

[SS117]

보건 및 안전 문화 관리

주제: 보건 및 안전 문화

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본 특별 세션은 설비 또는 자산과 개인 건강 및 안전에 영향을 주는 주요한 사고를 방지하기 위하여 안전문화를 관리하는 중요성을 고찰한다. KOSHA는 한국의 안전문화 촉진을 위한 전략을 논의하면서 특별 세션을 개최한다. La Trobe 대학교는 보다 효과적인 위험 관리 과정을 고안하기 위한 안전문화의 중요성을 구체적으로 고찰한다. 로이드 선급협회는 안전 풍토를 평가하여 안전문화를 관리하는데 도움을 주는 도구의 예를 제공하고 중요한 모니터로서 무사안일을 고찰한다. Lowell 대학교 및 Adelaide 대학교로부터 2가지 안전 풍토 연구를 제시하여 그 중요성을 설명한다.

## 한국에서 안전문화 촉진

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한국 확고하고 지속가능한 안전문화 기반을 구축하는 것은 한국에서 "세월호 참사"로 인하여 어느 때보다 뜨거운 쟁점이다. 불행이 이 재난은 한국의 안전문화 수준을 명백하게 반영하고 있다. 그 이유는 안전문화는 사회문화적 산물, 즉, 안전을 장려하는 안전한 습관 및 규정을 귀하게 여기는 안전인식과 안전을 가능케 하는 인프라의 조합이기 때문이다.

한국은 짧은 기간에 소위 "한강의 기적"이라는 대단한 경제성장과 산업발전을 이룩하였다. 한국의 급속한 산업화와 현대화 기간 중 급속한 성장은 안전규정 및 윤리와 같은 사

회적 규범의 준수를 무시하는 이익 지상주의자들이 만연하게 만들었다. 그뿐만 아니라 기량, 과학 및 기술적 발전의 갑작스러운 진보는 사회적 발전에 기여할 뿐만 아니라 과거 단편적인 위험에 비하여 산업구조의 변화(서비스 산업 증가), 노동력 구성의 변화(보다 많은 비정규직, 여성 및 이주 근로자)와 같은 보다 복잡하고 다양한 위험이 동시에 공전하는 "복잡한 위험사회"로 이어지고 있다. 사실상 1995년까지 안전문화에 관한 대중의식은 한국에서 낮았고 "안전문화"라는 용어는 기업 이미지를 제고하는 수단으로서 제한적인 용도만을 가졌었다. 그러나 삼풍백화점이 붕괴한 1995년 6월 9일부터 일반대중은 안전에 보다 많은 관심을 갖기 시작했고, 직장에서 정부가 주도하는 안전에 대한 접근법이 시작되었다. 고용노동부(Ministry of Employment and Labor, MOEL)와 한국산업안전공단(Korea Occupational Safety and Health Agency, KOSHA)은 한국에서 안전문화를 정착시키는데 중요한 역할을 하고 있다. 예를 들면, 매월 4일에 "안전점검의 날"을 지정하여 KOSHA는 "무재해 프로그램"을 확대하고 광범위한 OSH 교육을 제공할 뿐만 아니라 스마트폰, SNS 및 기타 매체용 응용프로그램을 사용하여 홍보에 집중하는 노력을 기울였다. 이러한 정부주도형 정책은 유용한 반면에 불행이도 이러한 정책의 효과는 대부분 치유적이기 보다는 완화적인 성격이다. 한국은 여전히 직업 사망률에서 모든 OECD 회원국들 중에서 최고 국가들 중 하나이기 때문이다. 덧붙이면 사업주들은 여전히 안전보건 관리에 지출하는 것을 투자보다는 경비로 간주하는 반면에 직장에서 안전보건을 촉진하는 자발적 활동은 부족하다.

최근 연구들에 따르면, 안전문화를 배양하는 효과적인 방법은 기업의 모든 사람들이 스스로 '교육훈련, 자발적 참여'에 전념하는 환경이다. 전문가 답변으로부터 얻은 분석에 따라서 안전문화에 관련된 활동을 실시하여 정부주도형 운동에서 실시되지 않지만 근로자와 사업주의 전적인 협조로 실시되는 예방활동을 위한 기초를 확보하고 촉진자로서 정부 지원의 도움을 받아서 대중 안전의식을 제고하는 것이 중요하다. 그뿐만 아니라, 조사대상 안전 전문가들 대부분은 안전의식 제고가 요람에서 무덤까지 시작되어야 한다고 말했다. 이것은 안전교육훈련은 기초적 수준에서 실시되어야 한다는 것을 의미한다.

안전의식 촉진과 높은 산업재해를 감소를 시도하는데 있어서 MOEL은 산업보건 안전문화 평가 시스템을 전 산업에 도입할 것을 고려한다. 이 평가 시스템은 산업재해 및 업무상 질병 감소를 위해 자발적 기업을 양성하도록 고안될 뿐만 아니라, 유해성과 위험성에 대한 자세를 확산시킬 것으로 예상된다. 이는 또한 바람직한 산업안전 문화를 만들고 대중의 안전인식 제고를 목적으로 한다. 결과적으로 평가 시스템은 기술중심, 수동적 대기업 접근법의 구식 패러다임을 습관중심, 선제적, 중소기업 형태의 접근법이라는 새로운 패러다임으로 이동시킬 가능성이 크다. 또한, KOSHA는 안전문화 및 건강문화 정착을 위한

평가 프로그램을 개발하여 모든 직장에 보급하였다.

한국의 직장 안전문화 수준은 개발 단계에 있다. 그러나 산업재해 및 업무상 질병의 추가적인 감소는 규정과 기법으로 예방활동을 강제하는 통상적인 접근법으로는 가능성이 없다. 근로자들의 안전과 건강을 보호하는 "양질의 일자리"를 창출하려면 안전문화에 관한 추가적인 진전이 요구된다. 이를 위하여 안전 시스템(규정 및 기법), 안전의식(훈련 및 홍보 자료)과 안전인프라(시설 및 네트워크)는 이 목표를 달성하는 주요한 수단이다. 평가 시스템과 같은 새로운 방법을 포함하여 위의 3가지 핵심 요소의 화학적 결합으로 '세월호 참사'는 발생하지 않을 수 있을 것이다.

## 근골격계 질환의 위험관리에 대한 개선된 접근법 개발에 있어서 조직문화의 역할은 무엇인가?

Jodi Oakman, David Tappin

인체공학 및 인간요인 연구소, La Trobe 대학교, 멜버른, 호주

근골격계 질환(Musculoskeletal disorders, MSD)은 많은 산업부문에서 여전히 최대 산업안전보건(OHS) 문제들 중 하나이고, 산업발전과 관련된 유해성 및 위험성을 보다 효과적으로 관리하는 긴급한 필요성이 있다. MSD를 해결하는 수단은 조직문화 및 조직풍토를 포함한 다양한 요인들을 고려하여 성공적으로 채택되도록 적절하게 목표를 삼을 필요가 있다. 다중위험 요인을 해결하는 수단의 조합은 성공으로 충족시킬 가능성이 많고, 이러한 수단의 참여적 개발은 그 적용성을 한층 증대시키는데 도움을 줄 수 있다는 것은 수용가능한 실천방안이다. 그러나 개인적 및 조직적 차원에서 변화에 대한 준비성과 이러한 수준에 맞는 맞춤형 MSD 예방수단을 고려하는 것은 이해성이 부족하다. Haslam(2002)이 제안한 하나의 모형은 변화 단계 프레임워크를 사용하는 것이 보통 OHS 관리 시스템 및 개입 개발과 관련한 활동을 알려줄 수 있다는 것을 시사했다. 이러한 제안의 논리에도 불구하고 이 접근법에 관하여 과거 10년 동안에 문서화된 것은 거의 없다. 이 논문은 변화단계 프레임워크가 채택된 연구문헌을 검토하고, 이러한 접근법이 MSD 개입 수단의 효능을 향상시키는데 도움을 준다는 것을 상정한다.

## 안전풍토 인식과 무사안일: 안전문화 개발을 위한 로이드 선급협회 도구

Vanessa Forbes, Garry Moon and Jason Devereux

아시아 집단안전부, 로이드선급협회, 홍콩

주요한 사고는 일반적으로 상호작용하는 많은 인간적, 기술적, 환경적 및 조직적 요인들의 결과이며, 모두가 지배적인 안전문화에 의하여 영향을 받는다. 예를 들면, 긍정적인 안전문화에 의하여 뒷받침되지 않는 안전관리는 그 적용 범위와 깊이가 제한된다. ‘높은 신뢰성’ 조직들을 대표하는 산업집단들은 안전문화 평가의 중요성에 관한 안내를 제공하고 있다. 그러나 상세한 평가를 실시하는데 종종 많은 시간과 자원을 필요로 한다. 로이드 선급협회는 조직의 안전 문화 및 ‘안전의식’에 대한 효율적이고 신뢰성있는 척도를 제공하는 안전풍토 평가도구를 고안하였다. 이 도구는 10개 국가들에 위치한 석유가스, 철도 및 해양 산업에 걸쳐 5724명의 참여자들로부터 수집된 데이터를 사용하여 개발되었다. 요인분석을 사용하여 경영진 약속, 지도력, 학습, 위험, 의사소통, 역량, 공정 및 절차와 참여 등 8개의 기본 차원을 구성하였다. 조직이 습관적 실패의 정도를 진단하는 것을 돕기 위하여 요인 구조를 집단화하여 학습, 적합성, 개입, 보고 및 진보적(문화 지속가능성) 하위문화를 평가하였다. 안전풍토 도구는 최근 7개 근해 플랫폼에 걸쳐서 거의 2000명의 석유가스 근로자들에 의하여 전개되었다. 각 플랫폼에 대해 생성된 권고사항을 비교하여 유해성 및 위험평가를 지향한 무사안일은 진보적인 안전문화를 향한 개선이 필요하다는 것을 나타내는 공통적인 특징이라는 것을 밝혀냈다. 이 조사결과는 설치 관리자들에 의하여 확증되었다. 로이드 선급협회 안전풍토 도구를 사용한 안전문화의 단면 평가는 석유가스, 원자력 및 해양 부문 조직들에 적절하다. 이 도구는 외면과 내용 유효성을 모두 갖고 있다. 향후 연구는 아차사고, 사건 및 탄화수소 배출과 관련한 도구의 예측적 유효성을 다룰 예정이다.

## 콜롬비아 건설업 안전풍토

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서론:

건설업은 세계적으로 가장 위험한 부문 중 하나로 인식된다. 안전풍토는 안전습관 및 부

상률과 시사하는 관련성을 감안하면 부상연구에서 적절한 요소로 간주된다. 이 연구는 건설 근로자, 현장감독 및 현장소장 사이에서 안전풍토 인식을 조사하기 위하여 콜롬비아 건설업에서 수행되었다.

#### 방법:

건설 근로자들은 참여 건설현장에서 무작위로 선정되었고, 현장감독과 현장소장은 너무 적어서 모두 모집하였다. 50개 항목 질문서(북유럽 산업안전 풍토, NOSACQ-50)를 사용하여 안전풍토의 7가지 주요 차원을 조작하였다. 강건 선형회귀를 사용하여 안전풍토와 직무 범주 사이의 관계 뿐만 아니라 연령, 재직기간, 경험 및 이전 직업관련 부상과의 관계를 검증하였다.

#### 결과:

26개 건설현장에 걸쳐서, 353명의 건설인력이 질문서를 작성하였다. 직무 범주별 총 안전풍토 점수는 2.83~3.06의 범위였다. 직무 범주는 현재 안전풍토의 유의미한 예측변수였다. 건설 근로자들은 현장 감독 및 현장소장보다 낮은 안전풍토 점수를 보고했다(각각 2.82, 2.93 및 3.00,  $p < 0.01$ ). 안전풍토 점수는 동일한 현장에서 오래 재직하고 건설업에 경험을 가진 근로자들에서 약간 높았다. 이 연구에서 안전풍토 점수와 이전 작업관련 부상 사이의 관계는 파악되지 않았다.

#### 토론:

안전풍토 인식은 균일한 특성이 아니었다. 현장소장은 보다 긍정적인 인식을 보고했으며, 이는 그들이 실제 작업조건에 관해 적게 알고 있다는 것을 반영할 수 있고, 이어서 안전 문제를 감시하거나 안전을 위한 적절한 예산을 할당하는데 있어서 그들의 관심에 영향을 줄 수 있을 것이다. 분산된 구조와 높은 자율성을 가진 다수의 계약자들 존재를 포함하여 건설업의 복잡성은 건설업의 일상적인 실재를 포착하도록 설계된 적절한 안전풍토 장치에서 언급할 필요가 있다.

**근골격계 통증 및 불편에 상관되는 안전풍토 및 직무 만족: 반복적인 단면 연구**

Paul Rothmore, Diana Doda 및 Dino Pisaniello  
인구보건대학, 보건과학부, Adelaide 대학교, Adelaide, 호주

## 서론:

근골격계 질환은 직무관련 병구의 으뜸가는 원인이고 개인, 산업 및 공동체에 주요한 비용부담을 준다. 지금까지 파악된 광범위한 위험요인들에도 불구하고, 대부분의 연구는 위험요인을 가진 특정한 직업이나 범주에만 초점을 맞추고 있다. 특히 종단적 연구에서 개인적 및 조직적, 신체적 및 심리적 요인들의 상대적 기여도는 제한적으로 파악되어 있다. 본 연구는 남호주의 다양한 작업장들에서 근골격계 통증 및 불편(musculoskeletal pain and discomfort, MSPD)과 직무만족도 및 안전풍토의 상관성에 관해 보고한다.

## 방법:

본 연구에서는 반복적인 단면적 연구설계를 사용하였다. 질문서는 대면식으로 작성하여 인구학적 특성 및 직무 특성, 안전풍토, 근골격계 통증 및 불편(musculoskeletal pain and discomfort, MSPD)과 직무만족도를 평가하였다. 잠재적인 예측변수들을 개인/직무 및 조직 특성과 조사대상 MSPD와의 연계성 측면에서 그룹화하였다.

## 결과:

총 406명의 근로자들이 기초조사에 참여했고 동일한 회사에 근무하는 270명의 근로자들이 추적조사에 참여했다. 기초조사에서 회귀분석은 MSPD와 직무만족도(조정된 확률비 = 2.6)와 안전풍토(AOR = 2.5) 사이의 유의미한 상관성이 있다는 것을 밝혀냈다. 추적조사에서는 안전풍토만 MSPD와 관계되었다(AOR = 2.6).

## 토론:

이 결과는 비신체적 요인과 직무관련 근골격계 질환 사이의 연계를 확인하며 이러한 요인들이 전체적인 안전보건 전략의 일부로서 더 큰 관심을 받아야 한다는 점을 시사한다. 조직은 종업원의 만족과 안전풍토 분위기를 정착시키는 조직적 요인들을 많이 고려해야 한다.

## Managing Health and Safety Culture

Topic: Health and Safety Culture     Date : June 1 (Mon.)

Time : 16:00-17:30

Location : 301B

Chair : Vanessa Forbes (Hong Kong)

Responsible Person : Vanessa Forbes (Hong Kong)

This special session considers the importance of managing safety culture in order to prevent major incidents affecting equipment or assets and personal health and safety. KOSHA opens the special session by discussing its strategy for promoting safety culture in Korea. La Trobe University specifically considers the importance of safety culture for devising a more effective risk management process. Lloyd's Register provides an example of a tool for helping to manage safety culture by assessing safety climate and considers complacency as an important monitor. Two safety climate studies from the University of Lowell and the University of Adelaide are presented to illustrate its importance.

### **Promoting safety culture in Korea**

Joon-Won Lee

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Establishing a firm and sustainable ground of safety culture is a current hot issue in Korea than ever due to the “Sewol ferry tragedy ”. Unfortunately, this disaster obviously mirrors the level of safety culture in Korea. This is because safety culture is a socio-cultural product, a combination of safety awareness that values safety behavior and regulations that encourage safety and the infrastructure that enables safety.

Korea has achieved a great economic growth and industrial development for a brief span, in a so-called “Miracle of the Han river”. During the Korea’s rush-to industrialization and modernization, rapid growth made profit supremacists prevailing neglecting the compliance of

social norms such as safety regulations and ethics. Furthermore, the abrupt advancement of skills, science, and technological development not only contributes to societal progress but also leads into "complex risk society" where more complex and diverse risks coexist concurrently such as changes in industrial structure (rise of the service industry), makeup of the workforce (more non-regular, female and migrant workers) and manifold hazards (new technologies and the use of new chemical substances), compared to fragmentary risks in the past. As a matter of fact, up until 1995, the public awareness on safety culture was low in Korea and the term "safety culture" had only limited usage as a means to boost corporate images. However, From June 9, 1995 on the day of Sampoong Department Store's collapse , the general public started to pay more attention to safety and government-led approaches to safety culture at work were initiated. Since then, The Ministry of Employment and Labor (MOEL) and Korea Occupational Safety and Health Agency (KOSHA) have had a critical role in settling safety culture in Korea. For example, with the onset of designating "safety check day" on the 4th of every month, KOSHA made an effort of expanding "zero-accident program" and providing extensive OSH education as well as focusing on public relations using applications for smart phones, SNS, and other media. Although these government-led policies are useful, but unfortunately the effects of these policies are largely palliative rather than curative because Korea is still one of the highest nations among all OECD-member countries for occupational fatality rates. Additionally, employers still consider the spending on safety and health management as expenses rather than investment, while voluntary activities to boost safety and health at work is lacking.

According to recent researches , an effective way of nurturing safety culture is an environment in which all the people in a firm is devoted themselves to 'education and training, spontaneous involvement'. In the line with the analyses from the experts' response, it is important to implement activities related to safety culture to secure the basis for prevention activities not conducted in government-led movements but conducted in wholehearted collaboration with workers and employers and to raise public safety awareness with the help of government's support as a facilitator. Moreover, the majority of surveyed safety experts said that enhancing safety awareness should be started from the cradle to the grave. It means that safety education and training should be enforced at the level of elementary level.

In an attempt to promote safety awareness and decrease the high occupational accident rates, MOEL considers the introduction of the Accreditation System for Occupational Health and



Safety Culture into the whole industries. The accreditation system is both designed to nurture autonomous enterprise for reduction in occupational accident and disease but also expected to spread its self-control over hazards and risks. It further aims at making desirable occupational safety culture and at enhancing the public safety recognition. Consequently, the accreditation system is more likely to shift the old paradigm of technology-oriented, passive, giant-sized firm approach to the new paradigm of behavior-oriented, pro-active, small and mid-sized form approach. In addition, KOSHA developed assessment program for settlement of safety and health culture and distributed in to every workplaces.

Korea's level of safety culture at work is in the development stage. However, further reduction in the rate of occupational accidents and diseases is unlikely with the business-as-usual approach, which forces prevention activities with regulations and techniques. To create "decent work" that safeguards workers' safety and health, further progress on safety culture is called for. To that end, safety system (regulations and techniques), safety awareness (training and PR materials), and safety infrastructure (facilities and network) are the main means to achieve this goal. With the chemical bond of three key factors above including new methods such as the accreditation system, 'Sewol tragedy' might have not been occurred.

### **What is the role of organisational culture in developing improved approaches to the risk management of Musculoskeletal Disorders?**

Jodi Oakman, David Tappin

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Musculoskeletal disorders (MSDs) remain one of the largest occupational health and safety (OHS) problems in many industry sectors, and there is an urgent need for more effective management of the hazards and risks associated with their development. Measures to address MSD need to be targeted appropriately to ensure they are adopted successfully taking into account a range of factors including organisational culture and climate. It is accepted practice that a combination of measures addressing multiple risk factors is more likely to meet with success, and that the participative development of these measures can help further increase their applicability. However, consideration of preparedness for change at both individual and

organizational levels and the tailoring MSD prevention measures to match these levels is less well understood. One model proposed by Haslam (2002) suggested that using a Stages of Change framework might usefully inform activities in relation to OHS management systems and intervention development. Despite the logic of these proposals little has been documented in the past decade about this approach. This paper reviews the research literature where the Stages of Change framework has been adopted and posits that this approach would help to improve the efficacy of MSD intervention measures.

### **Safety Climate Awareness and Complacency: a Lloyd's Register tool for developing safety culture**

Vanessa Forbes, Garry Moon and Jason Devereux

Group Safety Asia, Lloyd's Register Group, Hong Kong, Hong Kong

A major incident is generally the result of a number of interacting human, technological, environmental and organisational factors all influenced by the prevailing safety culture. For example, a safety management system not supported by a positive safety culture will be limited in its scope and depth of application. Industry groups representing 'high reliability' organisations have provided guidance on the importance of assessing safety culture. However, extensive time and resources are often required to undertake a detailed assessment. Lloyd's Register devised a safety climate assessment tool to provide an efficient and reliable gauge of an organisation's safety culture and 'safety awareness'. The tool was developed using data collected from 5724 participants across the oil and gas, rail and marine industries situated within 10 countries. Factor analysis was used to structure 8 underlying dimensions: management commitment, leadership, learning, risk, communication, competence, processes and procedures, and engagement. In order to help an organisation diagnose the extent of behavioural failures, the factor structures were grouped to assess learning, compliance, intervention, reporting and progressive (cultural sustainability) sub-cultures. The safety climate tool was recently deployed by nearly 2000 oil and gas workers across seven offshore platforms. A comparison of the recommendations generated for each platform revealed that complacency towards hazards and assessment of risk were common features indicating that

improvements towards a progressive safety culture were required. The findings were corroborated by installation managers. The snapshot assessment of safety culture using the Lloyd's Register Safety Climate Tool is suitable for organisations within the oil and gas, nuclear and marine sectors. The tool possesses both face and content validity. Future studies will address the tool's predictive validity in relation to near misses, incidents and hydrocarbon releases.

### **Safety climate in the construction industry in Colombia**

Luz Stella Marin, Hester Lipscomb, Manuel Cifuentes and Laura Punnett  
University of Massachusetts Lowell, USA

#### **Introduction:**

The construction industry is globally recognized as one the most hazardous sectors. Safety climate is considered as a relevant element in the study of injuries given its suggested association with safe behaviors and injury rates. This study was conducted in the Colombian construction industry to examine the perceptions of safety climate among construction workers, field supervisors, and site managers.

#### **Methods:**

Construction workers were randomly selected at participating construction sites; field supervisors and site managers were fewer so all were recruited. A 50-item questionnaire (Nordic Occupational Safety Climate, NOSACQ-50) was used to operationalize seven major dimensions of safety climate. Robust linear regression was used to test the association between safety climate and job category as well as with age, tenure, experience and previous work-related injuries.

#### **Results:**

Across 26 construction sites, 353 construction personnel completed the questionnaire. The total safety climate score by job category ranged from 2.83 to 3.06. Job category was a significant predictor of current safety climate; construction workers reported lower safety climate scores

than field supervisors and site managers (2.82, 2.93 and 3.00, respectively,  $p<0.01$ ). Safety climate scores were slightly higher in workers with longer tenure on the same site and experience in the construction industry. No association between safety climate scores and previous work-related injuries was identified in this study.

#### Discussion:

Perceptions of safety climate were not a homogenous characteristic. Site managers reported more positive perceptions, which may reflect that they are less knowledgeable about actual working conditions, which in turn might influence their interest in monitoring safety issues or allocating an appropriate budget for safety. The complexity of the construction industry including its decentralized structure and the presence of multiple contractors with high level of autonomy, needs to be addressed in appropriate safety climate instruments designed to capture the day-to-day reality of the construction industry.

### **Safety climate and job satisfaction as correlates of musculoskeletal pain and discomfort: a repeat cross-sectional study**

Paul Rothmore, Diana Doda and Dino Pisaniello

School of Population Health, Faculty of Health Sciences, The University of Adelaide, Adelaide, Australia

#### Introduction:

Musculoskeletal disorders are a leading cause of work-related ill health, and a major cost burden for the individual, industry and the community. Despite the broad range of risk factors that have been identified, most studies have focused only on specific occupations or categories of risk factors. There is limited understanding of the relative contributions of individual and organisational, physical and psychosocial factors, particularly in longitudinal studies. This study reports on the correlation of job satisfaction and safety climate with musculoskeletal pain and discomfort (MSPD) in a range of workplaces in South Australia.

#### Methods:

A repeat cross-sectional study design was used. Questionnaires were administered face-to-face,

assessing demographic and job characteristics, safety climate, musculoskeletal pain and discomfort (MSPD) and job satisfaction. Potential predictors were grouped in terms of personal/job and organizational characteristics and associations with MSPD examined.

#### Results:

A total of 406 workers participated in the baseline survey and 270 workers, in the same companies in the follow-up. In the baseline survey, regression analysis revealed that there was a significant correlation between MSPD and job satisfaction (adjusted odds ratio = 2.6) and safety climate (AOR = 2.5). In the follow-up survey, only safety climate was associated with MSPD (AOR = 2.6).

#### Discussion:

The results confirm a link between non-physical factors and work-related musculoskeletal disorders, suggesting that these factors should receive increased attention as part of overall health and safety strategies. Organizations should give greater consideration to both the satisfaction of their employees and organizational factors that set the tone for safety climate.

[SS121]

Nuclear Weapons Manufacturing: Health Impact for Workers from the “Cold War”

Topic: Occupational Medicine    Date : June 1 (Mon.)

Time : 14:15-15:45

Location : 307A

Chair : Lee Scott Newman (USA)

Responsible Person : Lee Scott Newman (USA)

Workers engaged in the manufacture of nuclear weapons have experienced exposures to numerous hazards including plutonium, beryllium, heavy metals, asbestos, silica, solvents, noise, among others. This session will focus on the health consequences for the so-called Cold War Veterans in the U.S. Large scale, nationwide medical surveillance programs have detected substantial numbers of now-retired workers with both work-related and non-work related health conditions. Speakers in this session will share their experience in the design and execution of large-scale medical surveillance programs and report on the results from the screening of more than 30,000 former energy workers.

# **The Health Consequences for Construction Trades Workers at US Department of Energy Sites**

Knut Ringen, L. Welch, J. Dement, E. Bingham, P. Quinn

HQ, CPWR: The Center for Construction Research and Training, Seattle, Washington, USA

## **Introduction:**

In 1993, the US Congress directed the Department of Energy (DOE) to establish an independent medical screening program to determine if workers are at significant risks. Over 500,000 construction trades workers have been employed at DOE facilities since 1943. The Building Trades National Medical Screening Program (BTMed.org) is responsible for delivering screening services to construction trades workers. BTMed screens workers from a total of 27 DOE facilities. The screening are performed by a national network of about 200 medical providers, with secondary review by BTMed nursing and medical staff.

## **Methods:**

BTMed includes data from 31,000 screenings in 24,000 workers, and include a detailed work history interview and targeted occupational medical screening exam results. Analysis of these data are performed in three ways:

- Prevalence analyses for four signal outcomes: chest radiography, spirometry, audiometry, and beryllium lymphocyte proliferation test adjusting for confounders.
- Standardized mortality analysis for all causes, all cancers, and selected causes related to occupational exposures, including radiation..
- Pilot evaluations of results from early lung cancer detection (ELCD) using low-dose CT-scans in very high risk participants.

## **Results:**

Morbidity data show elevated risk for signal morbidities of compared to low risk control groups with significant variation among construction trades. Mortality analysis show significant excess risk for all causes even though mortality for common causes such as heart disease and diabetes is significantly lower than in the general population. Risks for cancers associated with radiation risks are significantly elevated. Workers employed during all periods analyzed, including those employed after 1980, are at significant risk for work-related diseases. The

medical program has documented significant health improvements among participants. ELCD shows significant promise in the detection and treatment of early stage lung cancer.

Affiliated Institutions represented by Abstract Authors: The Center for Construction Research and Training, Silver Spring, MD, Division of Occupational and Environmental Medicine, Duke University Medical Center, Durham, NC, Department of Environmental Health, University of Cincinnati Medical Center, Cincinnati, OH, USA

### **Collection and Management of Data for a Nationwide Medical Screening Program for Retired Workers from US Department of Energy Sites**

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Health, Energy, and Environment, Oak Ridge Associated Universities, Oak Ridge, TN, USA

#### **Introduction:**

The National Supplemental Screening Program (NSSP) was established in 2005 to provide former US Department of Energy (DOE) workers with exposure-based medical screening examinations along with other tests and procedures to identify medical conditions that are non-occupational in origin. The program had to achieve and maintain quality and performance standards for the medical testing on a nationwide scale, utilizing over 2,000 separate clinical evaluation sites. The medical examinations had to be delivered to each former worker within 50 miles of their home and adhere to a standardized protocol. Each participant needed to be advised of urgent findings in a timely manner and a complete report of all findings was to be delivered within 8 weeks of the examination. The program collects over 1,000 pieces of information for each participant. This paper describes the design and operation of this program.

#### **Methods:**

A secure, web-based data system was designed to house all participant information collected in the program. Each participating clinic is provided with training for the examination process prior to the arrival of the first patient. All data collected during the clinical assessment are forwarded electronically to a central location for uploading to the web-based system. Blood

test results from reference or specialty laboratories also are electronically loaded into the system. When all components of the exam are available for physician review, a letter is populated with the clinical information utilizing algorithm-driven language, which also includes recommendations based on national practice guidelines. This automated process ensures that findings are not overlooked and significantly reduces the results letter processing time. Each letter is reviewed by a physician who has access to the letter and the results, which can be viewed simultaneously. The web-based system contains approximately 2,000 decision rules for producing the letters and categorizing findings as occupationally-related or non-occupational.

#### Results:

The use of a centralized web-based, computer algorithm-driven system has enabled the objectives of this nationwide program to be accomplished. It allows a small group of physicians to review the results from each participant in a timely and consistent manner. The physicians are also assured that they are producing consistent recommendations to each participant.

The NSSP is funded by Cooperative Agreement DE-FC01-05EH04022 between ORAU and the U.S. Department of Energy.

Affiliated institutions represented by Abstract Authors: Axion Health, Inc., Westminster, Colorado; Center for Worker Health and Environment, Colorado School of Public Health, University of Colorado Denver, Aurora, Colorado

### **Total Former Worker Health: Detection of Both Work-related and Non-work Related Health Conditions in Cold War Veterans**

Lee Scott Newman, B. Stange, A. Gordon, T. Spencer, J. McInerney, A. Mayer, R. Witter, L. Tenney, K. Stinson, D. Cragle  
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USA



## Introduction:

The National Supplemental Screening Program (NSSP) uses an integrated, Total Worker Health(TM) approach to address U.S. Department of Energy (DOE) former worker health. The NSSP, a DOE Former Worker Medical Screening Program, provides DOE former workers exposure-based medical screening examinations and also provides screening tests and procedures to identify medical conditions that are both occupational and non-occupational in origin.

## Methods:

The NSSP chose the National Institute for Occupational Safety and Health (NIOSH) Total Worker Health Program(TM) model as a means towards integrating occupational health and general health promotion. To achieve and maintain quality and performance standards on a nationwide scale the NSSP implemented a single, web-based relational data management health records system to collect and process all demographic, occupational exposure, and clinical data. This paper summarizes the results of an integrated health screening and health promotion program for the 12,000 DOE former workers that completed an initial NSSP medical screening examination prior to October 4, 2013.

## Results:

The NSSP identified potential occupationally-related health conditions in 40.5% of those screened, but more notably identified 85.8% of participants with undiagnosed addressable non-occupational health conditions. It is significant that a high proportion of participants with non-occupational findings such as diabetes, hypertension, colon cancer, cardiovascular disease, renal disease, and obstructive and restrictive lung disease were discovered in all age, gender, and job category strata. The NSSP identified 10.6% of the medically screened population with no abnormal findings, 3.6% with only an occupational finding, 48.9% with only a non-occupational finding, and 36.9% with both an occupational and non-occupational finding. Males and females with no abnormal findings had the highest proportion of non-smokers as compared to other groups. Females who only had an occupational finding had a higher distribution of smokers than females in other groups. For males, the highest distribution of smokers was observed in those who had both an occupational and non-occupational finding.

## Conclusions:

The NSSP demonstrates that the identification of potential occupational health issues in

conjunction with the identification of non-occupational health issues provides former workers and health care providers with information to more effectively manage health.

The NSSP is funded by Cooperative Agreement DE-FC01-05EH04022 between ORAU and the U.S. Department of Energy.

Affiliated Institutions represented by Abstract Authors: Oak Ridge Associated Universities, Arvada, CO, Oak Ridge Associated Universities, Oak Ridge, TN, National Jewish Health, Denver, CO, Tri-County Health Department, Aurora, CO, Axion Health, Inc., Westminster, CO.