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Characteristics of Effective Health and Safety Committees: Survey Results

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Background *Although perhaps the most common worker-management structure, there has been surprisingly little research on describing and evaluating the characteristics of health and safety committees.*
Methods *A survey of 380 health and safety committee members from 176 manufacturing workplaces was supplemented with administrative data and compared with reported workers' compensation rates. Survey respondents also reported perceptions of overall safety, committee, effectiveness, committee activities, and "best practices."*
Results *Extensive descriptive data is presented, including a mean of 8.7 members per committee spending 1,167 hr per year on committee business for an estimate of $40,500 worth of time per committee. Higher speed to correct action items, a focus on ergonomics, and planning for safety training was associated with lower injury rates. The discrepancy between managers and hourly committee members in estimating overall safety was strongly positively associated with injury rates.*
Conclusions *Communications and worker involvement may be important to address discrepancy issues. Prospective studies are needed to distinguish directionality of associations.* Am. J. Ind. Med. 56:163–179, 2013. *© 2012 Wiley Periodicals, Inc.*

KEY WORDS: health and safety committees; safety programs; management support; worker involvement; injury and illness rates

INTRODUCTION

Health and safety committees (HSC) are very likely the largest worker participation program in the workplace (with the possible exception of quality teams) [Dunlop, 1994], and there is extensive general support for this approach to reducing injuries and illnesses, including state laws that either require or provide incentives for HSC [Hecker, 1994; Liu et al., 2010]. A 1993 survey (most recent available) found health and safety committees in 75% of companies with over 50 employees, and 31% of smaller employers [Planek and Kolosh, 1993], with a Labor Department commission concluding that "joint safety and health committees are the most common form of employee participation program aimed at employee concerns about conditions of work" [Dunlop, 1994]. Surprisingly, while there are an extensive assortment of guides and recommendations for HSC, there is only a very small empirical evidence base for maximizing the effectiveness of the committees [Bryce and Manga, 1985; Milgate et al., 2002].

Liu has assessed the change in reported injury rates among companies participating in an incentive-based (5% reduction in workers' compensation premiums) health and safety committee program in Pennsylvania [Liu et al.,

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2010]. While there was no support for the reduction of injuries from participation, compliance with certain committee requirements were associated with reduced rates, including training of committee members and having a prepared agenda for the meetings. This would suggest that the proper implementation of the committee may be of critical importance. Smitha et al. [2001] in a state-based evaluation of the impact of state mandates on health and safety programs, found that mandatory HSC had the largest impact on injury rates of all the ecologic variables studied.

Despite the large investment in committees by employers, there is surprisingly little documentation of the actual functioning of committees, including composition, activities, and topics addressed, and the little information that is available tends to be dated [Kochan et al., 1977; Boden et al., 1984] or describing HSC in other countries [Lewchuk et al., 1996; O'Grady, 2000; Milgate et al., 2002]. This gap in the literature severely limits the research that can be done to understand which characteristics of committees are associated with beneficial outcomes. There is a potentially large impact from having an evidence base of effective structure and activities, since such information can be fed to committees in a quality improvement approach. Since committees exist so widely, such information can be implemented in a large number of workplaces quickly; it is perhaps the largest opportunity for translational research in the occupational health and safety area.

Connecticut was one of the first states to require HSC, implementing a law in 1995 as part of a broad reform of workers' compensation statutes. The statute requires committees for all employers with 25 or more employees, as well as smaller employers if their injury and illness rate exceeds the overall rate for the state as a whole. HSC must meet at least quarterly, be composed of at least 50% hourly workers (contrasted with managers), keep records of members and meetings, and be trained in the requirements of the statute. Workers' Compensation Commission personnel go out to workplaces on a regular basis to ensure compliance with the statute.

The ''characteristics of effective health and safety committees'' project was intended to address better documentation of HSC characteristics (in the manufacturing sector) as well as to compare those characteristics with committee self-evaluation of effectiveness and injury and illness rates. Data sources included a survey of committees, interviews with committee members, review of administrative records (including copies of HSC meeting minutes), and OSHA and workers' compensation injury and illness statistics. Availability of contact information and administrative data for HSC greatly facilitated this research and is highly recommended for other states that may want to contribute to similar studies. This report focuses on the results of the survey of HSC; other data is being currently analyzed and will be the focus of additional reports.

MATERIAL AND METHODS

Survey instrument development began with the definition of content domains based on prior literature and an analysis of domains discussed in 48 interviews with health and safety committee members that were conducted in phase 1 of this study. This resulted in the domains of demographics, committee composition, committee activities, management commitment, worker participation, communication, perceived effectiveness, time to resolve problems and participation, use of safety professionals/consultants, best practices, committee training, resources used, primary workplace hazards, incentive and behavior based safety programs, health promotion, time spent on committee work, and meeting characteristics. Literature was reviewed for questions and survey instruments that had been tested for reliability and validity but there was little availability due to the lack of research in this area, so most questions were newly developed based on face validity or objective content. Survey size was reduced to promote higher response rates. Question wording was reviewed by two survey methodologists to maximize face validity, ease of completion, comprehensibility, and usefulness of data. Cognitive testing was performed through a focus group of six HSC members, and a pretest of six additional HSC members for comprehension and wording. The survey instrument was available as a scannable (Teleform) paper survey or a web-based survey (www.surveymonkey.com). Surveys were coded by company but were individually anonymous.

The final survey (Appendix A) was sent to a size-stratified random sample of 505 manufacturing sector health and safety committees based on records of all committees maintained by the CT Workers' Compensation Commission. The names of health and safety committee chairs were obtained from the most recent inspection checklists contained in the administrative records. A pre-survey letter was sent to the chair of each committee, followed a week later by the survey, a cover letter, and a modest incentive (a $10 Dunkin Donuts gift card). A reminder post card was sent 2 weeks later for non-respondents and a follow-up phone call was made to 100 of the non-respondent companies. Surveys were re-sent if a better address or contact information was obtained. Sample recruitment was discontinued after the determination was made that the outreach efforts had been saturated. Fifty-two of the 505 surveys were resent (26 to a better address or company name, 18 to a new contact and 8 to a new address and contact). Eighteen additional

worksites appeared to have gone out of business (''unable to forward,'' ''no longer at this address'').

The survey packet included a second, reproducible, copy of the shorter survey for other (non-chair) committee members, and instructions for accessing a web-based version if preferred (therefore, some results presented below are for chairs only since members were not asked all questions, particularly questions that were more factually based about company characteristics). All committees that returned at least three surveys were eligible for a drawing for a ''health and safety committee library'' of books (each of the five libraries had a value of approximately $100).

Questionnaires were imported into a Microsoft Access database from the Internet platform and from scanned paper versions. Scanning utilized TeleForm software, which utilizes a comparison of imported data to visual review of the questionnaire image to ensure proper data importation in relation to stray marks, insertions and deletions, multiple responses, and missing data. A study book was developed to maintain a clear record of decision logic for error terms, attribution of missing data, out-of-range values, etc. A 10% sample of paper forms were compared to the database to ensure accurate entry. Frequencies and cross-tabulations of paper versions and Internet versions were compared to ensure that there was not a significant effect from the differences in format of the questionnaire. Once the databases had been fully evaluated and cleaned they were exported to SPSS (v. 17–19) for data analysis. Datasets were linked by company ID for analysis.

Survey results were supplemented with administrative records from the Connecticut Workers' Compensation Commission (WCC), which included data on committee size and basic compliance with the statute, and were available for all 505 companies in the sample.

Two sources of injury and illness data were available for comparisons to committee characteristics, one from federal OSHA and the other from the CTWCC. Injury and illness rates for companies for the years 1996–2007 were obtained from the federal Occupational Safety and Health Administration (OSHA) FOIA website that posted rates for those companies that were selected for reporting logs of injuries and illnesses (methods are posted at http://www.osha.gov/pls/odi/establishment_search.html). Additionally, the electronic dataset for all reported injuries and illnesses to the CTWCC were obtained for the years 2004–2009. Reporting criteria for the OSHA and CTWCC differ in some respects; only lost time cases are required to be reported to the CTWCC although some respondents voluntarily also provide non-lost time cases. Companies were matched between the survey/administrative data and the OSHA and CTWCC injury and illness data. Matching including searching for name and location matches, identifying potential alternative names (such as corporate names or name changes) through review of all names used in the CTWCC administrative data, company websites, and individual review by project staff with high familiarity with the CT manufacturing sector (TM). Since the OSHA data relies on a sampling strategy (particularly for small and medium sized companies) it was found that the CTWCC data provided more consistent data over the study period, and so the CTWCC data was utilized for this publication. Overall, CTWCC data was successfully matched for at least some of the years for 471 of the 505 companies in the sample (93.2%).

Survey variables that were not already dichotomous were made into dichotomous variables split at approximately the mean scores for each variable, based upon the committee chair scores only (since these were the longer survey form and could be used to represent a single company). These variables were tested against mean injury/illness rates based on workers' compensation reports for the years 2004–2009 using difference of means tests. Variables that were conceptually logical and significant at the 0.10 level were entered into linear regression models (also utilizing company demographics such as company size and union status) using backwards stepwise regression.

The study and all survey instruments were approved by the University of Connecticut Health Center's Institutional Review Board (IRB #07–112). Written informed consent was obtained for interviews, and implied consent was approved for the anonymous surveys based on the categories of minimal risk and social science surveys with no protected health information.

RESULTS

Sample Characteristics

HSC chairs from 176 of the 501 worksites (35.1%) returned the survey (5 sites had both co-chairs submit surveys for a total of 181 HSC Chair surveys), with an additional 199 committee members, for a total of 380 survey respondents. A total of 327 (85.6%) surveys were paper versions and 55 (14.4%) were the web version. An average of 2.2 committee members per company completed the survey.

Survey respondents were compared to non-respondents in relation to data available from administrative records. There were no significant differences in mean workers' compensation injury/illness rates, unionization, or size of company. Participating companies were fairly evenly divided across size categories, with 27% between 25 and 49 employees, 25% between 50 and 99, 31% between 100 and 249, and 17% 250 or larger. Of responding companies, 16.9% were unionized. More respondents identified themselves as a manager or supervisor (60.5%, $n = 228$) than as

an hourly worker (39.5%, n = 149). The vast majority of chairs identified themselves as managers or supervisors (89.4%, n = 161).

Company Demographics and Injury/Illness Rates

Larger companies had a significantly lower mean rate of injury and illness in the overall database (3.92 for 1–49 employees, 3.49 for 50–99, 3.33 for 100–249, and 2.08 for 250+; $P = 0.013$, n = 505). There was not a significant difference in injury/illness rate by union status (3.28 for non-union and 3.61 for union, $P = 0.523$, n = 461). However, unions were significantly more likely to be present in larger companies, with unionized rates of 7.4%, 11.4%, 10.2%, and 36%, respectively for the four size categories ($\chi^2 = 41.8$, $P = 0.001$). When rates were compared between union and non-union within company size categories, there were no significant differences in rates except for the 50–99 size range.

Committee Composition

Based on administrative records, there was a mean of 8.7 members per committee (median = 7.0), with a range of up to 60 members (Fig. 1; the highest numbers may include floor workers that are invited in as guests to HSC meetings on a rotating basis, based on qualitative responses to the survey). Results from the survey were similar (8.1 mean, 7.0 median, upper range of 27), composed of a mean of 2.9 management representatives (SD = 1.9, range 0–15; median = 2.0), and 5.2 worker representatives (SD = 3.4, range 0–25; median = 4.0). As one would expect, committee size varied significantly by size of company, with larger committees in larger workplaces (mean of 5.8 committee members in companies of less than 50 employees, 7.4 for 50–99, 9.63 for 100–249, and 13.5 for 250+; F = 54.1, $P = 0.001$).

There was not a significant association between the ratio of worker representatives to management representatives and the workers' compensation injury/illness rate. However, the overall size of the committee was significantly negatively associated with the injury/illness rate (i.e., the larger the committee the lower the injury rate; r = −0.09, $P = 0.05$). This relationship was due almost exclusively to the number of hourly employees on the committee (r = −0.09, $P = 0.05$); the number of management members was not significantly associated with the injury rate. Controlling for the overall size of the company did not appreciably affect this association, nor did controlling for union status.

Committee chairs reported that 73% of companies had a single chair, and 27% co-chairs. Based on administrative data, the most common ratio of worker to

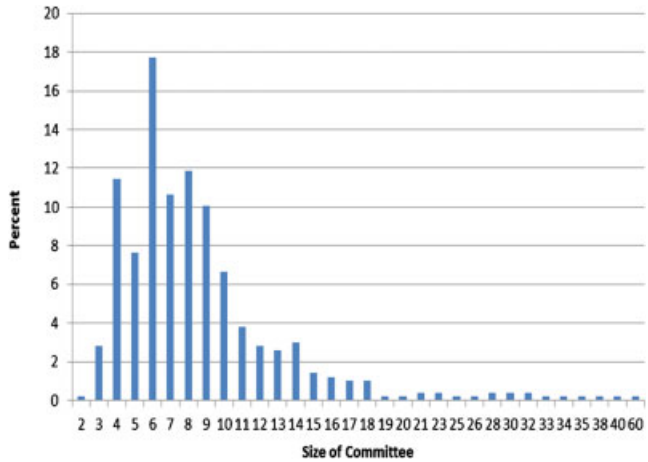

FIGURE 1. Size of committee, percent (n = 497).

managerial representatives was equal proportions (24.1%), which is the minimum required by the statute, with 13.5% having twice the number of workers compared to management, and 8.0% having three times (Fig. 2). Six (1.2%) of the committees appeared to be at least temporarily (i.e., a recent resignation that has not been replaced) out of compliance with the statute, with a smaller number of workers than managers, and 16.5% had more than three times as many workers as managers.

The most common occupational category represented on the committee (Table I) was manufacturing workers (91% of committees had at least one), followed by upper management or plant managers (67%), supervisors (67%), office workers (46%), and occupational and environmental health professional (38%). Owners or CEO's were on 16% of committees, and union representatives were on 12% of committees. Just over one-quarter of committees included representatives from off shifts (note that not all companies have off shifts, so this proportion would be effectively higher for applicable companies).

The most commonly used safety and health consultants used were the insurer (74%), followed by 38% using Connecticut OSHA (the free state consulting program; enforcement is performed by Federal OSHA, a different agency), a private consulting firm (34%), the Connecticut Business and Industry Association (24%), and corporate office staff (20%).

Committee members reported a mean of 7.3 years on the committee (SD = 6.23, n = 370; median = 5 years, mode 2 years). Chairs averaged almost 3 years more on the committee (mean = 8.7 years, SD 6.23, n = 177) than non-chair members (mean = 6.0, SD 5.8, n = 193).

The most common occupation for the chair was an occupational/environmental health and safety professional (26.5%), followed by upper management (26.0%), human

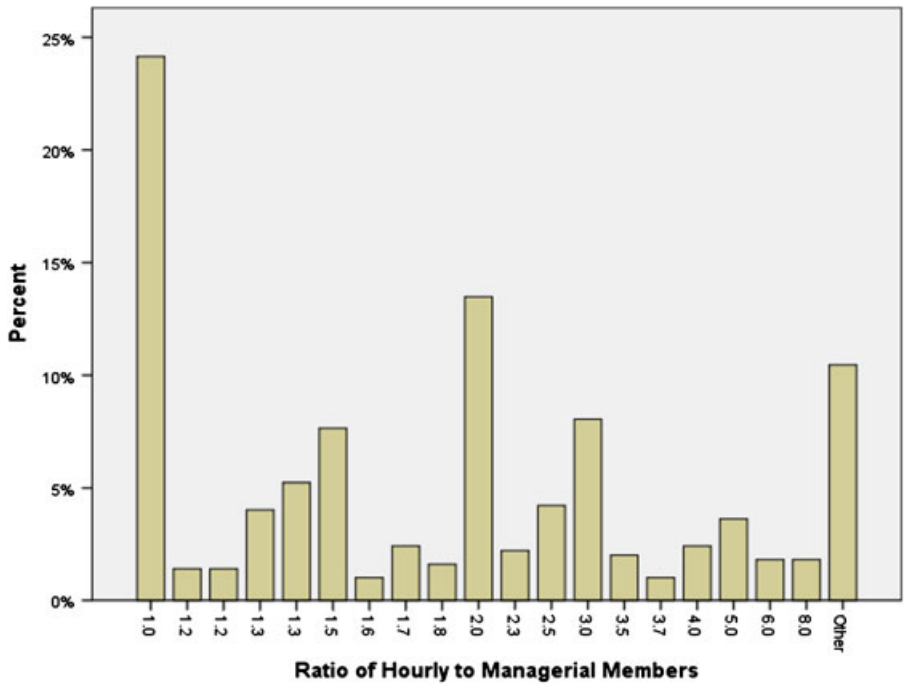

FIGURE 2. Ratio of worker to managerial representatives on committee (n = 497).

resources (20.4%), maintenance/facilities (17.7%), and worker or union representative (11.6%).

Committee Training

Committees reported that most training specifically for committee members (separately from safety training designed for all employees) was informal in nature. The most commonly used training for committee members was learning from other committee members (77%), followed by training by the company OSH professional (19%), outside consultant training (16%), and outside conferences and training programs (18%). Over half (55%) noted that committee members bring their own expertise from experience in trades.

Training for committee members was rated the lowest of any committee attribute in relation to committee functioning (see below) at 6.8 out of a possible 10. Worker members gave a significantly more favorable rating of training (7.2) than manager members (6.5; $F = 6.9$, $P = 0.009$); there was a similar trend for chair (6.6) versus committee member (7.0; $F = 4.0$, $P = 0.046$).

There were no significant differences in injury and illness rates based on either the rating of training nor whether outside training was utilized.

Chairs were asked for preferences for modalities of training for committee members. The strongest preferences were for written training materials (52%), followed by video training (48%), newsletters/factsheets (40%), and speakers at committee meetings (34%). Less desirable were web-based trainings (19%), half-day conferences (18%), all day conferences (7%), conference calls (3%), evening workshops/talks (2%), and week-long intensive trainings (1%).

TABLE I. Occupations on Committee (m = 181)

Workers-manufacturing	91%
Upper management/plant manager	67%
Supervisors	67%
Workers-office	46%
Occupational/environmental health and safety professional	38%
Second or third shift representative	26%
Owner/President/CEO	16%
Union representative	12%
Other	11%
Workers compensation	10%
Insurance company representative	4%

Meeting Characteristics

Attendance at committee meetings was reported as being high. Forty-two percent reported over 90% attendance, 43% reported 76–90%, 7.3% reported 51–75%, and

7.8% reported that 50% or less of members came to a typical meeting. Most committees (85%) reported having a written agenda for committee meetings.

Committee chairs estimated the time spent on a list of possible activities during committee meetings (Table II) from 1 (little or no time) to 10 (a lot of time). Sharing ideas from committee members was estimated to take the most time (mean = 7.06), followed by new action items, review of walkarounds, reviewing old action items, accident investigations, reviewing data, planning training for employees, and reviewing previous minutes. The lowest amount of time was for providing training for committee members (mean = 4.37).

Time Spent on Committee Activities

Committees met either quarterly (42.5%) or monthly (41.4% of committees), with a few meeting every 2 weeks (6.6%), weekly (1.1%) or less frequently than quarterly (8.3%). Meetings were most commonly 1 hr (50.8%), with 21.0% reporting >1 hr and 28.2% less than an hour.

The chairs reported spending a mean of 3.5 hr per week on committee business outside of meetings (SD = 3.8). Non-chair members reported that they spent 2.4 hr (SD = 4.3) per week outside of meetings, although the chair estimated only 1.4 hr per week for non-chair members.

Total time involved in committee work was calculated based on the mean of 8.7 committee members (with one of those being the chair), meetings over 1 hr estimated at 1.5 hr, and <1 hr estimated at 30 min. This results in estimates of 24 hr per year in meetings and 1,143 hr outside of meetings for a total of 1,167 hr for an average committee per year. Based on the 2007 manufacturing wage in Connecticut of $69,360 [CT Labor Dept, 2011] (approximately $35/hr), this provides an annual cost estimate of $40,500 per committee for just the time spent (excluding other costs such as paying for safety improvements recommended by the committee or other committee expenses).

Committee Activities

Most committees (72%) reported participating in accident investigations, 55% reported setting goals for the committee (such as injury rates or safety topics to focus on), and 24% reported that the committee participates in wellness programs (such as health fairs or personal health promotion).

Participants were asked to rank order eight common types of health and safety hazards (the list was derived from the interview phase of the project) for both importance and for the time spent on those topics by the committee on a scale from one to eight, with one the most important. Results were compared to see both how importance is rated as well as for any discrepancies between perceived importance and time spent (Table III). Respondents rated personal protective equipment as the most important (mean = 3.5) followed (in order) by faulty equipment/machine guarding, chemical hazards/disposal, ergonomics/lifting, electrical safety, fire/explosion, clutter/congestion/housekeeping, and noise. Respondents reported the largest discrepancy for not spending enough time relative to importance for chemical hazards/disposal (0.69 difference) and spending too much time on clutter and congestion (−1.28).

Communication and Incentives

Approximately one-third (34%) of Chairs reported that their company uses some type of health and safety incentive program (such as awards for days without injury or safety suggestions), 17% reported that committee members get some incentive (t-shirts, special dinners, etc.), and 15% reported that the company participates in a

TABLE II. Time Spent on Specific Topics During Committee Meetings in Previous Year (1, Little or no Time; 10, A Lot of Time)

	N	Mean	SD
Sharing ideas from committee members	179	7.06	1.92
Develop a list of new action items (new business)	179	6.91	1.962
Review observations noted during walkarounds/inspections/audits of the facility	178	6.63	2.257
Other	17	5.65	3.552
Review old action items (old business)	179	5.61	2.183
Review accident investigations	179	5.29	2.64
Review injury and illness data	176	4.99	2.571
Review accident statistics	180	4.92	2.588
Plan training for employees	180	4.8	2.518
Review previous minutes	180	4.47	2.243
Provide training on a health and safety topic for committee members	178	4.37	2.616

TABLE III. Ratings of Importance Versus Time Spent on Major Health and Safety Issues; Chairs and Members Combined: Rank Order From 1 (Most Important/Time) to 8 (Least Important/Time)

	N	Importance mean	Import SD	Time mean	Time SD	Difference time-import
Chemical hazards/disposal	319	4.05	2.414	4.74	2.359	0.69
Electrical safety	319	4.48	1.870	4.87	1.935	0.39
Fire/explosion	319	5.04	2.371	5.42	2.127	0.39
Noise	319	6.13	1.922	6.30	1.925	0.16
Faulty equipment/machine guarding	319	3.59	1.874	3.73	2.029	0.14
Personal protective equipment (PPE)	319	3.49	2.069	3.42	1.952	−0.07
Ergonomics/lifting	319	4.15	2.253	3.74	2.197	−0.41
Clutter/congestion/housekeeping issues	319	5.06	2.273	3.78	2.148	−1.28

behavior-based safety program. There were no significant differences in workers' compensation rates (nor for overall evaluation of effectiveness of the committee) based on the presence of any of these programs, even after adjusting for company size and union status. There was not a significant difference in injury and illness rate based on the presence of incentive or behavioral based safety programs (mean workers compensation rates were 2.87 injuries per 100 employees with incentive programs vs. 3.57 for companies with none ($F = 1.70$, $P = 0.195$, $n = 163$), and 2.56 with behavioral based systems vs. 3.11 with none ($F = 0.631$, $P = 0.428$, $n = 159$)).

Chairs reported that the most common person that is approached by workers for a health and safety problem is the supervisor or lead person (65%), followed by the company's OSH professional (12%), a health and safety committee member (11%), and Human Resources (8%).

Committee meeting minutes were distributed in some form in 77% of workplaces. Most commonly they were posted in a public area (45%), followed by being reported back to the department by committee members (28%), sent by e-mail (26%), posted on the company website (4%), or some other approach (12%) such as manual distribution of hard copies (totals to >100% since multiple methods could be used).

Evaluation of Committee Functioning

Committee members rated their committees on a number of attributes on a 1–10 scale, with 10 being the best (Table IV). Overall effectiveness of the committee was rated at 7.4. Representation from the worksite was rated the highest of committee attributes (mean = 8.1), followed by ability to get complaints from workers, support from upper management, and clear assignment of responsibility. Training for committee members was rated the lowest of any of the attributes (mean = 6.8).

Based on Principal Component Analysis, perceptions of the components of committee effectiveness broke down into two primary factors (Table V), one loading

TABLE IV. Evaluation of Effectiveness of Committee (1, Poor; 10, Excellent; n = 369–377)

	Chair	Member	*F*	*P*
Representation from all areas of the worksite	8.05	8.10	0.06	0.81
Support from upper management for the committee's activities	7.66	7.62	0.03	0.87
Ability to get complaints from workers	7.59	7.99	4.70	**0.03**
Clear assignment of responsibility for action items	7.46	7.68	1.30	0.26
Ability to pay for needed health and safety projects/action items	7.29	7.43	0.40	0.53
Time to correct health and safety action items	7.20	7.36	0.56	0.46
Communication from the committee to the rest of the company	6.91	7.44	7.50	**0.01**
Ability to get suggestions from workers	6.79	7.25	4.70	**0.03**
How interesting or enjoyable committee meetings are	6.76	7.40	10.80	**0.00**
Training for committee members	6.55	7.02	4.00	**0.05**
Overall effectiveness of committee	7.16	7.62	6.30	**0.01**

Attributes in bold indicate a significant difference between chair and member evaluations.

TABLE V. Factor Loadings for Questions on Committee Effectiveness

	Worker involvement/ communications component	Management commitment component
Ability to get suggestions from workers	0.78	
How interesting or enjoyable committee meetings are	0.75	
Ability to get complaints from workers	0.73	
Representation from all areas of the worksite	0.63	
Ability to pay for needed health and safety projects/action items		0.85
Time to correct health and safety action items		0.81
Support from upper management for the committee's activities		0.78
Communication from the committee to the rest of the company	0.62	0.42
Training for committee members	0.58	0.45
Clear assignment of responsibility for action items	0.47	0.56

Extraction method: principal component analysis; varimax with Kaiser normalization.

primarily on broad worker involvement and communication (''worker involvement/communications component'') and a second loading on management support and efficiency (''management support''). The score for the worker involvement/communications component was significantly negatively associated with the discrepancy (between manager and worker committee members) score ($r = -0.39$, $P = 0.005$, $n = 50$ committees), but the management support component was not significantly associated ($P = 0.26$). Neither factor was significantly associated with injury rates.

There was a significant difference between the mean rating for chairs compared to members on the overall effectiveness of the committee ($F = 6.3$, $P = 0.01$), with the chair giving a lower rating for overall effectiveness. Chairs were also significantly less positive compared to committee members for the ability to get complaints (and suggestions) from workers, communication to the rest of the company, training of committee members, and how interesting meetings are. Chairs gave a significantly ($P = 0.007$) lower rating of overall effectiveness in unionized workplaces (73.1% giving a rating of 7 or less, $n = 26$) compared to non-union (44.3% giving a rating of 7 or less, $n = 149$). There was also a difference among committee members, with 43.3% of unionized committee members giving a rating of 7 or less compared to 34.7% of non-union, but it was not statistically significant ($P = 0.175$).

However, the chairs were significantly more likely to say a higher proportion of hazards were resolved than members, with 40% of chairs (vs. 32% of members) saying over 90% were resolved within 7 days, and 27% (vs. 22%) saying 76–90% were resolved within 7 days ($\chi^2 = 10.9$, $P = 0.05$, $n = 373$). There was an even larger difference in the estimate for items resolved within 30 days, with 60% of chairs and 43% of members saying over 90% were resolved ($\chi^2 = 13.9$, $P = 0.02$).

Overall, committee members reported a mean of 8.16 (with 10 being the safest) for the overall safety of their workplace compared to other manufacturing workplaces. There was not a significant difference between chairs and members in relation to the perception of the overall safety of the company ($P = 0.63$).

Unionization

Committees at unionized facilities ($n = 70$ for administrative data, $n = 27$ for survey) were compared to non-union facilities ($n = 424$ for administrative data, $n = 149$ for survey); it should be noted that this gives a fairly low power to detect differences based on the survey. Unionized committees met more frequently ($P = 0.001$) based on administrative data; non-union committees were more likely to meet quarterly (the minimum required by statute; 57% vs. 29% for unionized) instead of monthly (32% non-union vs. 54% union). Meetings were also longer in unionized facilities, with a mean of 65 min versus 55 for non-union ($P < 0.001$), with clusters of committees meeting for 30, 45, or 60 min for non-union and clusters at 60 and 90 min for union.

Evaluations of effectiveness of various aspects of committees were dichotomized into highly favorable (score of 8 or higher on a 10 point scale) versus not. Based on survey data from committee chairs, chairs at non-union companies rated their committees more favorably than unionized companies on most aspects although not statistically significant on some: communication to the rest of the company (44% favorable non-union vs. 33% union, $P = 0.217$), ability to get suggestions (48% vs. 37%, $P = 0.210$), ability to get worker complaints

(63% vs. 52%, $P = 0.194$), management support (68% vs. 44%, $P = 0.020$), time to correct action items (56% vs. 35%, $P = 0.035$), ability to pay for safety and health changes (52% vs. 48%, $P = 0.422$), committee training (40% vs. 36%, $P = 0.453$), representation from all areas of the company (72% vs. 62%, $P = 0.203$), interesting and enjoyable meetings (41% vs. 35%, $P = 0.352$), clear assignment of responsibility (62% vs. 39%, $P = 0.023$), and overall committee effectiveness (56% vs. 27%, $P = 0.006$). A Mann–Whitney non-parametric *U*-test for linearity for the entire distributions (that is, using the entire range of responses rather than dichotomous variables) found much the same relationships, except that ability to get worker complaints was also significant ($P = 0.037$).

There were no significant differences between union and non-union workplaces in relation to the relative priority of the eight types of hazards (chemicals, clutter, ergonomics, electrical, equipment, fire, PPE, and noise) nor for the assessment of time spent on each, nor for the differences in ratings between time and importance.

Unionized workplaces had significantly more management representatives on the committee (4.1 unionized vs. 2.7 non-union, $P < 0.001$) but no difference in worker representatives, and chairs reported significantly more time on committee business (6.1 hr union vs. 3.0 non-union, $P < 0.001$) but no difference in non-chair time (as reported by the chair). These differences held even when controlling for company size.

Unionized facilities were more likely to employ a safety and health professional (59% compared to 37% non-union, $P = 0.024$). Non-union facilities had a higher frequency of having over 90% of committee members at committee meetings (46–26% union, $P = 0.04$). Unionized facilities were more likely to have safety incentive programs (56–29% non-union, $P = 0.007$) and behavior based safety programs (33–12% non-union, $P = 0.009$).

Associations with Injury and Illness Rates

In exploratory analysis, results for the Chairs of the committee were split into dichotomous variables, with results compared to the average injury and illness rates, with differences of mean flagged at the $P = 0.10$ level as an initial screen for further analysis (Table VI; no adjustment for multiple comparisons).

At the 0.10 *P*-level, the chair's rating of the speed to correct action items was associated with a lower injury/illness rate ($P = 0.086$), as was the overall committee effectiveness ($P = 0.105$), getting help from other members ($P = 0.068$), and a committee that plans together ($P = 0.034$). The chair's rating of the importance of ergonomics was associated with a lower injury/illness rate ($P = 0.014$). The chair's estimate of working 2 or more hours per week on committee business was associated with a higher injury/illness rate ($P = 0.084$). The presence of a union representative on the committee was associated with a higher rate ($P = 0.059$) when all companies were included in the analysis; the size of the difference was similar when including only unionized companies but the association became statistically non-significant ($P = 0.545$) due to the smaller sample size. In relation to meeting characteristics, spending time reviewing accident statistics was associated with a higher rate ($P = 0.027$), while spending time on planning health and safety training for employees was associated with a lower rate ($P = 0.089$). The use of the state OSHA consulting service was associated with a higher rate ($P = 0.021$). The posting of meeting minutes was associated with a higher rate ($P = 0.103$), as was e-mail distribution ($P = 0.108$).

The chair's rating of the speed to resolve hazards had some interesting trends. For the estimate of action items resolved within 30 days (Table VII), there was a mean injury rate of 4.0 for 51–75% of action items resolved, 3.7 for 76–90% resolved, and 2.8 for over 90% resolved (the number of respondents were low for the lowest categories of resolved). This trend was not apparent for the question of action items resolved within 7 days.

There was not a significant association (at the 0.05 level) between the chair's estimate of the overall safety of the company and the injury and illness rate ($F = 1.9$, $P = 0.08$).

Discrepancy Analysis

Estimates of the effectiveness of the committee and overall safety of the workplace were compared for workers and managers at the same workplace. There were 56 committees that had data for both workers and managers, with a mean number of responses of 3.9 people (1.5 managers and 2.4 hourly workers) per committee; this was reduced to 49 companies that had complete data for ratings and workers' compensation rates. There was an overall correlation of 0.625 ($P < 0.001$, $n = 54$) between the mean worker and mean manager rating of the overall safety of each company, and 0.475 ($P < 0.001$, $n = 55$) for effectiveness of the committee.

However, there was a range of the level of agreement across companies when comparing worker and manager assessments, which provides a measure of discrepancy (i.e., at company A, managers and workers had a higher level of agreement on the perceived overall company safety than at company B). There was no significant difference in the discrepancy by size of company for committee effectiveness nor perceived safety of the company. There was a significantly higher discrepancy on committee effectiveness in unionized companies (discrepancy of 1.17 for non-union and 2.37 for unionized, $F = 10.7$, $P = 0.008$; a

TABLE VI. Mean Injury/Illness Rate by Low vs. High Ratings on Survey Questions

	Low	High	Sig
Communication to company	3.25	2.91	0.500
Getting worker suggestions	3.15	3.06	0.860
Getting worker complaints	3.13	3.10	0.960
Upper management support	3.13	3.09	0.950
Time to correct action items	3.57	2.70	**0.086**
Ability to pay for corrections	2.89	3.34	0.370
Committee member training	3.10	3.20	0.850
Representation from al areas	3.03	3.15	0.830
Meeting enjoyability	2.85	3.44	0.240
Clear assignment of responsibility	3.19	3.05	0.780
Overall committee effectiveness	3.54	2.72	**0.105**
	Disagree	**Agree**	***P***
Help from other members	3.97	2.83	**0.068**
Members contribute equally	3.22	3.04	0.722
Plans together	4.02	2.80	**0.034**
Members are friendly	1.71	3.15	0.325
	No	**Yes**	***P***
90% serious problems resolved in 30 days	3.60	2.83	0.142
90% serious problems resolved in 7 days	3.42	2.70	0.161
	Unsafe	**Safe**	***P***
How safe is workplace	3.44	2.85	0.245
Importance	**Low**	**High**	***P***
Chemical hazards	2.81	3.41	0.235
Clutter and housekeeping	3.27	2.94	0.524
Ergonomics	3.61	2.34	**0.014**
Electrical safety	3.07	3.14	0.892
Equipment/machine guarding	3.10	3.23	0.810
Fire/explosion	2.82	3.31	0.346
PPE	3.24	2.84	0.447
Noise	3.63	2.89	0.375
Time	**Low**	**High**	***P***
Chemical hazards	3.06	3.26	0.709
Clutter and housekeeping	3.26	2.95	0.576
Ergonomics	3.30	3.04	0.858
Electrical safety	2.97	3.36	0.735
Equipment/machine guarding	3.26	3.07	0.902
Fire/explosion	4.06	3.18	0.923
PPE	3.31	2.69	0.255
Noise	3.01	3.27	0.667
	No	**Yes**	***P***
Chair 2 or more hours/week	2.55	3.48	**0.084**
Member 1 or more hours/week	3.46	3.02	0.426
Committee Chair is:			
EHS professional	2.64	4.43	**0.001**
HR	3.08	3.21	0.819
Engineering	3.14	2.80	0.695
Maint/facilities	3.23	2.49	0.266
Union	3.15	2.77	0.643
Upper Mgt	3.19	2.86	0.565
Other committee/company characteristics	**No**	**Yes**	***P***
Over 90% attend meetings	3.28	2.87	0.422
Incentive programs	2.87	3.57	0.195
Comm Member Incentives	3.01	3.57	0.393
BBS	3.11	2.56	0.428
Wellness Programs	3.14	2.89	0.677
Accident investigations	2.92	3.19	0.650
Set goals/objectives	2.80	3.28	0.344
Positions on Committee			
OEH Professional	2.79	3.62	**0.106**
Owner/President/CEO	3.08	3.22	0.841
Upper management/plant manager	3.10	3.10	0.983
Supervisors	3.24	3.04	0.707
Union representative	2.92	4.31	**0.059**
Workers compensation	3.02	4.01	0.256
Workers- manufacturing	2.17	3.19	0.258
Workers- office	3.43	2.74	0.171
Second or third shift representative	2.59	4.57	<.001
Insurance company representative	3.10	3.23	0.915
	No	**Yes**	***P***
Meetings more than quarterly	2.84	3.39	0.275
Meetings over 1 hour	2.91	3.85	0.132
Review previous minutes	3.26	2.83	0.429
Review accident statistics	2.72	3.89	**0.027**
Review accident investigations	2.77	3.55	0.127
Review injury and illness data	2.61	3.86	**0.015**
Review old action items	3.15	3.06	0.862
Develop new action items	2.43	3.35	0.113
Sharing ideas	2.92	3.15	0.711
Review walkarounds	2.67	3.29	0.269
Plan training for employees	3.43	2.54	**0.089**
HSC training OSH topics	3.28	2.78	0.351
Company OHS professional	3.30	2.99	0.562
Consulting services			
CONN-OSHA	2.64	3.82	**0.021**
Insurer	2.75	3.22	0.422
Corporate OSH professional	3.08	3.22	0.826
Private consultant	3.07	3.12	0.827
Business association)	2.98	3.49	0.381
Committee training methods	**No**	**Yes**	***P***
On the job training	2.94	3.15	0.730
Unique backgrounds	2.71	3.42	0.160
Internal OSH Professional	2.99	3.63	0.325
Outside consultants	2.95	3.83	0.176
Conferences	3.27	2.61	0.260
Outside training or consults	2.97	3.35	0.462

(*Continued*)

TABLE VI. (*Continued*)

	Low	High	Sig
Minutes distribution	**No**	**Yes**	***P***
Distributed	2.40	3.30	0.134
Posted	2.73	3.55	**0.103**
Email	2.86	3.79	**0.103**
Website	3.16	1.39	0.225
Members report to departments	3.23	2.79	0.424
Training preferences	**No**	**Yes**	***P***
All day conferences	3.07	3.60	0.584
Half-day conferences	2.92	4.00	**0.108**
Web-based training	3.26	2.53	0.232
Video training	3.10	3.11	0.977
Speakers at committee meetings	2.82	3.66	0.110
Written training materials	2.94	3.24	0.550
Newsletters/fact sheets	3.29	2.84	0.379

Numbers in bold indicate a statistically significant (at 0.10 level) association with injury and illness rates.

larger number indicates a larger discrepancy) but not for perceived company safety (discrepancy = 0.97 for non-union and 1.40 for unionized, $F = 1.4$, $P = 0.24$). There was a significant correlation between the manager rating of perceived safety and the discrepancy score ($r = 0.70$, $P < 0.001$), indicating that discrepancy scores may include a component relating to scores that are higher (or lower) than average.

The absolute value of the discrepancy between workers and managers on the estimate of the overall safety of the company was compared to the average annual workers' compensation rate. There was a strong positive correlation between the size of the discrepancy and the overall injury rate (Fig. 3; $r = 0.516$, $P < 0.001$); that is, companies with a greater difference between managers and workers on the perception of company safety had a higher injury rate. When this analysis was done separately for union and non-union workplaces, virtually all of the relationship came from the unionized workplaces ($r = 0.76$, $P = 0.017$, $n = 9$), and there was no significant relationship in the non-union ($r = 0.032$, $P = 0.85$, $n = 38$).

"Best Practices"

Respondents were asked to provide what they perceived as "best practices" represented by their HSC. These were qualitative responses that could not be generally compared to injury and illness rates, so there was no way of validating that the responses in fact lead to lower injury rates or higher quality HSC. They are presented here as indicators of what committee chairs and members perceive as practices important to committee structure and function. Responses grouped into suggestions concerning meetings, committee structure and membership, incentive programs, communications, and walkaround inspections.

Meetings

Suggestions included inviting "front line" workers as guests to each meeting and to "create a comfortable environment for them to express their concerns and observations and investigate and address their issues so that they realize their opinions are valued;" ensure that each committee member provides a report at each meeting; use videos and pictures during the meeting, and critique the meeting at the end of each meeting.

Incentive programs

There were anecdotal reports of decreases in injury rates due to incentive programs and behavioral based safety programs. One program described tracking "accident free days" (no recordable injuries and illnesses), with earning a slice of pizza for every 14 days, and after 8

TABLE VII. Mean Injury/Illness Rate by Speed to Resolve Action Items

	Resolved in 7 days			Resolved in 30 days		
	Mean	**N**	**SD**	**Mean**	**N**	**SD**
0	2.67	1				
1–25%	4.36	20	5.21	2.21	5	1.07
26–50%	3.66	15	3.30	3.08	4	3.93
51–75%	2.21	15	1.81	3.96	18	5.12
76–90%	3.35	44	3.43	3.66	35	3.39
Over 90%	2.70	68	2.46	2.83	101	2.76
Total	3.12	163	3.23	3.12	163	3.23

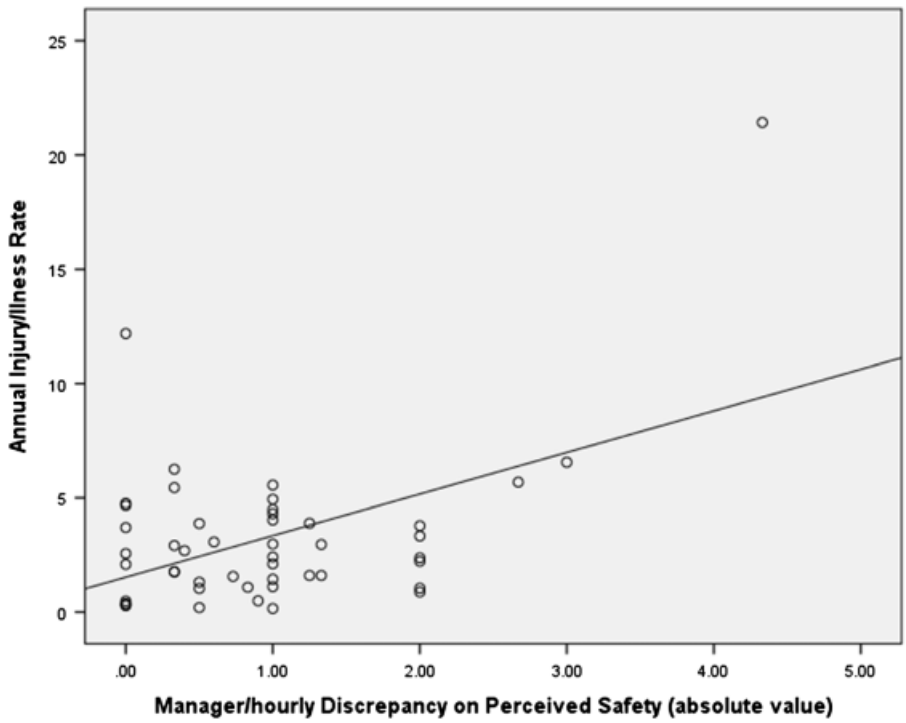

FIGURE 3. Discrepancy between workers and managers estimates of company safety compared to annual workers' compensation injury rate (n = 49 committees).

slices of pizza are earned (112 ''accident free days'') there is a pizza party for the company. Other incentive approaches rewarded behaviors that avoid the risk of incenting workers not to report injuries that may have occurred. These included a ''Triple AAA'' program where ''employees are rewarded using three criteria—awareness, attitude, and action. . .actions above and beyond employee's normal duties or tasks,'' a $100 reward monthly drawing for ''good safety suggestions or for production improvements,'' and awards based on safety suggestions that are ''reviewed and assigned a code based on their significance.''

Committee structure and membership

Several HSC described utilizing more specialized committees or ways to increase involvement in the HSC by other employees. One company had several independent committees representing each large unit on each shift, which pick projects they want to work on such as ''upgrading JSA's (Job Safety Analysis) in their area and performing specialized audits'', and including specialized training for committee members to accomplish those projects. Another had sub-committees for annual certifications, job safety analysis, and ergonomics. One committee included each supervisor as a permanent member and each month ''a different member of each supervisor's team participates [with] mandatory rotation through all team members, [and including] participating in a safety tour and any required training.''

Communications

One HSC noted that ''It is important that [a committee] member advises workforce everyone is responsible for safety and has the right to stop unsafe acts.'' Another HSC ''posted their action items list in the break room so our employees can see their suggestions along with a completion date.''

Walkaround inspections

There were a wide variety of approaches to inspecting the workplace, such as at least annual walkarounds by committee members, prompt inspections after accidents, and including root cause analysis. Others included:

- ''We split our plant in half and each time we do an inspection each team will inspect one half. At the next meeting we switch and inspect the other side.''
- ''Inviting other companies to perform audit—fresh eyes helps see different things.''

- "A member who is involved in our OSHA safety program designed a way to perform safety audits by random non-committee members in the factory and office. Teams of two are sent to specific departments with a check list of inspection items."
- "Photos of "good" and "bad" things found during our safety walk thru [and] after each formal safety meeting [these] are incorporated in the posted minutes for all to view."
- One week prior to each monthly safety committee meeting, the committee members walk through the manufacturing plant and take notes (and take pictures, if needed) on safety concerns to discuss at the next meeting, [with] the supervisor immediately notified... a safety committee member will check to make sure the concern was corrected prior to the next committee meeting."
- "We utilize a plant scorecard to track member activities and we have a written job description for members outlining responsibilities."

Other suggestions

Other suggestions including issuing "certified operator" wallet cards to employees who have been trained to operate forklifts, power tools, hoisting equipment, saws and nail guns, with only certified employees allowed to operate equipment; running an annual "safety week" promotion with "literature, training, speakers, [and] interactive games;" using a database to track any nonconforming safety issues from accidents/inspections; and to "Evaluate and score each "incident" based upon severity and preventability using a rating system rather than solely based upon number of recordable or lost time incidents to better evaluate safety program and identify trends." One HSC noted the benefit of "empowerment," where "the committee members are directed to go to Human Resources if a potential hazard is not corrected before they leave for that shift [and] H.R. immediately notifies the plant manager and general manager and responds to member by end of next shift."

DISCUSSION

Health and safety committees (HSC) are widely utilized and yet poorly understood empirically. This was designed as an exploratory and descriptive study, and so there are significant limitations to the interpretation of results, particularly in relation to the possible direction of causality. It may well be that the committee characteristics associated with higher injury and illness rates are a response to the high rates rather than a cause, which has been noted as a concern in cross-sectional analysis of committees [Hoonakker et al., 2005]. Similar difficulties in disentangling directionality was found in a study of public employee committees in Pennsylvania [Eaton and Nocerino, 2000]. Prospective studies are needed to better deal with causation issues; intervention studies could also be utilized to understand if changing HSC characteristics or activities could reduce injuries and illnesses. This is particular important given the findings by Hoonakker et al. [2005] that longitudinal results were often in the opposite direction of cross sectional results.

Another important limitation is that injuries are known to be very under-reported; some committee characteristics may encourage under-reporting and thus falsely appear to be associated with lower rates. These considerations are discussed in more detail below. Despite these limitations, this is one of the first studies to comprehensively describe characteristics of committees as well as to compare to reported rates, and so the initial associations can provide the basis for future longitudinal studies that can help to establish causality. Future research might address these issues of under-reporting by utilizing worker surveys of work-related injuries and symptoms (perhaps combining with workers' compensation reports utilizing capture–recapture analysis [Morse et al., 2001]); prospective studies could also utilize multiple data points within the same company which may reduce the impact of under-reporting (assuming that patterns of under-reporting may be relatively constant within the same company), or evaluate multiple worksites within the same corporation (assuming that reporting policies and incentives would be more similar within companies than across companies). Access to records that would include restricted duty as well as lost time might also make reporting more comprehensive.

This study found that in Connecticut (which mandates HSC) committees in manufacturing are quite large (7–8 members), active (2.5–3.5 hr per week on committee business for each member), often have considerably higher numbers of hourly employees than managers, and rate their committee effectiveness and company safety highly. This study was not designed to provide information on the effectiveness of having a committee versus no committee [Lewchuk et al., 1996; Smitha et al., 2001; LaTourrette and Mendeloff, 2008], since control sites with no committees were not available.

Approximately half thought that 90% of health and safety action items are resolved within a month, and almost one-third thought that 90% were solved within a week. While chairs were generally less positive about the effectiveness of their committee than were committee members, they actually gave a higher rating for the speed of resolution of hazards. This may indicate that chairs have higher expectations of the committee than members,

or it may indicate that chairs believe problems are fully resolved when they are not. The latter possibility assumes that members are more in touch with what is happening on the floor than the chair, who was almost always a manager rather than an hourly worker. A Canadian study of HSC found that the reported resolution time for action items was significantly associated with the lost time injury rate [Geldart et al., 2010]; this study found a lower rate as well, but it was not statistically significant.

The relationship of union status to committee functioning was complex, since unions were more common in larger workplaces, and injury rates were inversely associated with company size. Injury rates were not significantly associated with union status, except within the company size category of 50–99 employees. This general lack of association may be the result of the ''union safety effect,'' where the positive impact of unions on safety is masked by better reporting, particularly of less serious cases, and the higher likelihood of the presence of unions in more dangerous industries or companies [Morantz, 2009]. The problem of under-reporting is now well-documented, and makes interpretation of associations with reported injuries and illnesses particularly problematic [Morse et al., 2001, 2003, 2004; Rosenman et al., 2006; Boden and Ozonoff, 2008]. Geldart found that there was greater use of disability plans associated with lower injury/illness rates in non-union workplaces but not in unionized, indicating that there is better reporting in unionized workplaces [Geldart et al., 2010], and we also found less under-reporting in unionized workplaces in a separate study [Morse et al., 2003].

Chairs gave a lower rating of overall committee effectiveness in unionized workplaces, with significant perceived differences relating to the ability to get complaints from workers, support from upper management for the HSC, clear assignment of responsibilities, time to correct action items, and communication to the rest of the company. The discrepancy between manager and worker HSC members on perceived safety at the company was higher in unionized workplaces. Weil found that HSC in unionized workplaces were more likely to enlist OSHA in dealing with hazards than HSC in non-union workplaces [Weil, 1999]. A UK study found HSC reduced injuries but found little difference between union and non-union committees [Reilly et al., 1995].

There are several possible interpretations of these findings. It could be that a more independent voice for workers and alternative communication pathways in unionized workplaces gives rise to more challenges to the authority of the chair and managers, resulting in more perceived conflict and differences of interpretation of the magnitude of safety hazards. More worker protection may also contribute to better reporting of injuries and illnesses and greater use of the workers' compensation system, leading to higher reported rates of injury but lower actual injury rates. An alternate explanation could also be that greater overt conflicts could reduce the effectiveness of committees through reduced perceived teamwork and the encroachment of other union issues (such as job security, contract concessions, or grievances) into the health and safety area. Lewchuk found that in Ontario committees that there needed to be sympathy from both union and management for co-management of health and safety in order for HSC to reduce injury rates, so it may be a combination of these explanations [Lewchuk et al., 1996]. Our study could not differentiate between these or other possible interpretations, but this would be an important area for further research.

Our study supported the Canadian finding that a higher number of worker members on the committee was associated with a lower injury rate [Geldart et al., 2010]. This could be a result of better representation of more areas of the plant, a greater awareness of health and safety issues by more workers, or from giving a greater voice to hourly workers relative to managers (although the latter interpretation was not supported by an association between the worker/manager ratio and injury rate). It seems unlikely that the direction of causation would be reversed for this association—it seems likely that a higher reported injury rate would more likely to result in increasing the size of the committee rather than reducing it.

The same Canadian study found that faster resolution time for recommendations was associated with a lower injury rate, which was partially supported in our study. A study of safety programs in construction in relation to workers' compensation rates found that regularly scheduled safety meetings was associated with lower rates in longitudinal analysis (although with higher rates in cross sectional analysis) [Hoonakker et al., 2005], but we did not find a significant relationship in regards to more frequent meetings in our cross sectional analysis.

The overall annual staff time estimate of $40,000 per committee is a significant expenditure. Time was spent predominately on new issues, walkaround and accident investigations. Committees reported that personal protective equipment, equipment and machine issues, chemical hazards, and ergonomics were the most important issues, but that more time should be spent on chemical hazards (relative to its importance), and less time on housekeeping.

A high emphasis on ergonomics was the only issue that was associated with lower injury and illness rates. Since musculoskeletal disorders represent the largest single category of injury/illness (accounting for 30% of reported lost time injuries and illnesses [BLS, 2011]), this has considerable face validity. However, interpretation is complicated here by the impact of under-reporting in

relation to the workers' compensation data source. OSHA reports for overall injury and illness in manufacturing are dominated by cases with job transfer or restriction but without lost time, frequently because of the common use of light duty and return to work programs. The most recent OSHA statistics (for 2010) note that of the overall rate of 4.4 cases per 100 workers, only 2.4 are lost time cases (1.3 cases are job transfer/restriction without lost time and 2.0 are other recordable cases without lost time or transfer) [BLS, 2012]. Therefore, since workers compensation data only requires reports for lost time, many MSD cases are not reflected in that database [Morse et al., 2001; Azaroff et al., 2002]. Training of committee members was seen as one of the weakest areas of committee functioning.

Incentive-related programs are difficult to study in relation to overall reported injury and illness rates, since there is concern that some types of these programs may result in under-reporting rather than true lower injuries and illnesses. Some approaches to incentives may not have this effect, such as incentives for reporting safety hazards or making safety suggestions (as opposed to programs that base rewards on lower reported injuries). Due to a concern about survey length, our survey did not distinguish between these two approaches, so additional studies may be needed. Geldart et al. [2010] found an association of the use of ''safety awards'' with lower rates, but our study did not find any statistically significant association with incentive related programs. There were some qualitative comments supporting incentive programs, but the better approach, given the concern about discouraging reporting, would be incentive programs that reward useful safety suggestions rather than ones that reward employees for days with no reported injuries. This is also consistent with the OSHA Injury and Illness Recordkeeping National Emphasis Program (http://www.osha.gov/OshDoc/Directive_pdf/CPL_02_10-07.pdf), which directs inspectors to take into account incentives that decrease reporting in establishing citations, and the new OSHA policy prohibiting incentive programs that discourage reporting (http://www.osha.gov/as/opa/whistleblowermemo.html).

Behavioral based safety programs, with a focus on improving targeted behaviors thought to be associated with safety, have also been controversial in that resources are focused on individual behavior changes rather than broader (and potentially longer-lasting) environmental controls, though some studies have found a positive impact on reported injury rates [Krause et al., 1999; Sulzer-Azaroff and Austin, 2000; DeJoy, 2005]. Our study also did not find any statistically significant association with reported use of behavioral based safety programs.

Adequacy of training of committee members appeared to be a concern, both from relatively low ratings in comparison to other committee characteristics as well as qualitative results. This is consistent with a Pennsylvania study that found a 1.79 per 100 worker increase in injury rates for firms with a citation for absence of training of members [Liu et al., 2010]. A New Jersey study of public employees found mixed results in relation to training, with an association with higher injury rates cross sectionally but lower rates prospectively, with a possible explanation of committees existing in higher hazard workplaces [Eaton and Nocerino, 2000]. Cross-sectional issues are also likely a problem in interpreting the association of higher injury rates with use of Conn-OSHA consulting services, which is likely due to higher injury rate companies seeking consulting services.

Previous studies of HSC and programs in general tend to emphasize, at least in theory, the importance of management commitment and worker involvement [Boden et al., 1984; Milgate et al., 2002; LaMontagne et al., 2004; Walters, 2006; Geldart et al., 2010]. Our study found that committees tended to cluster around these two factors in relation to perceived effectiveness by committee members, and the worker involvement factor was significantly associated with discrepant scores between managers and hourly members perception of the overall safety of the company (though neither factor was significantly associated with reported injury rates). However, neither ratings of getting worker suggestions nor upper management support were associated with injury rates; instead, functional attributes such as the speed to correct action items and planning training and cooperation among members seemed to have more of an association.

A factor that appeared to be most strongly associated with injury rates was the discrepancy between managers' and hourly committee members' estimates of overall company safety, particularly in unionized workplaces. Discrepant evaluations of safety suggest that decision makers may not be aware of or acknowledge worker concerns about safety. This could impact prioritization of hazards, level of management commitment, and selection of appropriate intervention strategies.

These discrepancies could be related to communication in the company, level of sensitivity to worker suggestions, reluctance of hourly members to speak up in deciding on actions, or even to dishonest survey answers from managers, hourly members, or both. Interestingly, the association was observed whether hourly members thought that the company was safer or less safe than manager estimates, which might support the hypothesis of communication issues. This discrepancy characteristic has not been previously reported in relation to committees and deserves additional study, though it was observed as strongly predictive of injury rates in one Dutch study comparing workers' and managers' estimates of physical and psychosocial risk factors for MSDs [Warren, 1997].

CONCLUSION

Health and safety committees are one of the most common structures used in the prevention of occupational injuries and illnesses, represent a large investment in terms of time and finances, and are the structure closest to the application of preventive actions. However, they have been almost totally neglected in relation to evidence-based research, with very little descriptive research, even less outcomes-based and prospective research, and essentially no intervention research [Yassi, 2012]. Intervention research might usefully explore systematic committee training in the highest impact areas (for example, ergonomic evaluation and interventions) or improving area representation, ensuring the presence of high-level decision-makers with fiscal authority on committee, or systematically trying to reduce the time period to fix identified hazards. Since under-reporting is such a difficult and confounding issue in relation to evaluating the impact of interventions, it would be preferable to utilize multiple surveys of injuries and illnesses rather than passively reported data, particularly if incentive programs are in place. Such a study could also be utilized to compare active and passive reporting in an intervention situation to better understand how passive reporting is impacted by the intervention (for example, does an ergonomic intervention result in better reporting of MSD and thus appear to increase injuries).

Closing the research gap is even more important with the newly concentrated interest of OSHA in I2P2 (Injury and Illness Prevention Programs; https://www.osha.gov/dsg/topics/safetyhealth/index.html), where committees play an integral role. Further research is also needed on the impact of discrepancies between manager and worker assessments of safety and health risks; intervention research aimed at the effect of improved communication of worker-perceived risks to management may be useful to see if reduced discrepancies would improve prevention efforts.

A better understanding of the complex role unions play in health and safety committees and prevention efforts would also be useful, although such research is complicated by controversy as to whether non-union committees may in fact be illegal under the U.S. National Labor Relations Act [Weil, 1999] since management is appointing worker representatives. It would be logical that unions would be able to reduce discrepancies by providing a stronger voice on behalf of workers, but research is complicated by the current low levels of unionization and resulting problems of unmeasured co-variance without a carefully designed study, preferably of prospective design [Morantz, 2009; Morantz, 2012]. Research on HSC in non-union environments could focus on how worker representatives are selected (i.e., are they closer to management and less of a worker voice?) and the impact on discrepancies.

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