therefore removed from consideration. All statistical analysis was performed in R under version 3.3.2.

Results: The average (x), standard deviation (s.d.), median (x̃), and range (y) were summarized for each variable. H (x: 0.39 m; x: 0.38; y: 0.019 – 0.99), V (x: 1.093 m; x: 1.092; y: 0.000 – 2.06), A (x: 23.2 deg; x: 17.4; y: 0.0 – 120.7), D (x: 0.21 m; x: 0.15; y: 0.00 – 1.63), W (x̄: 6.47 kg; x: 5.31; y: 0.18 – 54.43), and F (x: 2.64 lift/min; x̃: 1.59; y: 0.00 – 13.13). The H and W variables have a positive linear relationship to CLI category increase. The A has a slightly negative linear relationship. The other variables did not show any meaningful relationships.

Discussion: The summary values of each of the variables represents typical exposures across multiple worksites represented in the US. The A variable's distribution did not center on zero as was expected. This is perhaps an area which could be improved to ensure workers are avoiding asymmetry while lifting. The horizontal distance (H) was the most influential factor contributing to an elevated risk followed by object weight (W). Asymmetry was observed to be inversely proportional to CLI category. Based on the results in this study, it is recommended that horizontal distance and load weight be prioritized when analyzing job exposure.

F3.3

Title: The Inequality Paradox: Hospital-Based Safe Patient Handling Intervention Decreases Overall Worker Injuries and Pain, but Widens Socioeconomic Disparities

Authors: Erika Sabbath, Jie Yang, Jack Dennerlein, Leslie Boden, Gregory Wagner, Karen Hopcia, Dean Hashimoto, Glorian Sorensen

Background: The "inequality paradox" posits that public health interventions, even if they improve overall population health, may increase health disparities by improving outcomes primarily in more-advantaged groups. This phenomenon has received scant attention in the occupational health literature. Evaluation of a comprehensive, hospital-wide safe patient handling intervention among hospital patient care workers in 2013found that, compared with workers at a control hospital, those at a hospital who received the intervention had improved perceptions of workplace norms around safe patient handling and reduced workplace injuries (particularly lifting and exertion injuries). The present study aims to test whether the intervention improved safe patient handling behavior and reduced injury for everyone, or whether such changes occurred primarily in higher-wage workers (nurses), who as a group perform fewer patient lifts and have lower overall injury rates than low-wage workers (patient care associates or PCAs).

Methods: For these analyses, we used data from the Boston Hospital Workers Health Study, a cohort study of approximately 8,500 nurses and nursing assistants at two large Boston-area hospitals. We also had longitudinal survey data from 2012 and 2014 on a subset (n=1,595) of workers across the two hospitals. First, using the survey data and comparing high-wage and low-wage workers, we examined changes in perceptions of workplace health and safety, and in self-reported pain, before and after the intervention. We also had employer-provided injury data and payroll data for the entire cohort. We used the latter data sources to examine changes in injury rates in the two hospitals, again comparing high-wage and low-wage workers.

Results: In the intervention hospital, low-wage workers showed more improvements than high-wage workers in self-reported safe patient handling behaviors and bigger reductions in number of lifts per shift, comparing pre-intervention and post-intervention surveys. While both high-wage and low-wage workers had improvements in self-reported overall pain, only high-wage workers reported reductions in shoulder/ neck pain, pain interference with work, and moderate to high pain severity; low-wage workers actually reported (non-significantly) higher levels of the preceding three variables post-intervention. Among high-wage workers, administratively-reported injury rates decreased from 14% to 12% pre- to post-intervention, but for low-wage workers, injury rates remained steady at 20% both pre- and post-intervention. Therefore, while the overall injury rate decreased following the intervention, the disparity in injury rates between high- and low-wage workers actually grew wider.

Discussion: These results have implications for both intervention development and analysis. In terms of intervention development, low-wage workers in this study received the same training in safe patient handling as their high-wage counterparts, and they did report that their handling practices improved, but they did not see the concomitant reductions in pain and injury that were seen in high-wage workers. Further analyses may reveal

the explanation for this disconnect, and could potentially point to ways that this intervention (and others) could be delivered in a way that has similar uptake for diverse working populations. From an analytic perspective, this paper demonstrates the necessity of analyzing occupational health interventions for disparities in intervention effectiveness, and of collecting data on relevant social and demographic characteristics so that researchers are able to test for such disparities.

F3.4

Title: Uncovering a Hidden JEM: A General Population Job Exposure Matrix to Estimate Biomechanical Work Exposures

Authors: Marcus Yung, Ann Marie Dale, Skye Buckner-Petty, Alexis D'Escatha, Bradley Evanoff

Background: Effective prevention efforts in the development of musculoskeletal disorders (MSD) involve identification and assessment of workplace biomechanical exposures. There is increasing interest in the use of job exposure matrices (JEMs). A JEM estimates exposures of occupational risk factors based on job titles, industry information, and group-level exposure data. Unlike individual-level measures, JEMs can be applied to large populations for relatively low cost, minimizes information bias between cases and non-cases, and can estimate exposures of both current and past jobs. JEMs based on self-reported exposures make use of workers' knowledge of their job and assign these exposures at the group level, minimizing information bias due to individual variation in reporting. The French CONSTANCES project provides an opportunity to create a JEM using self-reported exposure data and to enable large-scale studies of associations between workplace exposures and chronic diseases, including MSD. This presentation describes the creation of a JEM based on CONSTANCES data, evaluation of its ability to create homogenous exposure groups, and comparison of exposure estimates to those of an existing American JEM based on O*NET.

Methods: Self-reported biomechanical exposure data were obtained from the CONSTANCES project, a large prospective French cohort study that includes self-reported occupational exposures. Job titles were coded using French national job codes, the 4-digit PCS (Profession et Catégorie Sociale). A non-parametric multivariate analysis of variance (NPMANOVA) with Manhattan distances between ranks of exposures assessed between-group and within-group variance. Individually reported exposure responses were then compared to JEM assigned exposure values. We created a crosswalk to match PCS codes with American SOC (Standard Occupational Classification) job codes found within O*NET. The 27 physical exposures identified in the French CONSTANCES JEM were compared with 24 O*NET exposures. Two comparison methods are reported: Spearman correlations and Cohen's Kappa agreements.

Results: CONSTANCES subjects who were currently employed (n = 81,425) were considered for the creation of the JEM. Subjects who were not currently working or not assigned a PCS code were excluded, leaving 35,563 eligible subjects. The NPMANOVA model indicates significantly higher between-group variance than within-group variance among the 27 exposures ($F[253,21964] = 61.33$, $p < 0.0001$); 41.4% of the variance in individual exposures were accounted for by PCS groups. A 24x27 Spearman correlation matrix of biomechanical exposures was created between the French CONSTANCES JEM and the O*NET JEM. Exposure variable pairs measuring similar exposures [e.g., carry loads (French JEM) and trunk strength (O*NET JEM)] demonstrated moderate to strong correlations. Cohen's Kappa demonstrated moderate to strong agreement between high and low exposure levels for variable pairs measuring similar exposures.

Discussion: A JEM was developed based on individual-level self-reported exposure data from a general population cohort of working-aged people in France. This French CONSTANCES JEM classified individual subjects based on their membership in specific job titles, and created homogenous exposure groups. JEM assigned exposure values approximated individual exposure responses reasonably well. Exposure estimates from the French JEM appear to be broadly consistent with exposure estimates calculated using American O*NET data. Continued validation of this French JEM is underway; preliminary results indicate that this JEM is a promising tool for biomechanical exposure assessment.

Session F4

Title: Use of Claims Data to Advance Safety

Moderator: Steve Wurzelbacher

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