

Differences in Safety Climate Perception by Health Care Worker, Work Schedule, and Workplace Characteristics

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Abstract

Safety climate has been associated with patient and health care worker safety and outcomes. However, few studies have examined how perceptions of workplace safety differ by worker, work schedule, and workplace characteristics. Data from 10 168 participants in the National Institute for Occupational Safety and Health's Health and Safety Practices Survey of Healthcare Workers were analyzed. Multivariable regression analyses examined associations among worker and workplace characteristics and items measuring 5 areas of workplace safety perception. Safety climate perception scores were higher (more positive) for dentists and for health care workers who were salaried, were self-employed, worked day shifts and shifts ≤ 11 hours, and spent $<76\%$ of their time in patient care. A wide range of health care worker, work schedule, and workplace characteristics should be considered in analyses designed to evaluate safety climate and identify potential interventions to improve downstream safety outcomes.

Keywords

surveillance, health care, occupation, safety climate, survey

Safety climate has been defined as shared perceptions of employees about the importance of safety within their organization.¹ Research in the health care industry has found that safety climate is associated with patient and health care worker safety and outcomes,² and with health care worker injuries, exposures, and compliance with safe work practices,^{3,4} suggesting the potential importance of improving safety climate.

To date, most studies of health care work that have examined differences in perception of the safety environment have focused on limited characteristics, evaluating differences within a specific occupation or work setting, or by management level. Generally, studies have found more positive perceptions of the safety environment with increasing management level and with increasing clinical authority,⁵⁻⁸ though the differences also may reflect administrative distance or other perceptual factors. A smaller group of studies has examined characteristics of the worker (age, sex) or workplace (eg, number of hospital beds, location in an urban area, staffing ratios) expected to be associated with safety climate and/or outcomes⁹ or metrics such as duration in health care, in a specific health care profession, on a certain team, or in a specific workplace.^{5,9,10} However, few have explored the possibility of nonlinear relations among health care safety climate and work schedule characteristics such as shift

(both type and duration) and overtime, although some of the characteristics have been considered in research on safety outcomes.^{11,12}

The 2011 Health and Safety Practices Survey of Healthcare Workers conducted by the National Institute for Occupational Safety and Health (NIOSH) presents an opportunity to compare differences in safety climate dimensions over a wide range of employee, work schedule, and workplace characteristics. The current exploratory analysis of these survey data had 2 aims: (1) to identify worker, work schedule, and workplace characteristics that should be considered in analytic research on the relations between safety climate and downstream safety outcomes, and (2) to identify subgroups of health care professionals who should be given particular consideration in efforts to improve safety climate and, potentially, safety outcomes.

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Methods

The NIOSH Human Subjects Review Board determined that the activities in this project were surveillance and did not meet the criteria of research according to 45 CFR 46.1101(b)(2) and Centers for Disease Control and Prevention (CDC) Guidelines for defining Public Health Research and Public Health Non-Research (CDC, 2010).

Survey Design

The Health and Safety Practices Survey of Healthcare Workers targeted health care personnel who routinely use or come into contact with any of 6 classes of chemical hazards commonly found in health care settings. For this targeted, web-based, voluntary survey, participants were recruited primarily by professional practice organizations via email, though a minority of participants was recruited by online announcements.¹³ Participating organizations primarily represented 6 professions: physicians (almost all anesthesiologists); dental practitioners (dentists, dental hygienists, and dental assistants); nurses (mostly nurse anesthetists and oncology nurses); pharmacy practitioners (pharmacists and pharmacy technicians); technologists/technicians (primarily surgical technologists and central sterile processing technicians); and therapists (almost all respiratory therapists). The core module of the survey included an 18-item set of safety climate perception questions as well as extensive questions on worker, workplace, and work schedule characteristics.

Study Population

Of the 12 028 respondents found eligible by the screening questions, 10 968 completed the core module. The 800 of these respondents who did not answer any safety perception questions in the core module were excluded, leaving 10 168 for the current analyses of how health care safety climate perceptions vary by worker, workplace, and work schedule characteristics.

Survey Content

Of characteristics analyzed for relations with the safety climate themes, occupation was of primary interest. Other characteristics considered included work arrangement (regular employee, self-employed, temporary, or contractor), pay type, and duration with current employer and in current occupation; worker demographics (sex, race, ethnicity, age, highest educational level attained, whether the employee was born in the United States, union membership); work schedule and burden characteristics (non-mandatory and mandatory overtime, shift, shift duration, number of days worked in the past week, full-time vs

part-time work; percentage of time spent on patient care); and workplace characteristics (number of employees at the workplace, type of health care establishment, employer size, and workplace location density).

Development of Safety Climate Metrics

Safety climate themes comprised groups of perception questions that the survey authors used to explore different areas of climate (Table 1). The perception section had 18 questions with answers using a 4-point Likert-type scale (1 = *strongly disagree*, 2 = *disagree*, 3 = *agree*, 4 = *strongly agree*) with a *not applicable* option (see supplemental Appendix A, available with the article online). The thematic areas were (1) management commitment to health and safety/overall safety culture, (2) safety precautions, (3) ability to report injuries without fear of negative consequences, and (4) exposure to risk. Negatively-worded items (2 questions about risk) were reverse coded to align scoring with that of the other items. One perception question, "Health and safety concerns influence my decision to continue working in the healthcare field," was omitted from all analyses because the influence could be interpreted as either positive or negative. A question about how comfortable the employee felt reporting concerns to management was excluded in favor of 2 items that asked specifically about comfort reporting a specific adverse outcome: injuries. Questions about staffing and autonomy (1 each) were omitted because the wording did not link staffing to safety. Metrics for each safety theme were obtained by summing the item-specific scores (1-4, excluding *not applicable* answers) across the perception questions included in that theme.

Analysis

All analyses were conducted using SAS version 9.3 (SAS Institute Inc., Cary, North Carolina). To examine how safety perception varied across each worker, workplace, or work arrangement characteristic, means of each safety theme were calculated for each category of each characteristic. To compare a reference group to other levels of a characteristic, *t* tests (for bivariate characteristics) or SAS PROC GLM (for characteristics with ≥ 3 levels) were used. For the multivariable analysis, SAS PROC GENMOD with backward elimination was used to model the relations among each safety theme and occupation, with adjustment for the other worker, work shift, and workplace characteristics already discussed. Observations with missing values for specific characteristics were excluded from pertinent analyses. Because of the large number of comparisons conducted, unadjusted means for candidate variables are presented with and without Bonferroni correction.^{14,15} Regression analyses

Table 1. Safety Themes and Contributing Perception Questions.

Safety Perception Theme	Respondents (Percentage of Respondents) ^a	Perception Questions Included in Theme
Management commitment	9703 (95.4)	<ul style="list-style-type: none"> • The health and safety of workers is a major priority for management • I feel safe from work-related injury or illness • I feel managers and supervisors set proper examples by following safety rules and work practices
Safety precautions	9410 (92.5)	<ul style="list-style-type: none"> • I feel my organization has a positive safety culture • I usually have enough time to take safety precautions while completing my duties • Proper personal protective equipment is available to me • My work area is periodically inspected to identify potential health and safety hazards • Unsafe working conditions are corrected in a reasonable time period • I have received adequate training from my current employer to recognize health and safety hazards in my job
Risk	9900 (97.4)	<ul style="list-style-type: none"> • I am often required to do a task that makes me feel like I might be at risk of getting hurt • People working with me are frequently exposed to dangerous or risky situations
Reporting	9770 (96.1)	<ul style="list-style-type: none"> • I can report injuries to my manager without worrying about how it will affect my job • I can report injuries to my manager without worrying about how it will affect my department's safety record

^aRespondents = number of respondents with scored answers for all component questions (*not applicable* and missing excluded); percentage of all eligible respondents.

are presented after Bonferroni correction in the interest of parsimony.

Results

Occupation and Tenure

Most of the 10 168 respondents were members of professional practice organizations; by occupation, more than half of the respondents were nurses, with smaller numbers of technologists/technicians, anesthesiologists, dental practitioners, and respiratory therapists. The smallest groups of respondents were pharmacists and pharmacy technicians (together 1.5% of eligible respondents) and other health care professionals (2.4% of eligible respondents). Pharmacists and pharmacy technicians were retained as a single group for further analyses because of small numbers. Because occupation was of primary interest and respondents from the “other” occupations could not be mapped to categories with sufficient numbers, they were retained in univariate analyses but omitted from the multivariable analyses.

Safety climate scores differed by occupation (Table 2). Compared to nurses (the largest group of respondents,

used as the reference group for occupational analyses), dental practitioners with terminal degrees had the highest (most positive) mean scores on most metrics. Scores were slightly more negative for dental assistants and lower still for dental hygienists. Technicians and technologists, particularly surgical technicians (data not shown), had significantly more negative mean scores than nurses on the risk and reporting themes.

Workers with longer tenures with the current employer had more positive scores than workers with shorter tenures. Workers with 6 to 10 years in an occupation had the most negative scores on all themes except risk.

Demographics

Demographic characteristics also were associated with differences in safety climate perception scores (Table 2). Male health care workers had significantly more positive mean scores than their female counterparts. US-born workers, white workers (including those of multiple races), and nonunionized workers had more positive mean scores on all safety climate themes than their counterparts (foreign-born workers, nonwhite workers, and union members, respectively). Hispanics had more negative

Table 2. Safety Climate Perception Themes Scores by Demographic Characteristics.

Demographic Characteristic	Categories (Reference Bolded)	n ^a	Management Commitment, Mean (SD) Range 4-16 (n = 9703)	Safety Precautions, Mean (SD) Range 5-20 (n = 9410)	Risk Mean (SD) Range 2-8 (n = 9900)	Reporting Mean (SD) Range 2-8 (n = 9770)
All		10 168	12.34 (2.57)	15.78 (2.83)	5.83 (1.42)	6.58 (1.37)
Occupation	Nurse	5613	12.22 (2.44)	15.69 (2.78)	5.79 (1.39)	6.55 (1.36)
	Anesthesiologist	1165	12.22 (2.04)	15.40 (2.80) ^b	5.76 (1.40)	6.66 (1.35) ^b
	Dentist	382	14.61 (2.03) ^c	18.12 (2.31) ^c	6.94 (1.30) ^c	7.46 (1.06) ^c
	Dental hygienist	395	12.24 (2.83)	15.14 (3.38) ^c	6.18 (1.41) ^c	6.69 (1.39)
	Dental assistant	116	13.20 (2.36) ^c	16.82 (2.54) ^c	6.50 (1.26) ^c	6.80 (1.26)
	Pharmacy practitioner ^d	149	12.77 (2.70) ^b	16.04 (2.99)	6.34 (1.34) ^c	6.82 (1.42) ^b
	Respiratory therapist	683	12.54 (2.66) ^b	16.03 (2.86) ^b	5.77 (1.48)	6.58 (1.37)
	Technician/technologist	1416	12.16 (2.51)	15.84 (2.75)	5.64 (1.40) ^c	6.36 (1.39) ^c
Years in occupation	<1	302	12.40 (2.44)	15.80 (2.88)	5.69 (1.34)	6.52 (1.36)
	1-5	1676	12.35 (2.34)	15.86 (2.59)	5.71 (1.34)	6.57 (1.31)
	6-10	1526	12.10 (2.55)	15.57 (2.80)	5.79 (1.40)	6.50 (1.39)
	11-20	2585	12.33 (2.59) ^b	15.79 (2.84) ^b	5.81 (1.43) ^b	6.57 (1.36)
	21-30	2401	12.44 (2.64)	15.83 (2.90)	5.94 (1.44) ^c	6.62 (1.40)
	>30	1638	12.43 (2.69)	15.82 (2.96)	5.91 (1.45) ^c	6.61 (1.38)
Years with current employer	<0.5	328	12.40 (2.42)	15.59 (2.86)	5.84 (1.29)	6.41 (1.39)
	0.5 to <1	371	12.13 (2.54)	15.49 (2.85)	5.67 (1.39)	6.47 (1.33)
	1-5	2846	12.10 (2.51)	15.51 (2.79)	5.72 (1.38)	6.47 (1.39)
	6-10	2029	12.18 (2.62)	15.66 (2.83)	5.81 (1.45) ^b	6.55 (1.38) ^b
	11-20	2211	12.42 (2.62) ^c	15.88 (2.85) ^c	5.83 (1.42) ^b	6.60 (1.38) ^b
	>20	2357	12.73 (2.54) ^c	16.19 (2.80) ^c	6.00 (1.43) ^c	6.76 (1.31) ^c
Sex	Female	7314	12.23 (2.60)	15.72 (2.84)	5.82 (1.41)	6.51 (1.39)
	Male	2833	12.64 (2.48) ^c	15.95 (2.78) ^c	5.86 (1.42)	6.75 (1.31) ^c
Born in United States	Yes	9206	12.37 (2.57)	15.82 (2.82)	5.85 (1.42)	6.59 (1.37)
	No	931	12.08 (2.55) ^b	15.40 (2.87) ^c	5.64 (1.42) ^c	6.49 (1.37) ^b
Race	White^e	9130	12.37 (2.58)	15.81 (2.83)	5.85 (1.42)	6.59 (1.37)
	Nonwhite	888	12.13 (2.48) ^b	15.57 (2.71) ^b	5.62 (1.38) ^c	6.46 (1.31) ^b
Hispanic/Latino	Yes	334	12.39 (2.52)	15.76 (2.84)	5.64 (1.44) ^b	6.58 (1.34)
	No	9772	12.34 (2.57)	15.78 (2.83)	5.84 (1.42)	6.58 (1.37)
Union member	Yes	1085	11.42 (2.76) ^c	14.99 (2.88) ^c	5.46 (1.42) ^c	6.32 (1.44) ^c
	No	9071	12.45 (2.52)	15.88 (2.81)	5.88 (1.41)	6.61 (1.36)
Education (highest level attained)	<Associate's degree	1091	12.35 (2.42)	15.92 (2.67)	5.82 (1.40)	6.41 (1.37) ^c
	Associate's degree	2256	12.20 (2.65) ^b	15.70 (2.87)	5.80 (1.43)	6.48 (1.38) ^c
	Bachelor's degree	2847	12.38 (2.61)	15.84 (2.83)	5.86 (1.41)	6.61 (1.36)
	Master's degree	2193	12.18 (2.46) ^b	15.60 (2.75) ^b	5.72 (1.35) ^c	6.54 (1.36)
	>Master's degree	1723	12.79 (2.61) ^c	15.94 (2.97)	5.96 (1.88) ^b	6.81 (1.76) ^c
Age category	<35 years	853	12.34 (2.29)	15.76 (2.59)	5.69 (1.40) ^b	6.63 (1.28)
	35 to <40	731	12.15 (2.38)	15.52 (2.65) ^b	5.65 (1.37) ^b	6.48 (1.33)
	40 to <45	882	12.24 (2.55)	15.71 (2.89)	5.73 (1.47) ^b	6.53 (1.45)
	45 to <50	1276	12.38 (2.61)	15.80 (2.89)	5.86 (1.40)	6.59 (1.35)
	50 to <55	1889	12.34 (2.63)	15.78 (2.86)	5.84 (1.41)	6.55 (1.39)
	55 to <60	2261	12.29 (2.62)	15.77 (2.83)	5.86 (1.42)	6.56 (1.37)
	≥60	2083	12.52 (2.60)	15.92 (2.85)	5.94 (1.41)	6.65 (1.35)

^aNumber of respondents in category who answered at least 1 perception question. This is greater than the number of respondents in the category who were included in the theme average because workers missing a coded score (1-4) for any component of the theme were excluded from analyses for that theme.

^b $p < .05$.

^cStatistically significant ($p < 0.05$) after Bonferroni correction.

^dPharmacists and pharmacy technicians.

^eIncludes respondents who selected white and some other race.

mean scores on risk compared to non-Hispanic workers but no significant differences on the other metrics. More education was associated with more positive mean scores for all metrics. Scores did not show a linear relation with age; the oldest group of workers (>60 years old) had the most positive scores for all themes, but most differences were not statistically significant.

Number of Health Care Employers, Pay Type, and Work Arrangement

The number of health care employers a respondent worked for at the time of the survey as well as pay type and work arrangement were related safety climate scores (Table 3). Across themes, respondents working for 2 health care employers had more negative scores than those working for only 1 employer or for >2. Compared to salaried workers (reference group), fee-for-service employees had significantly more positive scores and hourly workers had more negative scores on every theme. With regular, permanent employees as the reference group, self-employed workers had more positive mean scores and contractors had more negative mean scores. Interns, residents, and students had the most negative scores for risk.

Work Schedule

Many components of work schedule appear to be associated with safety climate scores (Table 3). Part-time employees had significantly more negative scores on management commitment and safety than their full-time counterparts. Respondents who worked regular day shifts had significantly more positive scores on all themes than workers with any other shift arrangement. Workers with shifts longer than 10 hours had more negative mean scores on all metrics. Overall, employees who worked shorter shifts, fewer days, and no overtime (either mandatory or voluntary) had the most positive mean scores across all themes. The one exception was that those who worked 3 days per week had the most negative mean scores for all themes; 36% of these respondents worked 11- or 12-hour shifts (primarily 12-hour shifts).

Patient Care Burden

Patient care burden also was significantly related to safety climate (Table 3). In analyses restricted to workers who cared for patients, the percentage of time spent on patient care was inversely related to all safety climate themes: workers with the most time spent on patient care (76%-100%) had the lowest scores on all themes. Workers with no patient care had scores that fell into an intermediate position on all themes.

Workplace Characteristics

As with worker characteristics, several aspects of the workplace were associated with significant differences on safety climate scores (Table 4). Workers at smaller workplaces (<100 workers) had more positive mean scores, with some differences statistically significant, for all themes. Compared to workers employed by for-profit entities or local government (eg, those working in county-operated health care facilities), those working for non-profits had more negative scores on management commitment and risk. Employees of nonprofit organizations had more negative scores on risk than workers for other types of employers, and workers in rural areas had more positive risk scores than workers in cities. Respondents who reported their employers were ambulatory care organizations had significantly more positive scores on all themes than those employed by hospitals; scores were even more negative for those few respondents employed by nursing home/residential care facilities, but differences from hospital scores were not statistically significant. Results by work location (ambulatory care, hospital, nursing/residential care, other) were generally similar to results by employer (data not shown).

Regression Analyses

For most characteristics included in the final regression models (Table 5), results were consistent with the unadjusted means (Tables 2-4). Along with occupation, a number of characteristics were highly significant across all safety perception themes: union membership, duration with employer, pay structure, shift and shift length, overtime status, and percentage of time engaged in direct patient care. In addition, education and health care industry were significant for management commitment and risk, sex for management commitment and reporting, and work arrangement for all themes except risk. Years in the occupation was significant for management commitment and safety procedures, and age for reporting. Some of the demographic characteristics (race, ethnicity, and birthplace) that showed differences in univariate analyses were eliminated during multivariable analyses; the same was true of some work structure and schedule characteristics (full-time vs part-time status, number of health care employers, and number of days worked in the past week).

Discussion

Differences in safety climate scores observed in this study suggest that future analytic efforts to understand and target improvements in safety climate (and downstream safety outcomes) would benefit from considering

Table 3. Safety Climate Perception Themes Scores by Work Structure Characteristics.

Work Structure Characteristics	Categories (Reference Bolded)	n ^a	Management Commitment Mean (SD) Range 4-16 (n = 9703)	Safety Precautions Mean (SD) Range 5-20 (n = 9410)	Risk Mean (SD) Range 2-8 (n = 9900)	Reporting, Mean (SD) Range 2-8 (n = 9770)
Number of health care employers	1	7338	12.34 (2.58)	15.80 (2.82)	5.84 (1.42)	6.59 (1.36)
	2	990	12.10 (2.64) ^b	15.42 (2.96) ^b	5.75 (1.38)	6.50 (1.42) ^c
	3	263	12.30 (2.54)	15.63 (2.89)	5.91 (1.43)	6.60 (1.39)
	>3	1531	12.52 (2.49) ^c	15.96 (2.77)	5.82 (1.42)	6.57 (1.36)
Pay type	Salaried	3510	12.68 (2.52)	16.09 (2.83)	5.96 (1.41)	6.76 (1.33)
	Hourly	5770	12.03 (2.58) ^b	15.53 (2.79) ^b	5.70 (1.41) ^b	6.43 (1.38) ^b
	Fee for service	693	13.21 (2.34) ^b	16.39 (2.82) ^b	6.18 (1.40) ^b	6.91 (1.28) ^b
	Other	159	12.58 (2.66) ^c	15.56 (3.22)	6.06 (1.36) ^c	6.57 (1.46)
Work arrangement	Self-employed	1037	13.23 (2.40) ^b	16.45 (2.82) ^b	6.21 (1.40) ^b	6.90 (1.32) ^b
	Temporary	48	11.74 (2.44)	15.31 (2.90)	5.49 (1.41)	6.31 (1.41)
	Contractor	36	11.66 (2.54) ^b	14.71 (2.86) ^b	5.63 (1.43) ^c	6.15 (1.44) ^b
	Regular/permanent	8587	12.28 (2.57)	15.76 (2.81)	5.80 (1.41)	6.57 (1.36)
Full-time/part-time	Intern/resident/student	83	12.08 (2.21)	15.36 (2.51)	5.26 (1.34) ^b	6.42 (1.36)
	Full-time	8657	12.39 (2.56)	15.84 (2.82)	5.83 (1.42)	6.60 (1.36)
Shift	Part-time	1342	12.05 (2.60) ^b	15.38 (2.83) ^b	5.82 (1.42)	6.46 (1.40) ^c
	Regular day	6584	12.56 (2.55)	16.02 (2.82)	5.96 (1.42)	6.67 (1.33)
Shift length	Regular evening	221	11.51 (2.33) ^b	15.05 (2.54) ^b	5.34 (1.41) ^b	6.11 (1.44) ^b
	Regular night	294	11.61 (2.71) ^b	15.08 (2.77) ^b	5.39 (1.30) ^b	6.19 (1.46) ^b
	Regular + Call	1663	12.13 (2.47) ^b	15.56 (2.70) ^b	5.72 (1.35) ^b	6.51 (1.36) ^b
	Rotating	525	11.95 (2.52) ^b	15.26 (2.73) ^b	5.50 (1.41) ^b	6.34 (1.50) ^b
	Split shift/other	448	11.68 (2.76) ^b	15.21 (2.89) ^b	5.52 (1.50) ^b	6.30 (1.44) ^b
	Irregular	406	11.87 (2.71) ^b	15.05 (3.20) ^b	5.59 (1.42) ^b	6.43 (1.43) ^c
	<8 Hours	602	12.70 (2.41)	16.05 (2.57)	6.05 (1.38)	6.70 (1.27)
Overtime	8 Hours	4575	12.52 (2.53)	16.00 (2.78)	5.96 (1.39)	6.64 (1.34)
	9-10 Hours	2420	12.46 (2.54)	15.82 (2.86) ^c	5.83 (1.42) ^b	6.64 (1.36)
	11-12 Hours	1233	11.86 (2.67) ^b	15.39 (2.89) ^b	5.53 (1.41) ^b	6.38 (1.44) ^b
	>12 Hours	356	11.25 (2.88) ^b	14.71 (3.10) ^b	5.36 (1.53) ^b	6.12 (1.58) ^c
Number of days worked during past week	Varied/Other	957	12.01 (2.49) ^b	15.40 (2.74) ^b	5.67 (1.41) ^b	6.50 (1.38)
	None	6492	12.50 (2.51)	15.94 (2.78)	5.93 (1.40)	6.65 (1.34)
	Voluntary	2241	12.41 (2.48) ^b	15.93 (2.72) ^b	5.77 (1.41) ^b	6.61 (1.34) ^b
Percentage of time spent on direct patient care	Mandatory	1386	11.50 (2.80) ^b	14.85 (3.03) ^b	5.46 (1.44) ^b	6.21 (1.50) ^b
	1	147	12.22 (2.98)	15.31 (3.07) ^c	5.98 (1.54)	6.59 (1.42)
	2	381	12.25 (2.46)	15.77 (2.57)	5.81 (1.40)	6.61 (1.33)
	3	1354	11.99 (2.56) ^b	15.45 (2.80) ^b	5.71 (1.37) ^b	6.42 (1.39) ^b
	4	2405	12.32 (2.56) ^c	15.70 (2.79) ^b	5.84 (1.41)	6.60 (1.33)
	5	4862	12.51 (2.54)	15.99 (2.82)	5.90 (1.41)	6.65 (1.35)
	6	660	12.16 (2.63) ^c	15.53 (2.87) ^b	5.62 (1.44) ^b	6.38 (1.51) ^b
Percentage of time spent on direct patient care	7	332	12.12 (2.69) ^c	15.42 (3.08) ^b	5.69 (1.56) ^c	6.38 (1.49) ^c
	76%-100%	7092	12.13 (2.59)	15.52 (2.84)	5.76 (1.42)	6.49 (1.39)
	51%-75%	1299	12.60 (2.48) ^b	16.10 (2.72) ^b	5.89 (1.44) ^c	6.73 (1.31) ^b
	26%-50%	581	12.96 (2.36) ^b	16.48 (2.65) ^b	6.03 (1.39) ^b	6.80 (1.30) ^b
	1%-25%	683	13.33 (2.25) ^b	16.84 (2.65) ^b	6.15 (1.40) ^b	7.00 (1.23) ^b
	0%	485	12.69 (2.60) ^b	16.34 (2.84) ^b	6.03 (1.38) ^b	6.63 (1.38) ^c

^aNumber of respondents in category who answered at least 1 perception question. This is greater than the number of respondents in the category who were included in the theme average because workers missing a coded score (1-4) for any component of the theme were excluded from analyses for that theme.

^bStatistically significant ($p < 0.05$) after Bonferroni correction.

^c $P < .05$.

Table 4. Safety Climate Perception Theme Scores by Workplace Characteristics.

Workplace Characteristic	Categories (Reference Bolded)	n ^a	Management Commitment Mean (SD) Range 4-16 (n = 9703)	Safety Precautions Mean (SD) Range 4-16 (n = 9410)	Risk Mean (SD) Range 2-8 (n = 9900)	Reporting Mean (SD) Range 2-8 (n = 9770)
Number of workers at workplace	1	72	13.10 (2.41) ^b	16.35 (3.14)	6.10 (1.28) ^b	6.92 (1.31) ^b
	2-9	1114	12.89 (2.70) ^c	16.16 (3.11) ^c	6.31 (1.36) ^c	6.80 (1.31) ^c
	10-99	2232	12.54 (2.47) ^c	15.93 (2.77) ^b	6.03 (1.38) ^c	6.63 (1.35) ^b
	100-249	930	12.30 (2.52)	15.71 (2.80)	5.80 (1.41) ^b	6.47 (1.36)
	250-1000	2412	12.10 (2.54)	15.56 (2.74) ^b	5.67 (1.38)	6.51 (1.35)
	> 1000	3358	12.21 (2.60)	15.74 (2.83)	5.67 (1.44)	6.54 (1.41)
Employer type	For profit	4374	12.45 (2.57)	15.76 (2.89)	5.96 (1.40)	6.59 (1.37)
	Nonprofit	4405	12.30 (2.53) ^b	15.84 (2.76)	5.78 (1.41) ^c	6.57 (1.36)
	Local gov't	932	12.02 (2.81) ^c	15.50 (2.88) ^b	5.57 (1.45) ^c	6.57 (1.41)
	Federal gov't	304	12.22 (2.75)	15.98 (2.79)	5.63 (1.40) ^c	6.56 (1.48)
Workplace location density	Large city	5863	12.33 (2.58)	15.77 (2.82)	5.79 (1.42)	6.58 (1.37)
	Small city	2129	12.30 (2.58)	15.74 (2.86)	5.83 (1.40)	6.52 (1.39)
	Suburbs	1286	12.32 (2.61)	15.71 (2.91)	5.93 (1.42) ^b	6.62 (1.37)
	Rural	865	12.57 (2.45) ^b	16.05 (2.70) ^b	6.00 (1.39) ^c	6.67 (1.30)
Health care industry of employer ^d	Ambulatory care	2786	12.83 (2.58) ^c	16.13 (2.92) ^c	6.24 (1.37) ^c	6.77 (1.33) ^c
	Hospital	7134	12.14 (2.53)	15.65 (2.76)	5.67 (1.40)	6.50 (1.38)
	Nursing-Residential care	74	12.00 (2.77)	15.29 (3.34)	5.54 (1.42)	6.34 (1.37)

^aNumber of respondents in category who answered at least 1 perception question. This is greater than the number of respondents in the category who were included in the theme average because workers missing a coded score (1-4) for any component of the theme were excluded from analyses for that theme.

^b $p < .05$.

^cStatistically significant ($p < 0.05$) after Bonferroni correction.

^d"Other" industry of health care employer not analyzed ($n = 132$) because of overlap with other categories (sometimes within an individual's answer).

Table 5. Regression Analysis Results for 4 Health and Safety Perception Themes.

Characteristic	Level	Management Commitment	Safety Procedures	Risk	Report
Occupation	Nurse	11.9 (11.5-12.2)	15.1 (14.8-15.4)	5.6 (5.5-5.8)	6.4 (6.2-6.5)
	Anesthesiologist	11.8 (11.4-12.3)	14.7 (14.4-15.1)	5.8 (5.6-6.1)	6.3 (6.2-6.5)
	Dentist	13.3 (12.8-13.8)	16.7 (16.3-17.2)	6.4 (6.2-6.7)	6.8 (6.6-7.1)
	Dental hygienist	11.5 (11.1-11.9)	14.4 (14.0-14.8)	5.6 (5.4-5.8)	6.4 (6.2-6.6)
	Dental assistant	12.2 (11.6-12.7)	15.9 (15.3-16.5)	5.9 (5.6-6.2)	6.4 (6.1-6.7)
	Pharmacy practitioner ^a	11.8 (11.3-12.4)	14.7 (14.2-15.3)	6.0 (5.8-6.3)	6.2 (5.9-6.3)
	Respiratory therapist	12.0 (11.6-12.4)	15.3 (15.0-15.7)	5.6 (5.4-5.8)	6.3 (6.1-6.5)
	Technician/Technologist	11.7 (11.3-12.0)	15.2 (14.8-15.5)	5.4 (5.2-5.6)	6.1 (5.9-6.3)
Years in occupation	<1	12.2 (11.7-12.6)	15.5 (15.1-16.0)	Not in model ^b	Not in model
	1-5	12.4 (12.0-12.7)	15.6 (15.3-16.0)		
	6-10	11.9 (11.6-12.3)	15.1 (14.8-15.5)		
	11-20	12.0 (11.6-12.3)	15.2 (14.9-15.6)		
	21-30	11.9 (11.5-12.2)	15.1 (14.8-15.5)		
	>30	11.8 (11.4-12.1)	15.0 (14.6-15.3)		
Years with employer	0 to <0.5	12.0 (11.6-12.4)	15.0 (14.6-15.5)	5.8 (5.6-6.0)	6.2 (6.0-6.4)
	0.5 to <1	11.9 (11.5-12.3)	15.0 (14.6-15.5)	5.7 (5.5-5.9)	6.3 (6.1-6.5)
	1-5	11.8 (11.4-12.1)	15.0 (14.7-15.4)	5.8 (5.6-5.9)	6.3 (6.2-6.5)
	6-10	12.0 (11.6-12.3)	15.3 (15.0-15.6)	5.8 (5.6-6.0)	6.4 (6.2-6.6)
	11-20	12.1 (11.8-12.5)	15.4 (15.1-15.8)	5.8 (5.6-5.9)	6.4 (6.3-6.6)
	>20	12.4 (12.0-12.7)	15.7 (15.4-16.0)	5.9 (5.8-6.1)	6.5 (6.4-6.7)

(continued)

Table 5. (continued)

Characteristic	Level	Management Commitment	Safety Procedures	Risk	Report
Sex	Female	11.8 (11.5-12.2)	Not in model	Not in model	6.2 (6.1-6.4)
	Male	12.2 (11.9-12.5)			6.5 (6.3-6.6)
Union	No	12.5 (12.1-12.8)	15.7 (15.4-16.0)	6.0 (5.8-6.2)	6.5 (6.3-6.6)
	Yes	11.6 (11.2-11.9)	14.8 (14.5-15.2)	5.6 (5.5-5.8)	6.3 (6.1-6.4)
Education (highest level attained)	<Associates	12.2 (11.8-12.6)	Not in model	5.9 (5.8-6.1)	Not in model
	Associates	12.1 (11.8-12.5)		5.9 (5.7-6.1)	
	Bachelor's	12.2 (11.8-12.5)		5.8 (5.7-6.1)	
	Master's	11.9 (11.5-12.2)		5.8 (5.6-5.9)	
	>Master's	11.7 (11.3-12.1)		5.5 (5.3-5.7)	
Age category	<35 years	Not in model	Not in model	Not in model	6.6 (6.4-6.8)
	35 to <40				6.3 (6.1-6.5)
	40 to <45				6.3 (6.2-6.5)
	45 to <50				6.4 (6.2-6.6)
	50 to <55				6.3 (6.2-6.5)
	55 to <60				6.3 (6.1-6.4)
	>60				(6.2-6.6)
Pay type	Salaried	12.1 (11.7-12.4)	15.4 (15.1-15.7)	5.8 (5.6-6.0)	6.4 (6.3-6.6)
	Hourly	11.6 (11.3-11.9)	14.9 (14.6-15.2)	5.6 (5.4-5.8)	6.2 (6.1-6.4)
	Fee for service	12.4 (12.0-12.8)	15.7 (15.3-16.1)	6.0 (5.8-6.2)	6.5 (6.3-6.7)
	Other	12.0 (11.5-12.5)	15.0 (14.5-15.6)	5.9 (5.6-6.2)	6.3 (6.0-6.6)
Work arrangement	Self-employed	12.4 (12.1-12.7)	15.5 (15.2-15.8)	Not in model	6.5 (6.4-6.6)
	Temporary	11.9 (11.1-12.7)	15.4 (14.6-16.3)		6.4 (6.0-6.9)
	Contractor	11.6 (11.2-12.0)	14.6 (14.2-15.0)		6.1 (5.9-6.3)
	Regular/permanent	12.1 (11.8-12.4)	15.5 (15.2-15.7)		6.5 (6.4-6.6)
Shift type	Intern/resident/student	12.0 (11.4-12.7)	15.3 (14.6-16.0)		6.3 (5.9-6.6)
	Regular days	12.3 (12.0-12.7)	15.7 (15.4-16.0)	6.0 (5.8-6.1)	6.6 (6.4-6.7)
	Regular evenings	11.6 (11.1-12.0)	14.8 (14.3-15.2)	5.6 (5.3-5.8)	6.1 (5.9-6.4)
	Regular night	11.9 (11.4-12.3)	15.1 (14.7-15.6)	5.7 (5.5-6.0)	6.2 (6.0-6.5)
	Regular and call	12.3 (11.9-12.6)	15.6 (15.2-15.9)	6.0 (5.8-6.1)	6.5 (6.3-6.7)
	Rotating	12.2 (11.8-12.5)	15.3 (14.9-15.7)	5.8 (5.6-5.9)	6.3 (6.1-6.5)
	Split or other	12.0 (11.6-12.4)	15.3 (14.9-15.7)	5.8 (5.6-6.0)	6.4 (6.2-6.6)
	Irregular	11.9 (11.5-12.4)	15.1 (14.7-15.5)	5.8 (5.6-6.0)	6.4 (6.3-6.7)
Shift length	<8 Hours	12.3 (11.9-12.7)	15.6 (15.2-16.0)	5.9 (5.7-6.1)	6.5 (6.3-6.7)
	8-9 Hours	12.3 (12.0-12.6)	15.5 (15.2-15.9)	5.9 (5.8-6.1)	6.5 (6.3-6.6)
	10-11 Hours	12.3 (11.9-12.6)	15.4 (15.1-15.7)	5.8 (5.7-6.0)	6.5 (6.3-6.6)
	12 Hours	12.0 (11.6-12.3)	15.2 (14.9-15.6)	5.8 (5.6-6.0)	6.4 (6.2-6.5)
	>12 Hours	11.3 (10.9-11.7)	14.6 (14.1-15.0)	5.5 (5.3-5.8)	6.0 (5.8-6.2)
	Varies/other	12.0 (11.6-12.4)	15.3 (14.9-15.6)	5.8 (5.6-6.0)	6.4 (6.2-6.6)
Overtime	None	12.2 (11.9-12.6)	15.5 (15.2-15.8)	5.9 (5.8-6.1)	6.4 (6.3-6.7)
	Nonmandatory	12.3 (12.0-12.7)	15.6 (15.3-15.9)	5.9 (5.7-6.0)	6.5 (6.3-6.7)
	Mandatory	11.5 (11.1-11.8)	14.6 (14.3-15.0)	5.6 (5.4-5.8)	6.1 (6.0-6.3)
Percentage of time spent on direct patient care	76%-100%	11.5 (11.2-11.8)	14.7 (14.4-15.0)	5.6 (5.4-5.8)	6.1 (6.0-6.3)
	51%-75%	11.9 (11.5-12.2)	15.1 (14.8-15.4)	5.7 (5.5-5.9)	6.3 (6.1-6.5)
	26%-50%	12.2 (11.8-12.5)	15.4 (15.0-15.8)	5.8 (5.6-6.0)	6.4 (6.2-6.6)
	1%-25%	12.4 (12.0-12.8)	15.6 (15.3-16.0)	5.9 (5.7-6.1)	6.4 (6.4-6.7)
	0	12.2 (11.8-12.6)	15.5 (15.1-15.9)	6.0 (5.8-6.2)	6.5 (6.0-6.7)
Health care industry of employer	Ambulatory care	12.3 (12.0-12.6)	Not in model	6.0 (5.9-6.2)	Not in model
	Hospital	11.8 (11.1-12.4)		5.7 (5.6-5.8)	
	Nursing home/other	12.0 (11.7-12.3)		5.6 (5.3-6.0)	

^aPharmacists and pharmacy technicians.^bCovariate not in final model.

how a wide range of worker, workplace, and work schedule characteristics influence health care workers' perceptions of safety climate.

Across safety climate perception themes, certain characteristics were associated with more positive or negative mean scores. Groups with the most positive mean scores were dentists, workers who were salaried or paid on a fee-for-service basis, and workers with 1% to 50% of their time providing patient care. Groups with the most negative mean scores were employees working 12-hour shifts or variable shifts, those who worked mandatory overtime, evening and night shift workers, and contractors.

Race, ethnicity, and whether a worker was born in the United States were not retained in the most parsimonious models, although they were statistically significant for several metrics before Bonferroni adjustment. However, numbers of nonwhite, Hispanic/Latino, and non-US born workers were small, so the study might have been underpowered to find differences, particularly after adjustment for covariates.

Some of the present study findings on differences by occupation and work setting are consistent with the literature in this area. Health care workers practicing in inpatient settings (ie, hospitals) have been found to have less positive perceptions than workers in ambulatory care facilities¹⁶; this is consistent with the findings of more positive scores for workers who reported being employed by ambulatory care organizations than those employed by hospitals, although the definitions of ambulatory care are not coextensive.

Safety climate perception has been found to be more positive for physicians than nurses in some studies of dimensions of safety climate^{9,17-20} and the related concept, safety culture.^{5,6} However, equivocal or reverse results have been reported on some safety climate metrics in other studies.^{21,22} In this study, physicians had more positive mean scores than nurses on reporting only; the lack of contrast on the other metrics may reflect that almost all physicians in the study were anesthesiologists who worked long and on-call shifts, in contrast with general practitioners who may have office jobs and regular hours. Demographic, work schedule, and workplace characteristics are interrelated. The contrast between anesthesiologists, who may work long shifts, and dentists, who often are self-employed and control their shifts, suggests that a range of factors related to work schedule may affect safety climate perceptions.

Several studies have found that safety climate perception is more positive in older workers. In the same Norwegian study, perceptions generally were more positive in the middle (41-55 years) or oldest (≥ 56 years) age groups than in workers who were aged 40 years or younger.¹⁰ The oldest workers in the present study (>60

years) had more positive mean scores than younger workers, but some differences were not statistically significant. Workers from ages 35 to 45 years had the most negative scores, lower than the scores of the youngest workers, perhaps reflecting other factors such as work-family balance. Contrasts in results between the univariate and multivariable analyses for this and other factors suggest that safety climate perceptions are the joint product of multiple characteristics.

The percentage of work time spent on patient care generally had an inverse relation with safety climate score both in the present study and in a study of nurses and physicians working in Swiss hospitals.¹⁷ This finding may have implications for patient safety. Of note, in both studies, workers with no patient care had lower safety climate scores than would be expected from this trend; they had the lowest mean safety climate score in the Swiss study and intermediate scores for all metrics in the present survey.

Methodological Considerations

This study has a number of limitations. The Health and Safety Practices Survey of Healthcare Workers utilized a targeted sample, and results may not be generalizable to all health care workers. Some characteristics were not captured by the survey. The literature has shown that members of management have a more positive perception of safety climate than frontline workers.^{6,7,19} The survey did not solicit information about whether the health care worker had management responsibilities (eg, charge nurses). Restrictions on survey length precluded collection of detailed information on work schedule, and data quality issues precluded analysis of associations with weekend work or total hours worked per week. In addition, because of rapid changes in health care workplace ownership, especially the increasing acquisitions of ambulatory care facilities by hospitals and health care systems, additional questions would be needed to fully capture the implications of health care workplace ownership and worksite—factors that have been found to influence perception of safety climate or culture in other studies.⁶

The literature on safety climate stresses the importance of multilevel modeling or other adjustment for clustering when surveys are administered to groups within the same organizational subunit.^{20,23,24} Practice-level, ward-level, and other suborganization-level factors have been found to affect patient safety outcomes.²³ The identity of the workplace was not collected in this anonymous survey, so these issues could not be addressed. Respondents were not recruited through workplace channels but through professional organizations, perhaps mitigating the impact of nonindependence to some extent; however, the inability to assess these aspects of safety

climate remains a limitation. Along with work group, personality differences, which also have been related to safety climate and outcomes,²⁵ were outside the scope of this survey.

Questions were divided into safety climate themes based on the intent of the instrument's authors. Other groupings are possible and could yield different results. Nearly 10% of respondents who answered some questions on the core module of the survey did not answer any perception questions and were excluded from the current analyses; these respondents often left a subset of other core module questions blank as well. Respondents who did not answer or gave an answer of *not applicable* to a component of a safety climate theme were dropped from analyses of that theme. Fewer than 4% were excluded from any theme. This study examined individual perception questions by occupation to detect any clustering of nonresponse and found none. However, *not applicable* is an appropriate response when self-employed workers are queried about supervision-related issues, so the distribution of these excluded responses on this metric likely is not independent of work arrangement.

Organizations representing a limited number of health care professions participated in this study. For example, almost all participating physicians were anesthesiologists, and results for other specialties may differ. Moreover, numbers of participating pharmacists and members of "other" professions were small; particularly for these professions, analyses should be replicated in the context of systematic surveys with more participants. Finally, the study is cross-sectional, so no causal relations can be assessed.

Strengths of this study include the sample size, with more than 10 000 respondents answering at least one perception question. The survey covered a range of health care workplaces and occupations and collected information on worker, workplace, and work schedule characteristics. Despite a history of research on relations between shift and safety outcomes, this is one of the few surveys to examine differences in safety climate perception for multiple components of work schedule and burden. Long shifts, overtime, and evening and night shift were associated with more negative perceptions of safety climate. Many of these shift characteristics are less relevant in the outpatient setting than in hospitals and nursing/residential care homes. These findings suggest a need to focus on workers on off shifts, rotating or variable shifts, and workers with shifts longer than 10 hours. Some shift factors cannot be altered, but any interventions targeting general organizational safety climate, as well as reporting mechanisms, may benefit from attention to employees working these shifts.

Future analyses should include health care workers largely absent from these analyses: nurse assistants,

medical assistants, personal and patient care assistants, environmental services staff, and orderlies, among others. These workers, who often are of lower sociodemographic status, are frequently hard to reach and left out of studies of safety climate but are critical to many safety practices and outcomes. Overall, the findings suggest that workers in professions lower on the health care hierarchy and those working long or unusual work schedules warrant particular attention.

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