JANITOR WORKLOAD AND INJURY STUDY

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The following information on some of the Methods utilized for this study was extracted from the publication:

Green D, **Gerberich SG**, Kim H, Ryan A, McGovern P, Church T, Schwartz A, Arauz RF: [2019] Knowledge of work-related injury incidence, severity, and associated risk factors. Journal of Occupational and Environmental Medicine 61(2):153-161. doi: 10.1097/JOM.0000000000001505

Additional publications, associated with this study, are provided at the end of this document.

METHODS

Study Population

The study population included janitors who were members of the Service Employees International Union (SEIU), responsible for cleaning, maintaining, and providing security for commercial office buildings, co-ops, and apartment buildings, as well as public facilities like theaters, stadiums, and airports. The SEIU Local 26 chapter, comprised of approximately 4000 janitors, represents a major portion of janitors, security officers, and window cleaners in the Twin Cities metropolitan area. Among these janitors, the target population necessarily included only 1200 janitors who were classified as full-time (ie, working more than or equal to 30 hours per week). Full-time janitors were selected because of known higher turnover rates and difficulty in accessing the part-time janitor community over two, 6-month sequential data collection periods. This study was approved by the Institutional Review Board at the academic research institution.

Data Collection

To achieve the goal of this study—to determine injury incidence and severity and potential associated risk factors for injury among janitors—data were collected using a survey methodology. A questionnaire, appropriate for administration, was developed in coordination with experts from the fields of injury prevention, survey design, and epidemiology, incorporating modifications based on initial focus group pilot testing and discussions with the janitors and union representatives. Piloting was used to determine the likelihood that the study population would understand the questions, assess the effectiveness of educational materials provided prior to survey questioning, and estimate a likely response rate. In order to accurately capture the effectiveness of the data collection tool, it was essential to develop an optimal data collection instrument in a rigorous manner.

The questionnaire was piloted using a focus group of approximately 30 janitors, selected with the support of SEIU Local 26, to obtain feedback and assess the adequacy of the questionnaire. Based on initial feedback, the questionnaire was revised as appropriate. Following the piloting, questionnaires were translated into the different languages of the study participants (English, Spanish, and Somali) and validated by professionals to ensure accuracy. Questionnaires requested information on work-related exposures and personal characteristics, including demographics, injury, and general health status. The research team, following the focus group

meeting, assessed participant feedback and modified the questionnaire, accordingly, based on responses to the questions.

Following relevant modifications of the questionnaire after development and pilot pre-testing, data collection was conducted in two sequential 6-month periods. Questionnaires were disseminated to participating janitors to collect data for each preceding 6-month period (baseline and follow-up), yielding data on a full year of the janitor's experience. The initial baseline questionnaire was administered in November 2016 and collected information regarding the 6-month period between May 1st and October 31st, 2016. The follow-up questionnaire was then administered 6 months later, during May 2017, and collected information regarding the 6-month period between November 1st, 2016 and April 30th, 2017. Questionnaire distribution was conducted using SEIU Local 26 representatives, who are referred to as stewards and are leaders within the union. Each steward is assigned a building or an area of janitors and is responsible for providing their members valuable union and contract information in addition to helping them resolve any issues and problems. At the onset of the study period, all stewards attended a 3-hour session during which they received training on how to distribute the questionnaires, answer questions that could arise during questionnaire completion, and how to collect and return the materials to the study team.

The questionnaires were distributed to all employees who agreed to participate in the study and had consented to participate. Questionnaire completion time ranged from approximately 30 to 45 minutes. The questionnaires were distributed at the commencement of janitors' work shifts and, following completion, were returned to the stewards in an individual sealed envelope addressed to the research team.

Measures

For each of the questions posed, pertinent to injury outcome or personal and work-related characteristics, they were identified within the context of the previous, respective 6-month data collection periods. For some questions (health conditions, demographics, duration working as a janitor), they were asked about their experiences over their lifetime.

Definition of Injuries

The definition used for work-related injury was based on the National Center for Health Statistics (NCHS) and Bureau of Labor Statistics.14 ‘‘Work-related’’ includes any activities, including travel, associated with the job or events that occur in the work environment. Work-related injuries are defined as any wounds or damage to the body associated with the job that occur in the working environment; they result from acute traumatic events that involve: restriction of normal activities for at least 4 hours; and/or the use of professional medical care; and/or loss of consciousness, loss of awareness, or amnesia for any length of time. At the request of this population, via the focus groups, *pain* was included in the injury description and subsequently as an injury type. The janitor members of the focus group consistently identified work-related pain as a major concern and associated that pain as a type of occupational injury. Injury data collected included type (diagnosis), cause and severity (hospitalization; lost work time; time restricted from

regular activity; time restricted from work) of the injury, together with the source, mechanism, and potential contributing factors.

Definition of Variables

Personal Characteristics

Janitors' demographic information collected for this study included age, sex, ethnicity, marital status, education, income, and language.

Physical and Mental Health Conditions

Physical health: Health status information, including physician-diagnosed heart conditions, asthma, cancer, lung disease, and diabetes were collected.

Mental health: This was determined by doctor-diagnosed depression, including currently being treated for depression, taking medications, or seeing a health professional for counseling.

Work-Related Characteristics

Job title: Based on the majority of job duties, janitors were classified as bathroom cleaners, floor cleaners, general cleaners, or special project workers.

Work experience: This involved years working as a janitor at the current company, as well as over their lifetime.

Other jobs: This included any additional jobs to their fulltime employment as a janitor. Additional janitorial service jobs were also included.

Work start time: This category included the times that janitors began their work shifts on any given workday. There were four subcategories of work time commencement: 12:00 a.m. to 5:59 a.m., 6 a.m. to 11:59 a.m., 12:00 p.m. to 4:59 p.m., and 5:00 p.m. to 11:59 p.m.

Data Analysis

Descriptive statistics were utilized to summarize the frequencies of participant demographics, work characteristics and health conditions, as well as injury type, cause, and severity. A binary variable (yes/no) was used to indicate occupational injury, and Poisson regression with robust variance was used to estimate incidence probability for occupational injury among janitors.15 A second analysis to estimate the rate of work-related injury events per person-year used a negative binomial regression. Regression estimates to determine incidence probability and the rate of injury utilized an offset term to differentiate between janitors who completed one survey only (6-month recall) versus those who completed both surveys (two 6-month recalls). To determine the strength of associations between personal and work-related characteristics and occupational injury, relative risks were calculated using Poisson regression models with robust variance estimators.15

Rates and associated 95% confidence intervals (CI) were estimated using generalized estimating equations (GEEs) with

exchangeable working correlation matrices. GEEs are an extension of generalized linear models for correlated data; they produce marginal models, which establish average estimates across subjects, while accounting for dependence within subjects.16 In this study, janitors could have completed both a baseline and a follow-up survey or completed just one of the surveys during the study period. For those participants who completed both surveys, GEEs accounted for any potential correlation between subjects. In the models, each janitor was considered to be independent. The exchangeable working correlation structure assumes all observations, over time, within each janitor, have the same correlation and, thus, was used in the GEE models for each of the exposures of interest.

Bias Analyses

Non-response bias arising from missing data was a potential concern. To minimize non-response bias prior to data collection, and promote survey response: (1) the questionnaire was translated to relevant languages; (2) focus groups were utilized to determine questionnaire comprehensibility; (3) the research team collaborated with union representatives to identify ideal dissemination methods; and (4) all SEIU Local 26 members contacted for the study were given the opportunity to be entered into a drawing for a $50 Target giftcard, whether or not they participated. To account for any missing data following survey collection, and to minimize possible non-response bias, models were adjusted by weighting observed responses by inverse probabilities of response estimated as a function of characteristics known for all SEIU Local 26 janitors available from the union. This method provides greater upweighting for those categories of subjects with low response rates compared with those with higher response rates to account for potential differences in responses and exposures between responders and non-responders.17 These characteristics included birth year, sex, and contractor.

Selection of Variables

Based on relevant literature and expert knowledge, a causal model was developed to determine the variables to be measured and controlled for in the study analyses. From the model, directed acyclic graphs (DAGs) were derived, a priori, based on relevant literature and experts' knowledge, to determine the minimum sufficient set of potential confounders for the identified characteristics and exposures of interest. When selecting potential confounders, the DAG allows identification of a minimal set of confounders for adjustment as well as any variables that would introduce confounding if adjusted for, following the methods described by Greenland et al.18 and illustrated by Hernan et al.19

ASSOCIATED PUBLICATIONS

Doctoral students identified as primary authors - underlined

Schwartz A, **Gerberich SG,** Kim H, Ryan A, Church TR, Albin T, McGovern PM, Erdman A, Green D, Arauz RF: [2019] Janitor ergonomics and injuries in the Safe Workload Ergonomic Exposure Project (SWEEP) Study. Applied Ergonomics 81:1-9 https://doi.org/10.1016/j.apergo.2019.102874

Schwartz A, Albin T, **Gerberich SG**: [2019] Intra-rater and inter-rater reliability of the Rapid Entire Body Assessment (REBA) tool, International Journal of Industrial Ergonomics 71:111-116. https://doi.org/10.1016/j.ergon.2019.02.010

Green D, **Gerberich SG,** Kim H, Ryan AD, McGovern PM, Church TR, Schwartz A, Arauz RF: [2019] Knowledge of work-related injury reporting and perceived barriers among janitors. Journal of Safety Research 69:1-10. doi: 10.1016/j.jsr.2019.01.003 [

Green D, **Gerberich SG**, Kim H, Ryan A, McGovern P, Church T, Schwartz A, Arauz RF: [2019] Knowledge of work-related injury incidence, severity, and associated risk factors. Journal of Occupational and Environmental Medicine 61(2):153-161. doi: 10.1097/JOM.0000000000001505

Green D, **Gerberich SG**, Kim H, Ryan AD, McGovern PM, Church TR, Schwartz A, Arauz RF: [2019] Janitor workload and occupational injuries. American Journal of Industrial Medicine 62:222-232. DOI: 10.1002/ajim.22940

Green D, **Gerberich SG**, Kim H, Ryan AD, McGovern PM, Church TR, Schwartz A, Arauz RF: [2019] Janitor workload and occupational injuries. CORRIGENDUM American Journal of Industrial Medicine 2020;63:101–102.

Schwartz A, **Gerberich SG**, Albin TJ, Kim H, Ryan AD, Church TR, Green DR, McGovern PM, Erdman A, Arauz RF: [2019] Mental workload, psychosocial factors, physical fitness, and injury in the SWEEP Study, In review.