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Associations Between Self-Reported Working Conditions and Registered Health and Safety Results

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Learning Objectives

- Recall information on self-reported working conditions and sickness absence in this study of on-shore and off-shore workers at a Norwegian petroleum company.
- Identify those particular elements of self-reported work conditions that correlated most closely with adverse workplace incidents and sickness absence.
- Outline the data from this survey that bear on relationships between work conditions and recordable injuries.

Abstract

Objective: *To investigate the association between self-reported working conditions and registered health and safety results in a petroleum company in Norway.* ***Methods:*** *We analyzed data from company surveys of working and organizational conditions in 2003 and 2004 and data from the company's files of sickness absence, personal injuries, serious incidents, and undesirable incidents in 2003 and 2004 as well as personal injuries from 2000 to 2004 using Pearson's correlation analysis and multiple linear regression analyses.* ***Results:*** *Good perception of confidence in management in 2003 and 2004 was significantly negatively correlated with the number of personal injuries from 2000 to 2004.* ***Conclusions:*** *Management style and trust in the manager are important factors for predicting personal injuries. The company's working and organizational survey might be used as an indicator for injury risk.* (J Occup Environ Med. *2007; 49:139–147*)

Norway's petroleum industry has many performance measures to maintain and improve health and safety. The industry monitors the workers' perception of the working environment by performing organization surveys and audits, evaluating the statistics on sickness absence and identifying and reporting accidents, injuries, near-miss events, and environmental emissions. However, the relationships between these surveillance methods are not known. Investigations of the causes of major accidents in the petroleum industry in Norway have underlined the importance of the interacting factors between humans, technology, and organizations.[1] Management and organizational factors, as well as technical and individual factors, play an important role in improving health and safety performance in the petroleum industry.[2–6]

Occupational health issues have been important in workplaces in affluent countries for many years and have been seen as critical for improving the health and safety of employees. It is generally agreed that the working environment needs to be systematically improved to avoid accidents and work-related diseases.[7] Despite this relatively old tradition, few studies have been performed to evaluate the relationship between the employees' opinions about the working environment and important health and safety outcomes such as the frequency of personal injuries and sick leave.

Organizational climate refers to shared perceptions among members

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of an organization with regard to fundamental properties, policies, procedures, and practices.[8,9] Researchers on organizational climate frequently use questionnaires to get insight into the employee's opinions about the working environment and typically focuses on communication, leadership, social relationships, and organizational performance, which are associated with the physical, psychosocial, and organizational working environment.[10] Various aspects of the organizational climate may be measured regularly for developing initiatives to improve organization.

Organizational health research during the past decade has shown that organizational climate is a strong factor influencing the well-being of employees.[11] In the international literature, the safety climate related to accidents at work has been used since Zohar[12] described in 1980 safety related to accidents at work as a climate for safety, and since then this expression has been used in the international literature. A study of the relationship between safety climate and leadership showed that management's commitment and involvement in safety work was the most important factor associated with satisfactory safety performance.[13,14] Mearns et al.[2] found a relationship between good health and safety management and accident statistics. Mearns and Hope[15] investigated this relationship further and found that the perception of an organization's commitment to health was significantly related to safety outcomes. There seems to be a relationship between health and leadership in organizations. One type of health measure is sickness absence. Sickness absence is caused by a variety of factors, including factors related to the physical working environment[16] and to organizational factors such as management style, work pressure, and work overload.[17,18] Competence might result in improved ability to deal with demands and thus protect against ill health.[19] Several studies show that high control of the work situation is associated with lower sickness absence.[16] Ulleberg and Rundmo[20] have shown that a high level of job strain is associated with high self-reported sickness absence on Norway's offshore installations.

A qualitative study performed in 2004 in an integrated oil and gas company in Norway described work with health and safety as an umbrella.[21] Five spokes were used to signify behavior, competence, collaboration, procedures, and physical conditions. The fabric was divided into two sections: managers and employees, which are interrelated and have different roles in health and safety work. Similarly Wiegmann et al.[22] reported that organizational safety culture has at least five global components or indicators: organizational commitment, management involvement, employee empowerment, reward systems, and reporting systems.

Activities in the petroleum industry in Norway are both onshore and offshore. Typically in a Norwegian oil and gas company, administration personnel and staff are located onshore together with specialists who support the offshore installations and the onshore process sites. Offshore workers spend two weeks offshore, followed by a 4-week free period at home. Since the offshore installations are isolated, the workforce travel by helicopter to the platforms and work 12-hour shifts the entire work period. Some only are scheduled for workday shifts, while others work on a 24-hours shift system. Most of the workers have their own cabin. If workers get ill offshore they may have a few days sickness absence at the platform. In more serious cases, they are transported onshore, either home or to a hospital. The production workers at onshore process sites work 8 hour shifts, day and night following a rotation schedule. Offshore workers usually report to more than one manager. At onshore process sites, the mid-level managers follow the same shift schedule as the workers.

This study investigated the possible associations between self-reported working conditions and the registered health and safety results in a petroleum company in Norway. The results can be used to evaluate whether self-reported working environment and organizational surveys can be used as an indicator for risk of injuries and sickness absence in a company.

Materials and Methods

We collected data from 2 main sources: the results from a company-wide survey of self-reported working conditions in 2003 and 2004 and data from the company's files of sickness absence, recordable injuries, serious incidents, and undesirable incidents (Table 1).

Study Population

The study population comprised production workers employed in a Norwegian oil and gas company working on 2 onshore process sites and on 16 offshore installations. Such work categories as industrial and automatic control mechanics, electricians, instrument technicians, logistic personnel, oil and gas processing operators, service workers and cooks, crane operators, and direct managers were included in the study. A total of 89% of the study population were men. Ages were categorized in 5 groups: less than 30 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, and older than 60 years.

Working Conditions

The results of surveys of self-reported working conditions were obtained from a database in the company. The questionnaire used for the survey was not standardized but had been developed in the company in 1986 and revised and implemented every year by the organization. The statements in this measure are closely aligned to organizational climate questionnaires.[24]

TABLE 1
Variables, Definitions, and Outcomes for the Health and Safety Data of a Petroleum Company Used in a Study

Variables	Definitions	Outcomes for Health and Safety Data in a Petroleum Company
Injury	An injury is a bodily injury caused by an accident. The injury must be caused by a sudden or external stress or load that is greater than can be expected in the ordinary performance of work. Recordable injuries include fatalities and lost-time injuries involving substitute work and health care.	Recordable injuries calculated in percent per employee in each unit
Serious incidents	Serious incidents are defined as all undesirable incidents that have or could have caused (conditions and near misses) injury, damage, or loss categorized as having a degree of seriousness of level 1 or 2 on a five-level scale.[23]	Reported serious incidents calculated in percent per employee in each unit
Undesirable incidents	Undesirable incidents are defined as all undesirable incidents that have or could have caused (conditions and near misses) injury, damage, or loss categorized as having a degree of seriousness of levels 1–5 on a five-level scale.	Reported undesirable incidents calculated in percent per employee in each unit
Sickness absence	Sickness absence is defined as days of absence from work with a medical certificate from a doctor or an absence reported by the employee (self-reporting).	Percentage of working days absent per employee in each unit

The self-reported surveys of working conditions were distributed in the electronic mail system to all employees in October/November every year. A personal e-mail was sent to all employees with a link to the electronic questionnaire and an assurance of anonymity. The questionnaire was sent only to the company's own employees, not to the contractor staff. This study used the results from the survey data on working conditions from 2003 and 2004. The response rate for the survey was 71% in 2003 and 76% in 2004.

The survey had 70 items in 2003 and 59 in 2004. The items were phrased as "I have confidence in . . ." or "In my unit we have . . ." and were to be answered on a 6-point scale ranging from one ("fully disagree") to 6 ("fully agree"), where 6 was the best score. In addition, "not relevant" was a response option.

The survey responses in 2003 and in 2004 were aggregated from individual data to organizational levels for each year. The data were compiled at 2 organizational levels: departments, with 90 in 2003 and 92 in 2004; and 14 business units, both in 2003 and 2004. The departments and business units included both offshore and onshore installations and their administration staff. Department was used as the unit of analysis when health, safety, and environment (HSE) data were available at that level.

TABLE 2
Number of Employees Responding to a Survey on Working Conditions and Number of Departments and Business Units in 2003 and 2004, in a Petroleum Company

	Number of Employees		Response Rate (%)		Number of Departments/ Business Units	
	2003	2004	2003	2004	2003	2004
Departments						
Offshore	1933	2067			60	63
Onshore	1006	1123			30	29
Total	3023	3094	71	76	90	92
Business units	5433	5475	74	81	14	14

Table 2 lists the number of employees, response rate and number of departments and business units in 2003 and 2004. Results for departments are given both for offshore and onshore entities. Business units are not split up as some business units contain both onshore and offshore process sites.

Health and Safety Data

The petroleum company used the same reporting system for HSE data in all the departments in Norway. The company has procedures for processing the reported data, from immediate notification of the incident or injury, through investigation and follow-up of corrective and prevention activities.[23] All incidents were registered in the same database. Data on sickness absence were collected from the human resources registration tool in the company. All days of sickness absence were recorded, both absence with a medical certificate from a doctor and absence reported only by the employee (Table 1). Other types of absence, such as those resulting from sick children, childbirth, and adoption, were not recorded as sickness absence.

The study used HSE data on recordable injuries, serious incidents, undesirable incidents, and sickness absence from 2003 and 2004. In addition, recordable injury data for 2000 to 2003 and for 2000 to 2004 were summarized, because of few injuries every year, to study the relationship between these injuries and self-reported working conditions in 2003 and 2004, respectively. Data from the 14 business units were used in this analysis because recordable injury data were not available on department level due to organizational changes. The analysis was based on the assumption that the employees in the business units were quite similar in the period between 2000 and 2004 because of low turnover. The same analysis was not performed for serious incidents because the classification system changed during the period.

Methods

The mean responses from the survey of working conditions in the departments or business units were used for analysis. Sickness absence, recordable injuries, incidents, and undesirable incidents were calculated as the percentage per employee in each department or business unit.

From a former qualitative study in the company[21] demonstrating the importance of leadership factors, behavior, competence, collaboration, procedures, and physical conditions for the working environment, 30 items concerning these relationships were extracted for further analysis. However, the surveys of self-reported working conditions had no items about such physical conditions as noise, vibration and chemical, and ergonomic exposure. Typical items not included for the further analysis were statements about managers' ability to manage the unit profitably and effectively, the customers' requirements, relations with other units within the company, and systematically following up feedback with customers and clients.

Statistics

An exploratory principal component analysis was used to assess the factorial structure of the 30 items from the survey of working conditions. The factor analysis was performed on the individual data for 2004 for 3094 employees (Table 3). Kaiser varimax rotation served to extract the factors that yielded a 5-factor structure for use in the former analyses. These factors accounted for 53.2% of the variance, where each factor contributed to the variance between 7% to 14%. Missing values were excluded. Table 3 shows that the items from the survey of self-reported working conditions are divided into 6 factors including the item of procedures. These were 11 items about 2 different types of management or supervisory style, 9 items about competence, 6 items about HSE behavior, 3 items about collaboration, and 1 about procedures. In the factor analysis, only factor loadings greater than 0.4 were selected. To test the internal consistency of the indexes in the study, Cronbach's alpha values were calculated. High values ($\alpha = 0.70-0.90$) indicate that the items measure different aspects of the same construct.

A two-sample t test was used to test differences between offshore and onshore workers. Pearson's correlation analysis was performed to calculate the correlation between the 6 factors emerging through the factor analysis and recordable injuries, serious incidents, undesirable incidents, and sickness absence. The data were weighted according to the number of employees in each unit.

To study the relation between factors in the self-reported working condition survey and injuries summarized for 2000 to 2003 and 2000 to 2004, linear regression analyses were carried out. Standardized beta coefficient, are an expression for adjusted correlation coefficient. The dependent variable was summarized injuries; working conditions were used as the independent variable in separate analyses. The analyses were adjusted for work offshore, onshore, and for gender. Adjusting for age was not performed because the aggregated data were given in percent of employees' in 5 age groups in each unit. The level of significance was set at 0.05. The Statistical Package for the Social Sciences 13.0 (SPSS Inc., Chicago) was used for analysis.

Results

Self-Reported Working Conditions

The study included 90 departments in 2003 and 92 in 2004. On a scale ranging from one to 6, in which 6 was the best score, the mean score in the departments varied between 2.9 and 4.8 for the 6 factors in the survey of self-reported working conditions (Table 4). Offshore workers reported lower scores for all working condition factors and there were significant differences between the 2 groups on perception of nearest manager, confidence in management, and procedures in both 2003 and 2004. In addition, significant differences between offshore and onshore departments were found for collaboration and competence in 2004 only. A total of 89% of the study population were men (92% offshore, 85% onshore). There was a significant difference between percentage of men offshore and onshore ($P < 0.001$).

Age was categorized in 5 groups; 8% of the employees were younger than 30 years (4% offshore, 19% onshore), 27% were 30 to 39 years old (23% offshore, 33% onshore), 34% were 40 to 49 years old (38% offshore, 25% onshore), 29% were 50 to 59 years old (32% offshore, 20% onshore), and 3% were older than 50 years (the same both offshore and onshore).

Health and Safety Data

The employees in the selected departments had 28 recordable injuries

TABLE 3
Factor Analysis of Individual Data From the 2004 Survey of Self-Reported Working Conditions Showing Factors, Number of Items, Reliability (Cronbach's α), Items Included and Factor Loadings

Factors of Working Conditions	No. Items	Reliability (Cronbach's α)	Items Included	Factor Loading
Perception of nearest manager	7	α = 0.97	I have confidence in my immediate superior	0.70
			The working environment and organization survey is used actively as a tool for improvement in my unit	0.41
			Work actively to achieve good HSE results	0.68
			Clearly communicate the individual's responsibility for health, safety, and the environment	0.70
			Practices what he or she preaches	0.78
			Cares about his or her colleagues	0.81
			Is good at motivating his or her colleagues	0.81
Confidence in management	4	α = 0.90	I have confidence in the management of my business unit	0.59
			I have confidence in the corporate executive committee	0.79
			I am confident that the company displays social responsibility and acts in accordance with basic human rights wherever it has operations	0.69
			To my friends, I speak of the company as being a good company for which to work	0.60
HSE behavior	6	α = 0.92	In my unit, the zero mindset (zero accidents, harm or losses) forms the basis for the planning and implementation of our work	0.73
			Work on HSE is given high priority in my unit	0.77
			Concern with the external environment is given high priority in my unit	0.73
			I contribute actively to the creation of good HSE results in my unit	0.75
			In my unit we have a high level of ethical behavior and practice good business morals	0.45
			In my unit we deliver what we promise	0.46
Competence	9	α = 0.94	I have the opportunity to utilize my expertise and abilities in my daily work tasks	0.62
			Conditions are favorable for my further personal development in a systematic manner	0.74
			I receive the training necessary in order to do a good job	0.70
			I take the initiative and actively seek to develop my skills	0.61
			In my unit we are good at making use of each other's expertise and experience	0.50
			I am sufficiently involved in decisions relating to my own work situation	0.50
			I am satisfied with my career opportunities in the company (2004)	0.52
			In my unit, suggestions for improvements are quickly put into practice	0.51
			At my workplace tasks are organized according to the capabilities of the individual employee	0.47
Collaboration	3	α = 0.83	At my workplace colleagues get along well together	0.70
			At my workplace the working environment is encouraging and supportive	0.60
			All in all, how well do you enjoy your job?	0.53
Procedures	1		It is easy to find the information I require in the electronic information systems I use	0.42

in 2003 and 32 in 2004. Table 5 shows the percentages of departments with 0, 1 to 2, and >2 injuries and serious incidents in 2003 and 2004.

Undesirable incidents are reported by all employees and range from the most minor undesirable incidents to more serious incidents. Example of a minor undesirable incident is spilling coffee on the floor, more serious incidents are injuries where people need hospital treatment or it could be gas leakages. The mean was 2.6 undesirable incidents per employee in 2003; in 2004 the number was 2.7 per employee; however every employee did not report undesirable incidents in each time period.

Sickness absence in the departments in 2003 varied between 0% and 12.4%; the mean was 4.7%. In 2004 it varied between 0.2% and 12.7%; the mean was 5.0%.

The number of employees in each department in 2003 varied between 5 and 161; the mean was 34. For 2004, the range was 5 to 137 employees, with a mean of 34. The number of employees in each of the 14 business units varied between 112 and 648 in 2003; the mean was 447. In 2004 it varied between 118 and 639 employ-

TABLE 4
Six Factors in the Self-Reported Working Condition Survey for 2003 and 2004 in the Departments Analyzed by Offshore, Onshore, and Total Departments

	2003				2004			
Factors of Working Conditions	**n**	**Mean**	**SD**	***P* Value***	**n**	**Mean**	**SD**	***P* Value***
Perception of nearest manager				<0.001				<0.001
Offshore	60	4.0	0.35		63	4.1	0.41	
Onshore	30	4.4	0.47		29	4.5	0.40	
Total	90	4.2	0.52		92	4.3	0.45	
Confidence in management				<0.001				<0.001
Offshore	60	3.7	0.35		63	4.1	0.41	
Onshore	30	4.1	0.26		29	4.5	0.23	
Total	90	3.9	0.38		92	4.3	0.42	
HSE behaviour				0.26				0.09
Offshore	60	4.7	0.18		63	4.7	0.21	
Onshore	30	4.8	0.29		29	4.8	0.25	
Total	90	4.7	0.27		92	4.7	0.23	
Collaboration				0.06				0.025
Offshore	60	4.7	0.26		63	4.6	0.28	
Onshore	30	4.8	0.27		29	4.7	0.27	
Total	90	4.7	0.29		92	4.6	0.28	
Competence				0.08				<0.001
Offshore	60	4.0	0.26		63	4.0	0.30	
Onshore	30	4.2	0.29		29	4.2	0.28	
Total	90	4.1	0.52		92	4.1	0.31	
Procedure				<0.001				<0.001
Offshore	60	3.1	0.41		63	2.9	0.49	
Onshore	30	3.6	0.40		29	3.6	0.36	
Total	90	3.4	0.53		92	3.2	0.54	

*t test.

TABLE 5
Percentages of Departments With 0, 1–2, or >2 Recordable Injuries and Serious Incidents in 2003 and 2004 in a Study Conducted at a Petroleum Company

	Recordable Injuries, %		Serious Incidents, %	
n	**2003**	**2004**	**2003**	**2004**
0	74	63	77	70
1–2	23	30	21	15
>2	3	7	2	15

ees; the mean was 439. The onshore workers were younger than the offshore workers.

No significant differences in health and safety reporting were found between onshore and offshore departments, except for sickness absence (t test, $P < 0.001$ both in 2003 and 2004). The sickness absence for offshore departments was 6% and for onshore departments 3.9% in 2003. In 2004 the sickness absence was respectively 5.8% and 3.7%.

Working Conditions and Health and Safety Data for 2003 and 2004

In 2004, all factors in self-reported working conditions were negatively associated with recordable injuries in all departments and offshore. Only the factor collaboration at offshore departments was statistically significant (Table 6). The other associations were not statistically significant and the correlation coefficients were small. The results for data from 2003 were similar with only minor differences.

In 2004 there were no significant correlations between working conditions and serious and undesirable incidents. In 2003 there were significant positive associations between serious incidents and collaboration (correlation coefficient, $r = 0.28$, $P = 0.04$) and significant negative associations between undesirable incidents and HSE behavior ($r = -0.34$, $P = 0.01$) and competence ($r = -0.31$, $P = 0.02$) in offshore departments. Onshore departments had a significant positive association between HSE behavior and undesirable incidents ($r = 0.40$, $P = 0.03$).

Self-reported responses about the perception of the nearest manager and confidence in management were significantly negatively correlated with sickness absence in 2004 when analyzing all departments (Table 6). The higher the mean score was on the management items, the lower the sickness absence rates. The same results were found in data from 2003. However, these results were not found when grouping according to offshore and onshore work.

Working Conditions and Recordable Injuries 2000 to 2003 and 2000 to 2004

There were few recordable injuries every year. The sum of recordable injuries was 245 from 2000 until 2003 and 283 from 2000 to 2004.

The multiple linear regression analysis showed that the responses related to confidence in manage-

TABLE 6
Pearson's Correlation Coefficients Analyzing Data From a Petroleum Company in a Survey of Working Conditions and Health and Safety Results in 2004

Factors of Working Conditions	Recordable Injuries			Serious Incidents			Undesirable Incidents			Sickness Absence		
	Offshore	Onshore	Total	Offshore	Onshore	Total	Offshore	Onshore	Total	Offshore	Onshore	Total
Perception of nearest manager	−0.22	−0.26	−0.11	0.00	0.10	0.01	−0.10	−0.08	−0.08	−0.10	−0.09	−0.26*
Confidence in management	−0.22	0.22	−0.15	0.16	0.04	0.11	0.14	0.06	0.06	−0.09	−0.11	−0.30**
HSE behaviour	−0.15	0.15	−0.06	0.14	0.27	0.16	0.02	0.05	0.05	0.00	−0.03	−0.09
Collaboration	−0.33**	0.12	−0.12	0.10	0.19	0.03	0.00	−0.01	−0.01	−0.16	0.18	−0.17
Competence	−0.22	0.20	−0.20	0.03	0.08	0.11	−0.10	−0.07	−0.07	−0.07	0.14	−0.14
Procedure	−0.25	0.17	−0.16	0.03	−0.09	0.00	0.07	−0.03	−0.03	−0.25	0.15	−0.20

*$P < 0.05$ (two-tailed).
**$P < 0.01$ (two-tailed).

TABLE 7
The Relationship Between Items From a Survey of Working Conditions in a Petroleum Company in 2003 and 2004 and the Sum of Recordable Injuries From 2000 to 2003 and 2000 to 2004, Respectively

	Working Conditions 2003 Recordable Injuries, 2000–2003 ($n = 245$)		Working Conditions 2004 Recordable Injuries, 2000–2004 ($n = 283$)	
Factors of Working Conditions	Bivariate Correlation Coefficient	Standardized Beta Coefficient*	Bivariate Correlation Coefficient	Standardized Beta Coefficient*
Perception of nearest manager	−0.09	−0.00	−0.23	−0.17
Confidence in management	−0.48	−0.58†	−0.54‡	−0.74§
HSE behavior	−0.48	−0.34	−0.53	−0.45
Collaboration	−0.24	−0.04	−0.20	−0.12
Competence	−0.39	−0.24	−0.30	−0.28
Procedure	−0.45	−0.21	−0.35	−0.51

*Adjusted for work onshore/offshore and gender in a multiple linear regression analysis.
†$P = 0.043$.
‡$P = 0.046$.
§$P = 0.024$.

ment, both in 2003 and in 2004, were significantly negatively associated with the mean of the sum of recordable injuries for 2000 to 2003 and 2000 to 2004 respectively (Table 7). Standardized beta coefficients, as an expression for adjusted correlation coefficient, were slightly higher and also significant. These results were adjusted for gender, offshore, and onshore work. Adjusted R square (R^2) varied between 0.25 and 0.37, except for confidence in management where $R^2 = 0.51$ in 2003. In 2004 adjusted R^2 varied between 0.25 and 0.42, except for confidence in management where $R^2 = 0.57$. For both 2003 and 2004, recordable injuries were negatively correlated with all the working condition factors. This means that the better results the business units had on the self-reported working environment and organization survey, the fewer registered accidents occurred.

Discussion

This study investigated the possible association between self-reported working conditions and health and safety results in a petroleum company in Norway. The number of recordable injuries was significantly correlated with confidence in management.

Workers might work more safely when upper management emphasizes safety in policy.[25] The managers set goals and policy and decide on the priorities, and their policies regarding health and safety, goals, and priorities influence the workers directly and indirectly. The company in this study had a goal of zero harm to people and the environment. The top managers were included in a performance pay system that gave variable remuneration based on preagreed targets, including health and safety results. Payment rewards might be one way to force the managers to work actively at different levels to ensure good health and safety results.[26] The company also had a mandatory safe behavior program focusing on the decisions all employees have to make to prevent injuries, and most managers have attended open safety dialogue courses. This might be a framework for why employees rated the management highly on confidence concerning working environment issues. In a safety climate survey of 13

offshore oil and gas installations in the United Kingdom, Mearns et al.[2] found that management commitment to health and safety emerges as a key predictor of accident incidence, and proficient safety management practice was associated with fewer official accident reports. Such an effect might have occurred here, as the number of recordable injuries and serious incidents seems low.

Managers' payment rewards and focus on health and safety results might cause underreporting of accidents, injuries, and incidents due to fear of negative impact. However, according to Reason,[25] a reporting organization is important for good health and safety performance. A reporting culture is based on trust, and the purpose is to learn from experience to avoid unfortunate incidents. The International Association of Oil and Gas Producers suggests that incentive schemes be used with caution and should include leading indicators as a supplement to lagging indicators. However, sickness absence is not included in managers' payment rewards, and this is also very low in the company. Statistics Norway (2005) reported 8.1% percentage sickness absence for all workers in Norway in 2003 and 7.1% in 2004.[27]

This study also showed that recordable injuries offshore in 2004 were negatively associated with collaboration. However in 2003 offshore departments had significant positive associations between serious incidents and collaboration. This means that these results are not entirely reliable and should be interpreted with caution.

The study showed few significant associations with recordable injuries, serious incidents, and undesirable incidents per year and the 6 factors from the survey of self-reported working conditions in the total material. This might be explained by methodological artifacts for the serious incidents, due to low numbers. The numbers of recordable injuries summarized for 2000 to 2003 and 2000 to 2004 were significantly correlated with the results concerning confidence in management in the self-reported working environment survey. This strengthens this assumption.

The number of undesirable incidents was strongly related to campaigns in the business units. The best business units might be the ones that reported the most undesirable incidents and not the business units that really have the most health and safety problems. This outcome was probably not a reliable measure to correlate with health and safety outcomes due to unclear "success" related to this factor and might be the reason why both positive and negative correlations were found for this factor.

Sickness absence can be viewed from several perspectives. It is a complex phenomenon that is influenced strongly by factors other than health. The decision to attend work can be related to individual factors, family and social conditions, as well as the real and perceived physical and psychosocial working conditions. The present findings indicate an association between confidence in management and sickness absence in the material before grouping into onshore and offshore. However, this was not found when grouping according to offshore and onshore work. This might be explained by differences between these two groups, as onshore workers report both higher scores on the factor confidence in management and lower sickness absence than offshore workers. The findings are in contrast to other studies showing that working conditions are associated with sickness absence and that management style is an important factor for work attendance. However the scientific evidence for this relationship is limited.[16] Also some studies showing a positive relation between sickness absence and good leadership, divide sickness absence into long-term and short-term absence in the analyses.[18] This was not possible in the present study, and could be another reason for the differing results. In addition, very few previous studies of relationship between work and sickness absence exist in the petroleum industry.[17]

The present study showed differences between offshore and onshore departments, although the workers had similar tasks and education. Onshore workers were younger, there were more females, and they had lower sickness absence. The findings are not consistent with previous studies[16] as females usually report higher sickness absence.

The results of this study should be interpreted in the context of its limitations. The self-reported working environment questionnaire was used in one company and was not standardized. However, it had been used and tested since 1986. Cronbach's alpha, measuring the overall internal reliability of the items from both 2003 and 2004, ranged from 0.75 to 0.97, which ought to be acceptable.[28] This suggests that the items consistently measure what they are supposed to measure: perception of the nearest manager, confidence in management, behavior, competence, collaboration, and procedures. The survey was a general instrument for measuring organizational climate and not constructed to be correlated with health and safety results. If more or other items had been included, such as more than one item about procedures and other items within HSE behavior and collaboration, different results might have been obtained. We expected to find a stronger relationship between these factors and HSE results, as other studies underline their importance. Developing and expanding the items about HSE might give the organization better insight into the factors underlying injuries and incidents. Also the number of recordable injuries and serious incidents were rather small, and this might have influenced the results.

One strength of the study was that we studied the self-reported working conditions and their association with health and safety results in the entire workforce in a company. The response rate to the questionnaire was high and very similar for both years. The management of human resources and health and safety values and procedures was the same since

all workers were employed in the same company. Another strength of the study was that the datasets came from different data sources and were independent. Complete datasets of both the survey of self-reported working conditions and the company's file of safety and sickness absence data were available. Because data sources differed, we had to aggregate the data from the survey of self-reported working environment to correlate it with health and safety data. The results would be more precise if individual data could be used for all analysis. The analyses were done at the lowest possible organizational level, using departments whenever possible. The analyses used data from more than one year, which ensured that the results were not occasional.

The results showed a relationship between self-reported working environment concerning management functions and injuries. On this basis, surveys of self-reported working environment and organization can probably be used as indicators for risk of injuries. Similar studies are needed to clarify whether these relationships are valid in other settings. There were found differences in the self-reporting survey and on health and safety results onshore and offshore and it is suggested to study this further.

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