of relations with the workplace in the experience of disability. We show how questions developed based on the qualitative results were used in a longitudinal study and proved to be important prognostic indicators for the injured workers. Qualitative research, although common in the social sciences, is rarely used in epidemiology. Fundamental differences in the underlying research paradigms, methods of inquiry, and rules of evidence in qualitative research and epidemiology pose challenges to the integration of these two genres of research. However, these same differences make the combination of methodologies a particularly powerful approach to the investigation of occupational injury problems, especially when applied to those with strong social or psychosocial components.

This is illustrated through an examination of the application of findings from a qualitative study of the experience of work-related back problems to an epidemiologic study of occupational musculoskeletal injuries. Injured workers' and key informants' verbatim interview data were analyzed using methods of grounded theory. Critical social dimensions of their experience were identified which appeared to influence recovery and return to work; in particular, problems of legitimacy and vulnerability in the workplace appeared central to the workers' experiences of injury and disability. Measurement constructs were subsequently developed and a series of closed-ended questions devised for inclusion in two prognostic cohort studies to enable the statistical testing of hypotheses which emerged from the qualitative research data. The questions were used in the Early Claimant Cohort Study, a prognostic cohort study of over 1800 injured workers. Workers were interviewed when they submitted Workers' Compensation claims, and at several other times for up to one year after injury. The time on benefits for up to one year after injury was determined from records. Using factor analysis we have confirmed the existence of two independent constructs: legitimacy and job vulnerability. The prognostic significance of these variables and their demographic correlates have also been examined. The results of these analyses indicate that the constructs are important in prognosis, but also highlight the need for more questionnaire development in this area.

Occupational Injury Costs Per Employee: Pinpointing the Risks —Shannon H

Objectives: 1. To estimate the medical and work loss costs of lost-workday occupational injuries reported to the Bureau of Labor Statistics (BLS). 2. To determine which occupations, industries, sources, events, age groups, and gender are associated with the highest costs per employee.

Methods: Work Loss Costs. BLS annual survey data show work days lost through a fixed date. Therefore, durations are censored for some cases. By major injury grouping, we built and applied non-linear regression models to estimate the full duration for censored cases in the 1993 annual survey. This was a massive modelling effort. It corrected for heterogeneity in the data and accounted for the existence of permanently and totally disabling injuries.

Once work-loss durations were available for all cases, we developed algorithms to compute lost wages. One approach used wages by occupation, industry, sex, and age group from the Current Population Survey. A problem with this approach is that an executive's injury can be weighted much more heavily than a production worker's, obscuring where the injury problems lie. A second, more egalitarian approach used an average daily wage loss. The second approach facilitates injury risk comparisons between groups, but does not accurately depict employer or societal costs.

The work loss costs were supplemented by fringe benefit costs and by household work loss costs. Household work loss was estimated from work loss duration, data showing workers typically return to housework 10% sooner than wage work (but possibly trading for less demanding tasks), and studies of the value of housework.

Medical Costs. Medical costs by diagnosis were derived separately by injury diagnosis for hospital-admitted and non-admitted cases. Diagnosis-specific costs for admitted cases came from national average lengths of stay for cases covered by Workers Compensation (from 1987-1992 National Hospital Discharge Survey data) and costs per hospital day from states where cost control regulatory agencies force hospitals to accurately report these costs. Post-discharge costs in the acute care phase came from 1987 National Medical Expenditure Survey (NMES) data. Longer-term costs came National Council on Compensation Insurance Detailed Claims Information (DCI) data.

For non-admitted cases, costs per visit came from Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) data. NMES described short-term visits per case and DCI described long-term costs.

1987-1992 National Health Interview Survey data were used to compute the number of medically treated cases without work loss from the BLS lost work-day case counts. Data scarcity forced us to perform these computations for broad diagnosis groupings.

Results. The analysis is in process. The data set lets us rank costs per employee by occupation, industry, source (e.g., a machine), event (e.g., a fall), body region, diagnosis, age group, and gender.

Session 4: Work Organization

Encouraging worker participation in safety programs: A selected review of research findings—Peters RH

Various strategies have been used to encourage employee participation in safety programs. The intent of this presentation is to provide guidance to safety professionals concerning the use of three techniques for encouraging employees to participate in their safety program: (1) employee surveys, (2) incentives, and (3) fear communications. Each strategy is briefly described and a summary of the empirical evidence concerning its effectiveness and limitations is given. Some recommendations are made concerning the use of these strategies.

Management practices affecting safety: An overview of coal industry research findings—Peters RH

This presentation focuses primarily on summarizing the past 20 years of research on management practices affecting underground coal miners' safety. Three factors have consistently been found to account for differences in mine safety performance across multiple research studies involving different samples of miners, different research methods, and different researchers. The factors are: (1)

the extent to which workers perceive that upper management is concerned about their welfare; (2) the extent to which management actively involves the work force in identifying safety problems and defining solutions; and (3) the favorableness of management-labor relations. The findings and implications of this research are discussed.

Reducing Accident Rates with Organizational Performance Management—Saarela KL

Safety professionals know a lot of safety and health, but do they know enough on how to achieve a change in practice. This difficult question is considered here on the basis of two intervention studies which were carried out in the shipbuilding industry and in the metal product industry. The goal of both projects was to launch an improvement process leading to a better work environment and safety, as well as to more efficient production. The cooperation partners represented industries in which the accident rate is above the national average in Finland. The action research approach combining research and practice and organizational performance management was utilized in the studies. The project at the shipyard was started in three departments at the beginning of 1995. In 1996 when the project was reported, it involved more than 10 departments (over 900 employees). The project in the metal product factory involved one department (about 200 employees) and was carried out in 1996. In the beginning of the projects, a questionnaire survey provided the personnel the opportunity to participate, to report problems they had identified, and to make suggestions for improvements. Local small groups with managers, supervisors and workers as members arranged regular meetings and followed a systematic model consisting of identification of problems, setting goals, solving problems, implementing changes, monitoring the results and providing feedback. In connection with the projects, everybody working in the intervention area participated in a two-hour training and development seminar. The questionnaire survey was repeated in order to get evaluative information. The effects of the interventions on accident rates were also investigated. The overall accident rate of the shipyard decreased by 56 % during the two year period (the goal was 25 %). According to the questionnaire survey, almost all the workers in the departments with the best results agreed that housekeeping had improved, work was progressing better, hazardous situations had decreased, cooperation had improved, new working practices had been learnt, and job satisfaction had improved. Over 70 % of the workers in these departments reported that it was easy to achieve improvements in their department; this reflected the innovative organization culture. Despite some differences between the departments, some improvements had been achieved in all departments participating in the project. In the metal product factory, the accident rate was reduced by 45 % during the one year period. In addition, improvement was noted, e.g. in delivery reliability, throughput time, productivity and profit. The department was interested in continuing with more demanding development tasks, and a new project was started this year in cooperation with the Finnish Institute of Occupational Health.

The Relationship Between Safety Climate and Injury/ Exposure in an Acute Care Hospital—Gershon RRM, Karkashian C, Martin LS, Grosch J, Murphy L

Introduction. We have previously identified organizational commitment to safety (i.e., "safety climate") as an important correlate to safe work practices within the hospital workplace. To further advance our understanding of the complex relationship between safety climate and safe work practices and to clarify the role safety climate plays with respect to workplace injuries, such as needlestick injuries, we conducted a cross-sectional survey of employees at a large, 1000 bed, tertiary care hospital.

Methods. A questionnaire was designed to assess and characterize specific aspects of safety climate and to determine the relationship, if any, between these aspects and injury rates among hospital-based health care workers. The resulting five-page questionnaire was psychometrically analyzed and validated. Employee perception of safety climate was measured using a fifty-item safety climate scale, which factored into three distinct constructs: (1) facility-wide safety climate, (2) departmental-based safety climate, and (3) environmental safety climate. The questionnaire also contained items on injuries employees had experienced within the previous six months and these were further subdivided into categories of injuries and exposures, including exposures to bloodborne pathogens. Employees' compliance with safe work practices was measured using a 13 item compliance scale, and the questionnaires also included standard sociodemographic items. Most responses were based upon a five-point Likert scale (from strongly disagree to strongly agree). The confidential self-administered questionnaires were sent to a stratified random sample of clinical health care workers (i.e., those with direct patient or patient specimen contact) employed at a large, regional medical center.

Results. Responses were obtained from over 750 employees (60% response rate). Eighty-five percent of the respondents were female, the median age was 37 years, and the median tenure was 4.5 years. A total of 186 injuries (which occurred within the previous six months) were reported by 116 respondents. The respondents also reported 330 bloodborne pathogens exposures; 53 respondents reported a total of 74 needlesticks, 81 respondents reported 97 splashes to the mucosa, 52 respondents reported 81 cuts with sharp objects and 27 respondents reported 107 contacts with open wounds. Ninety-three (42%) of these exposures involved blood from a patient known to be infected with the human immunodeficiency virus and/or hepatitis B virus. Injuries were found to be highly correlated with two out of the three safety climate constructs. For example, low rates of injuries/exposures were correlated with strong facility-wide safety climate ($p<.01$) and departmental safety climate ($p<.001$). Employees who perceived a strong safety climate were significantly less likely to report workplace injuries. Safety climate was also significantly associated with high levels of self-reported compliance with safe work practices, and this was the case for all three safety climate constructs ($p<.001$).

Conclusions. Two safety climate constructs (facility-wide and departmental-based) were found to be significantly correlated with injuries and exposures; employees who perceived a strong safety climate at work were significantly less likely to report workplace injuries and exposures. Since these data are cross-sectional, we cannot determine causality—i.e., employees with fewer injuries may perceive their workplace to be safer, and this can only be determined from prospective studies. Nevertheless, these results inform us and help to identify the important determinants of safety climate. This will help us to appropriately focus our resources in our efforts to minimize the risk of injury/exposure among hospital-based health care workers.