective in reducing workers' compensation costs and lost work days and that the effectiveness increases for jobs that are more physically demanding.

When analyzing strength as a predictor of injury, dividing the subject population into two strong and weak groups based on the mean may not have been sensitive enough. Perhaps stratifying the subjects by quartile or percentile rank would have allowed for more detailed analysis of difference in injury between subjects at the high and low end of the strength spectrum. The study took place over a 13-year period in which many other cost control, employment, economic, or environmental factors may have influenced change in medical costs and lost work days. The study did not account for specific physical demand variances of different jobs that may be performed within the food plant but rather classified jobs into one of 5 physical demand levels based on the DOT. Twenty test components can be time consuming and costly to administer. The study could have evaluated which test components had the best predicative value or no predictive value in order to streamline the screen for future use. Results of this study provide evidence that a physical pre-placement

screen can be effective in reducing employment related costs but cannot be used to predict work injuries.

Gassoway J, Flory V. Pre-work screen: Is it helpful in reducing injuries and cost. *Work*. 2000;15(2):101-106.

The purpose of the study by Gassoway et al[12] was to determine the effectiveness of pre-work screening on reducing incidence of injury, workers' compensation costs, and turnover rate for nursing assistants at a regional health system. The authors implemented Isernhagen Work Systems to perform job site analysis and develop a pre-work screen based on identified physical essential job functions.[13] Test components consisted of various lifts, push/pull, simulated transfers, and dexterity and coordination tasks. The study compared 144 subjects who were hired between May 1996 and May 1997 without completing the pre-work screen, to 163 subjects hired between May 1997 and May 1998 who successfully completed the pre-work screen. Subjects were monitored for one year after their hire date for work related musculoskeletal injuries and employment status.

Results for the unscreened versus screened group respectively were as follows: Injury rate reduced from 18.1% to 13.5% , workers' compensation costs reduced from $377 to $320 per employee and turnover rate reduced from 60.4% to 41.7%. Approximately 20% of the applicants in the screened group failed a test component and were denied employment. No other statistical data was provided. The authors concluded that the pre-work screen was effective in reducing the incidence of injury, workers' compensation costs, and nursing assistant job turnover rate.

Subjects were monitored for only one year of employment which may not be a sufficient time for musculoskeletal injuries to manifest. No subject demographic information was disclosed other than the subjects were nursing assistants. The study suggests that the pre-work screen was effective in reducing injuries, controlling costs, and reducing employment turnover; however, more scientific statistical analysis would lend more credibility to the study.

Anderson C, Briggs J. A study on the effectiveness of ergonomically-based functional screening tests and their relationship to reducing workers' compensation injuries. *Work*. 2008;31(1):27-37.

The purpose of this study by Anderson et al[14] was to evaluate if an ergonomically-based functional post offer screening program was effective in reducing workers' compensation costs for physically demanding jobs in 3 similar industries. All industries involved constant manual material handling of product weighing up to 60 lbs. A post offer test battery was designed for each job based on a job site analysis that documented the strength and cardiovascular endurance demands. Dynamic lifting and isometric exertion tests were used to compare subject's strength with job match cut off scores that were based on the respective job essential functions. Because an individual can only work at a percentage of their maximum aerobic capacity for an extended period of time, a cardiovascular step test was used to assess the subject's aerobic capacity and scored against the National Institute of Occupational Safety and Health's (NIOSH) guidelines for the percent capacity at which an individual can work for extended periods of time.[15] Subjects were 468 new hire employees who completed the test battery and were monitored for musculoskeletal workers' compensation injuries and employment status. Time frames and subject demographics were not disclosed. Injury rates were determined by comparing injury incidence to the total number of hours worked by the respective group. Employment retention was determined by the number of subjects who were employed at 8 weeks post hire. A predictive validation study was conducted comparing the injury rate and employment retention of 377 subjects who passed the test battery versus 91 subjects who failed the test battery criteria.

New hires that passed the test battery had 47% less injuries than new hires who failed the test battery, significant at $\alpha < 0.001$. New hires that passed the test battery were 21% more likely to be employed at 8 weeks post hire than new hires who failed the test battery, significant at $\alpha < 0.05$.

In a separate study the authors examined the musculoskeletal injury rate for employees one year prior versus one year post implementation of the test battery for 175 other companies across the United States. In this study, applicants who did not pass the test battery were not hired. Injury reduction rates ranged from 37% to 54%.

The authors concluded that the test battery was effective in reducing the musculoskeletal injury rate across a wide range of industries and geographic locations and that the ergonomically based functional screen can be effective in identifying individuals who can safely perform physically demanding jobs.

Subject demographics were not disclosed; therefore, the applicability to a specific working population is speculative. The utilization of aerobic capacity as criteria to predict job performance is a unique approach compared to other published methodologies.

Nassau D. The effects of pre-work functional screening on lowering an employer's injury rate, medical costs, and lost days. *Spine*. 1999;24(3):269-274.

Nassau[16] conducted a 3-stage retrospective longitudinal study to evaluate the effectiveness of a pre-work functional screen on lowering workers' compensation costs and work related injuries. A pre-work functional screen was developed to test applicants for their ability to perform the physical essential functions of 16 jobs requiring heavy work demands as defined by the DOT at a regional hospital. Stages I and II were conducted from 1986 to 1992 and involve case management, patient education, and an early return to work program. Stage III involved the pre-work functional screen and was conducted from 1992 to 1996. Thirty of the 938 applicants did not pass the pre-work screen and were not hired. Injury rates and workers' compensation costs were compared between the screened employees and unscreened employees in other jobs.

In stage III, the injury rate per 100 employees was 0.58 for screened versus 0.97 for unscreened subjects; however, the reduction was not significant. There was a significant reduction, $P < 0.001$, in lost work days for screened (0.83) versus unscreened (3.83) subjects. Cost per musculoskeletal workers' compensation injury was significantly reduced for screened ($311) versus unscreened subjects ($1432). Nassau concluded that the pre-work functional screen was effective in lowering the severity of work related musculoskeletal injuries and workers' compensation costs.

Neither the subject demographics nor the pre-work screen test battery were disclosed which limits applicability and repro-

ducibility of the study. There is concern with the author comparing screened subjects in heavy jobs to unscreened subjects in less physically demanding jobs, as one would suspect lesser injury rates in the less physically demanding jobs. Perhaps comparing injury rates of subjects performing the same jobs prior to and after implementation of the pre-work screen would have been a better indicator of the screen's effect on injury rates.

DISCUSSION AND CLINICAL APPLICATION

Examination of the 5 articles provides good support for the effectiveness of pre-placement functional testing in reducing work related injuries and employment costs. Study designs reviewed were quasi-experimental and no randomized controlled trials were found. All studies reported a reduction in the incidence of work related musculoskeletal injuries but only Anderson et al[14] reported a significant reduction at 47%. All studies indicated that pre-placement functional testing is effective in reducing workers' compensation costs that far outweigh the expense of administering the tests. Littelton[8] reported a cost savings of $18 in expenses for every dollar spent on testing. Cost reductions were noted most often in the reduction of severity of injuries[8,16] which is directly related to reduction in medical expenses and lost work days.[10,16] Reductions in injury rates and costs were similar in study designs that compared screened to unscreened subjects in different time frames[8,12] and studies that compared subjects who passed or failed the screen in the same time frame.[10,14] A related case study reported by Scott[7] indicated a 25% reduction in the injury rate for screened subjects. Isokinetic pre-placement studies that tested subjects' strength matched to job requirements reported favorable reduction in injury incidence and workers' compensation costs as well.[5,6] Gassoway[12] and Anderson[14] reported an added benefit of improved employee retention which reduces recruiting, replacement, and training costs.

Various test methodologies were employed including dynamic and isometric lift tests, replication of essential job tasks such as patient transfers and aerobic testing. No one methodology appears superior to another; however, it is evident that specific test methods are most effective when they are matched to the essential job functions.[14,16] It appears that a pre-placement testing program is most effective for jobs with heavy physical demands or higher, and less effective for jobs with medium physical demands or lower as defined by the DOT.[8,10,16]

Based on the evidence outlined in this analysis, it would be appropriate to recommend an essential function based pre-placement testing program to employers as a strategy to lower injury rates and employment costs for employees performing heavy physical demands jobs. It would not be appropriate to recommend a functional pre-placement testing program for the purposes of predicting or preventing injury of specific job applicants. Further research on the effectiveness of pre-placement functional screens using a randomized controlled trial experimental design would add credibility to the body of evidence supporting the hiring strategy.

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