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Original Article

Effectuality of Cleaning Workers' Training and Cleaning Enterprises' Chemical Health Hazard Risk Profiling

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ABSTRACT

Background: Goal-oriented communication of risk of hazards is necessary in order to reduce risk of workers' exposure to chemicals. Adequate training of workers and enterprise priority setting are essential elements. Cleaning enterprises have many challenges and the existing paradigms influence the risk levels of these enterprises.
Methods: Information on organization and enterprises' prioritization in training programs was gathered from cleaning enterprises. A measure of enterprises' conceptual level of importance of chemical health hazards and a model for working out the risk index (RI) indicating enterprises' conceptual risk level was established and used to categorize the enterprises.
Results: In 72.3% of cases, training takes place concurrently with task performances and in 67.4% experienced workers conduct the trainings. There is disparity between employers' opinion on competence level of the workers and reality. Lower conceptual level of importance was observed for cleaning enterprises of different sizes compared with regional safety delegates and occupational hygienists. Risk index values show no difference in risk level between small and large enterprises.
Conclusion: Training of cleaning workers lacks the prerequisite for suitability and effectiveness to counter risks of chemical health hazards. There is dereliction of duty by management in the sector resulting in a lack of competence among the cleaning workers. Instituting acceptable easily attainable safety competence level for cleaners will conduce to risk reduction, and enforcement of attainment of the competence level would be a positive step.

1. Introduction

The cleaning service industry is a major end-user of chemicals. It is estimated that an average cleaning worker uses approximately 110 kg of hazardous chemicals annually [1]. Although use of dry methods has increased in recent times, large quantities of chemicals are still used. The Norwegian Product Register (the central register for chemicals in Norway) showed that in 2012, about 270,000 tons of cleaning chemicals were registered. This amount includes chemicals other than biocides, classified in one or more hazard class.

Generally, cleaning workers have the highest incidence of contact dermatitis [2,3], and have an increased risk of asthma and rhinitis [4]. It is becoming evident that cleaning products are the cause of up to 12% of reported asthma cases in several countries across Europe [5]. It is therefore important that cleaning workers receive appropriate and proper knowledge on chemicals safety. Employers are required to ensure that their employees are familiar with the risk of chemical hazards and safety in relation to their work [6]. It is suggested that training of cleaning workers should, in minimum, include a general theoretic introduction [7], workplace instruction, basics on quality of work, chemicals, and ergonomics. It has been recommended that new employees be trained especially in the correct use of chemicals and safety data sheets [8].

There have been attempts in Norway to develop cleaning work into a skilled trade by introducing vocational certificates and

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certificates of apprenticeship programs by training cleaning workers through joint sectorial training programs [9]. There were, however, doubts on their usefulness, and their implementation was ineffective due to the lack of enthusiasm and motivation among stakeholders [9]. Both employers and employees' representatives opined that the training programs were expensive and achieved very little in terms of progression of the workers [9]. Cleaners need specially designed training programs in order to have a reasonable contingency for advancement [10]. It is, however, reported that in a program to encourage cleaners to take up training entitling one to a proficiency certificate, only 0.6% of the cleaners took part [10].

In Norway, a training program, which on successful completion of theory and a 5-year practice period, leads to an award of certificate of apprenticeship costs approximately US$4,000/€3,000 [11]. The cost and the perception on the lack of usefulness and benefits of the training demotivated cleaners from taking up such training. Employers in the sector avoid asking for a certificate of apprenticeship as a requirement for employment and instead opt for in-house training. This raises a problem as few supervisors/managers in the sector have taken the law-required health and safety training [12].

Trygstad et al [9] reported an estimated 41,000 cleaning workers in Norway, and in some instances ~90% of cleaners are of other backgrounds than Norwegian, have a low level of education [13] where ~75% have primary education or less [9]. Despite a law provision requiring that nonNorwegian speakers be provided with information in the language they understand [6], inspections of cleaning enterprises confirm that this is not the case. This emphasizes the need for proper and effective training.

The purpose of this study was thus: (1) to determine how training of workers in the cleaning service sector is organized and to elaborate on the relative importance given to chemical health hazards in the training; (2) to evaluate the suitability and effectiveness of training offered to cleaning workers as a tool for chemical health hazard communication; and (3) to map and compare the relative level of risk of exposure to hazardous chemicals among cleaning workers in different enterprises.

2. Materials and methods

Surveymonkey version 2 (https://www.surveymonkey.com/?ut_source=header) electronic questionnaire was distributed to cleaning enterprises across the country registered as approved according to the approval ordinance of the Norwegian Labor Inspection Authority (NLIA) by October 2013. The approval is a requirement for all enterprises offering cleaning services [14]. Similarly, the questionnaire was sent to municipal entities anticipated to have in-house cleaning personnel making about 20% of those invited. The rest were all private enterprises. The questionnaire was sent as a web-link through the enterprises' business email addresses listed in different sources. About 15 enterprises received a paper version of the questionnaire during visits by regional safety delegates (RSD). No additional efforts were made to reach other enterprises other than the above mentioned.

The questionnaire included questions on demographics, organization of cleaning workers' training, and priorities of training themes considered relevant to such trainings. Also asked was the number of cleaning workers employed and the average age interval of these workers, permanent/temporary employment or employment on a need-basis, type of cleaning task performed, whether a member of a sector or employers' organization, and Norwegian language competence of the workers.

The electronic distribution of the questionnaire minimized chances of repeated response from the same enterprise.

Twelve themes considered relevant in a training program for cleaning workers were presented in the questionnaire. Supervisors/holders of the enterprises ranked the themes according to how they would prioritize them in their training programs, based on their own consideration of the theme's importance. This part of the questionnaire was also answered by the RSDs ($n = 8$) and NLIA occupational hygienists (OH; $n = 15$) based on their experiences and own assessment. Results obtained from RSDs and OHs, representing state institutions responsible for information and enforcement in the sector, were compared with the outcome from the cleaning enterprises.

In ranking the themes, the most important theme was ranked as 1, labeled as $S_R = 1$, while the least important was ranked 12 ($S_R = 12$). The ranking would thus be sequential from the most to the least important theme. The themes were placed in three main categories as listed below:

Category 1: *Enterprise related.* (1) Correct job performance to satisfy customers' requirements and needs (work ethics); (2) Dutifulness, orderliness, effectiveness in job performance (job performance); (3) Setting positive attitude that one is doing important work for the community (workers' attitude); and (4) Customer relation and marketing of the enterprise (customers relation).

Category 2: *Regulatory requirements.* (1) Possession of identification card for cleaners as requirement of NLIA (identification card); (2) Information on occupational health services and their role (occupational health services); (3) Source of information on chemicals, health, and existing regulation (information sources); and (4) Ergonomic factors to prevent physical injuries (ergonomics). Note: Ergonomics is important for cleaning workers and is here included in this group to balance the groups.

Category 3: *Chemicals health hazards prevention.* (1) Chemical health hazards and the risk posed by cleaning products (health hazards); (2) Correct, purposeful handling of chemicals (handling chemicals); (3) Properties of the cleaning chemicals (properties of chemicals); and (4) Safety data sheets/other information sheets and their contents (safety data sheets).

A conceptual level of importance (CLI) based on the ranking of the themes was established according to the ranges of summed S_R ($\sum S_R$), as shown in Table 1.

In order to attain the high CLI for chemical health hazard prevention, all the items in category 3 (cat.3) have to be ranked in the first four positions to give $\Sigma S_R = 10$; for low CLI, the items have to be in the lowest ranking, $26 < \Sigma S_R$. Medium level is, thus, defined in the range $10 < \Sigma S_R \leq 26$.

Table 1
ΣS_R ranges and the conceptual level of importance based on ranking of the given themes

Sum of rank of the items	Conceptual level of importance	Envisaged position from the conceptual importance level
$\Sigma S_R = 10$	High	High priority given to all elements in same category. Expectedly, the themes would feature predominantly in workers' training
$10 < \Sigma S_R \leq 26$	Medium	Considered important & would feature in a training program, but less predominantly as those in the high level
$26 < \Sigma S_R$	Low	Considered less important, & may not be included in a training program at all

Table 2
Assignment of scores to the various parameters (from the questionnaire) used in deriving conceptual risk indices

Nature of employment	Language proficiency (Norwegian)	The type of work done*,†	Training point of time	Training conducted by	Membership	Assigned score
All on permanent employment	All speak Norwegian well	Schools/offices/shops	Workers certified prior to employment	Supplier of chemicals	Sector organization	1
		Domestic cleaning (in private homes)	After signing of contract, before work begins	Sector/employers' organization/consultant		2
Both permanent & temporary	Majority speak Norwegian well	Hotel/overnight lodges		Holder/supervisor/facility manager	Employers organization	3
		Restaurant/canteens/means of transport	Same time as the work is done	Experienced cleaners train other		4
On demand	Few/none speak Norwegian	Hospitals/nursing homes/industrial cleaning	No training offered	Not applicable	Not a member of an organization	5

* More than one type of work might be done by the same enterprise. Where tasks from different categories are undertaken, the average value should be used.
† Where window cleaning is done, a score of 5 should be added to that which is read from the table, and a score of 4 for washing of staircases, and the average value calculated.

Mean values of the rankings by enterprises were calculated for each of the themes and the total for cat.3 elements, labeled $\sum S_{R3}$, calculated. $\sum S_{R3}$ for the different-sized enterprise groups and for RSDs and OHs were also calculated. Comparison of $\sum S_{R3}$ from RSDs, OHs, and all enterprises combined was made in order to assess for differences among the three different stakeholders. Rank correlation coefficients (Spearman's correlation) for the rankings by the three groups (enterprises, RSDs, and OHs) were calculated.

A model for determining the risk level for exposure to chemicals was established by conceptualizing risk index (RI) as a measure of the cleaning enterprises' risk level. Parameters given in the questionnaires were used to design the RI model. The parameters are assigned scores 1–5, such that 1 is for ideal conditions, and 5 for the least ideal conditions. Table 2 shows the parameters included in the conceptual model and the possible alternatives the different enterprises would fit in, together with their assigned scores.

Some assumptions are necessary in order to validate the applicability of the model. First, that training on chemicals and related health hazards would be most effective when conducted by the supplier of the chemicals, as these are presumed to be most knowledgeable about their products. Thus, whoever conducts the training is an overriding element. The point-of-time the training is similarly conducted, i.e., before/during undertaking the assigned tasks. This leads to the second assumption, that prior certified cleaners are more knowledgeable on chemical health hazards risks than those not certified. Thirdly, members of sector organizations receive support from their respective organizations. These factors are important in differentiating the enterprises, and are considered ideal ($Sc = 1$), as shown in Table 2. Workers' language proficiency, point-of-time for training, and who conducts the training are the other important parameters. In addition is the nature of employment—employers are likely to invest more resources on permanent employees than temporary ones. The parameters were put into five, four, or three levels depending on the options reckoned actual in work situations. Below is the formula for deriving the index: $RI = \sum_1^n Sc/3.00n$, where Sc is the assigned score for each parameter; n is the number of parameters considered; and 3.00 is a factor used to keep the index values within value 1.00 ($\pm$ 0.67).

The best attainable index by the most ideal enterprise would be 0.33, while the value for the least ideal enterprise is 1.67. Again, three risk levels are established here according to the attained index value as: (1) $0.33 \le RI \le 0.66$, indicating low risk level; (2) $0.66 < RI \le 1.33$, indicating a medium risk; and (3) $1.33 < RI \le 1.67$, indicating high risk level.

For the medium level, further differentiation is realizable where the range 0.66–1.00 represents the lower medium risk level and 1.00–1.33 the higher medium. Consequently, the index value in the lower range are construed to suggest good conditions, which can be translated to imply good knowledge of chemicals and associated health hazards among the workers. The opposite applies for values in the higher range. The spectrum of the index can be expanded by including other parameters where additional operational data is available. The CLI can be used as one such additional parameters, assigning scores of 1, 3, and 5 to CLI high, medium, and low respectively.

To elucidate on the application of the model is an example of an enterprise with 11–50 employers and the average age being > 45 years (these do not count in the RI calculation) where all are permanently employed ($Sc = 1$). Also, only a few speak Norwegian (5), clean both schools and private homes [$(1 + 3)/2 = 2$]. Further, training is offered by experienced employees (4) at the same time as the assigned task is performed (4). The enterprise is a member of an employer organization (3). The index for the enterprise would be 1.06, which is in the higher medium index value range. This is RI based on organizational paradigms. Calculating the same whilst

including a high CLI (Sc = 1), the outcome improves to 0.95, moving from the higher to the lower medium. Indices for different scenarios can be derived and the risk level determined.

A group of 98 workers (45 hospital cleaning workers, 18 domestic cleaners, 20 hotel cleaners, and 15 office and other cleaners) with 2–5 years or more of experience in cleaning work were given a questionnaire on among other items, type of training received, and its usefulness in countering chemicals health hazards. The aim was to determine the cleaners own assessment of the training received and its effectivity. Further on, a 20 multiple-choice questions test was made and sent to the same enterprises for administration. Some of the questions asked included: (1) What do you understand by classification of chemicals? (2) Which substances may have corrosive properties? (3) What does the pH-scale represent? (4) Which pH-values are considered as extreme values? (5) What precautions should one observe when using a chemical labeled "toxic"? and (6) What type of information can one find in a safety data sheet?

The test was to be taken on voluntarily. There were no restrictions on how the test was to be conducted and participants were to be given ample time and could use all aid in their disposition. The same workers who answered the first questionnaire were preferred, but others could be selected as per the wish of the supervisors. The number of participants invited by their respective supervisors was not determined. Both the questionnaire and the test could be answered either in English or Norwegian. SPSS version 21 (IBM SPSS Inc., Chicago, IL, USA) was used to calculate all descriptive statistics reported.

3. Results

From 1,991 e-mails sent, 1,823 were successively sent while the remaining 168 came back either due to error in the e-mail addresses or other reasons. No further effort was put into these. From those successively sent, 347 (19.0%) responded during the period of data collection between November 2013 and March 2014. Again, no more effort was put into nonrespondents. Furthermore, only responses correctly filled were considered, giving 322 respondents (17.7%). These were sorted and grouped size-wise according to the reported number of workers. With a reported average of 26 cleaners in cleaning enterprises [8], 322 enterprises translated to a little over 8,300 workers. All the results are based on the 322 respondents.

Table 3 shows the distribution of the selected study parameters sorted according to the size of the enterprise. These include age group, the mode sex group, when training is offered and who the trainers are, and the type of the work done. Only the mode sex groups are given in the table for each group. Results of this study confirm the known fact that women represent the largest demography in the cleaning service sector.

Overall, 9.0% ($n = 29$) reported not having training programs for cleaners because either they employ only those with vocational certificates or cleaners with long experience, and therefore see no need for training. None of the respondents reported training being conducted by the sector or employers' organizations the enterprises are members in.

Considering the enterprises' rankings, few had cat.3 elements as highest priority. Table 4 shows how different-sized enterprises ranked the cat.3 elements; top or low priority. $\sum S_{R3}$ values are also given. It is apparent from the $\sum S_{R3}$ values that ranking of the themes generally follows a rather similar pattern irrespective of the size of the enterprise, with ΣS_R values falling between 22 and 25. In total, 18.6% of the enterprises had ranked one of the cat.3 elements as the highest priority ($S_R = 1$) in what would be their plan. However, 6.2% had the same elements as the least important ($S_R = 12$). Both cases give a similar distribution of age and sex groups. The 51–100 group has the highest number of enterprises (25.0%) ranking the cat.3 elements as top priority, but at the same time has the highest number (12.5%) with the lowest priority. The 11–50 group has the lowest number (5.0%) with the lowest priority.

The ranking correlation coefficients for ΣS_R between the different-sized enterprises are all in the range 0.996–1.000 and statistically significant at the 0.01 level confirming the similarity in ranking by the different-sized enterprises as is also seen from the $\sum S_{R3}$ values calculated. A comparison of ranking order of the cat.3 elements by the enterprises (overall mean ranking), the OHs, and the RSDs is shown in Fig. 1. Included in the figure are the $\sum S_{R3}$ values for the three groups.

Spearman's ranking correlation for ΣS_R between the three groups is as follows: enterprise-OH: 0.536 ($p = 0.073$); enterprise-RSDs: 0.315 ($p = 0.319$); and OH-RSDs: 0.900 ($p < 0.001$). The ranking correlation coefficients show significant correlation between OHs' and RSDs' rankings. No significant correlation is seen between enterprises' ranking and those of the OHs and RSDs.

When looking at the enterprises' highest priorities to the different elements in all categories, the three highest ranked elements were ergonomics, job performance, and work ethics. The prioritization of cat.3 elements and the enterprises' risk levels measured with RI, conduce characterization of enterprises in the sector.

The RI values using the mode responses in the questionnaire are shown in Table 5. The 6–10 group attained an RI = 0.89, which is in the lower medium range, and the lowest among all groups. This suggests a slightly lower risk level than the other groups with values ≥ 1.00.

The CLI shows medium level importance given to health hazards and the RI indicates medium risk level across the groups. This agreement confirms the common trends among the enterprises of different sizes. This strongly indicates that there is little difference in organizational paradigms and so the working conditions of cleaners in small and in larger enterprises.

In assessment of the workers' competence, 64 workers (65.3%) participated but with much difficulties due to poor language proficiency. It was necessary to elaborate on the questions in much simpler language for the workers to respond. Despite the assistance provided, most of the workers showed difficulties following simple instructions such as "Pick only one answer among the given alternatives." In the multiple-choice questions test, supervisors of the hospital workers reported that none of those selected could answer the questions despite having been given ample time to take the test. The workers cited difficulties in understanding the questions and mostly insufficient knowledge on the topics tested upon as the reasons for not taking the test. The domestic cleaning workers also reiterated this. Table 6 gives the distribution of Norwegian language proficiency among the different-sized enterprises and shows that only 18.6% reported that all workers speak Norwegian well, whereas 65.5% indicated that majority speak the language well. The remaining 51 (15.8%), where few or none of the workers speak Norwegian, are even more disadvantaged on effectively training their workers as all the chemicals information is supposedly in Norwegian. Adding to the fact that less than 20% speak well, attaining overall effective training would undoubtedly be arduous.

4. Discussion

In this study, the label S_R was used in ranking of the themes for training as prioritized by the enterprises ($S_R = 1$ highest ranking, $S_R = 12$ lowest), and the ΣS_R for cat.3 elements (chemicals health hazards prevention) gave the CLI a measure of the importance the enterprises give to training on chemicals health hazards, whereas

Table 3
Outline results of the selected parameters grouped according to the size of the enterprises

Size of enterprise‡	Responses	Age group distribution (y)	Mode sex group	Training organization	Training conducted by: *,†	3 types of cleaning work mostly done (in order of importance)
1–5	27 (8.4)	≤35 (29.6); 36–45 (29.6); >45 (40.8)	OW (70.3)	Before start (29.6); during work performance (51.9); no training (18.5).	Experienced workers (48.1); supervisor/owner/others (40.7); supplier of cleaning products (11.1)	Hotel/stop-overs; hospitals/nursing homes; schools/other places of learning
6–10	55 (17.1)	≤35 (20.0); 36–45 (40.0); >45 (40.0)	OW (56.4)	Before start (34.5); during work performance (54.5); no training (11.0)	Experienced workers (65.3); supervisor/owner/others (22.4); supplier of cleaning products (10.2); consultant (2.0)	Offices/other public buildings; schools/other places of learning; washing of stairs
11–50	181 (56.2)	≤35 (9.9); 36–45 (48.6); >45 (41.3)	W > M (51.9)	Before start (19.9); during work performance (71.8); no training (8.3)	Experienced workers (74.1); supervisor/owner/others (19.9); supplier of cleaning products (3.6) consultant (2.4)	Offices/other public buildings; schools/other places of learning; window cleaning
51–100	27 (8.4)	≤35 (11.1); 36–45 (44.4); >45 (44.4)	W > M (66.7)	Before start (11.1); during work performance (85.2); no training (3.7)	Experienced workers (70.4); supervisor/owner/others (18.5); supplier of cleaning products (11.1)	Offices/other public buildings; schools/other places of learning; hospitals/nursing homes
>100	32 (9.9)	≤35 (21.9); 36–45 (53.1); >45 (25.0)	W > M (71.9)	Before start (31.3); during work performance (65.3); no training (3.4)	Experienced workers (90.6); supervisor/owner/others (9.4); supplier of cleaning products (0)	Offices/other public buildings; schools/other places of learning; window cleaning
Total over-all	322 (100)	≤35; (15.2) 36–45 (45.0); >45 (39.8)	W > M (48.0); OW (39.8); M > W (7.6); W = M (4.0); OM (0.6).	Before start (23.6); during work performance (67.4); no training (9.0)	Experienced workers (72.3); supervisor/owner/others (20.1); supplier of cleaning products (5.3) consultant (2.3)	Offices/other public buildings (83.2); schools/other places of learning (74.8); Window cleaning (55.0)

Data are presented as %.

* Supervisor/other include holders and facility managers.

† Where consultants are given as trainers and includes the organization the enterprise is a member of.

‡ Size is according to the reported number of workers.

M > W, more men than women; OM, only men; OW, only women; W > M, more women than men; W = M, equal number of men and women.

Table 4
Overview of high and of low ranking priorities by enterprises including the associated dominant age and sex groups

Size of enterprise*	$\sum S_{R3}$	No. of enterprises with highest priority ranking of category 3 elements					No. of enterprises with lowest priority ranking of category 3 elements				
		Health Hazard	Handling chemicals	Properties	Safety data sheet	*n* (%)	Health hazard	Handling chemicals	Properties	Safety data sheet	*n* (%)
1–5	24	0	3	1	1	5 (18.5)	0	0	0	2	2 (7.4)
6–10	25	6	3	0	0	9 (16.4)	0	0	1	2	3 (5.5)
11–50	22	14	17	3	2	36 (19.9)	1	1	0	7	9 (5.0)
51–100	22	3	3	1	1	8 (25.0)	1	2	1	0	4 (12.5)
>100	25	0	1	0	1	2 (7.4)	1	1	0	0	2 (7.4)
Total		23	27	5	5	60 (18.6)	3	4	2	11	20 (6.2)
Age-group (y)		36–45	>45	>45	36–45		36–45	>45	36–45	36–45	
Gender group		OW	OW	OW	W > M		OW	OW	OW/W > M	OW	

* Size is according to the reported number of workers.
OW, only women; W > M, more women than men.

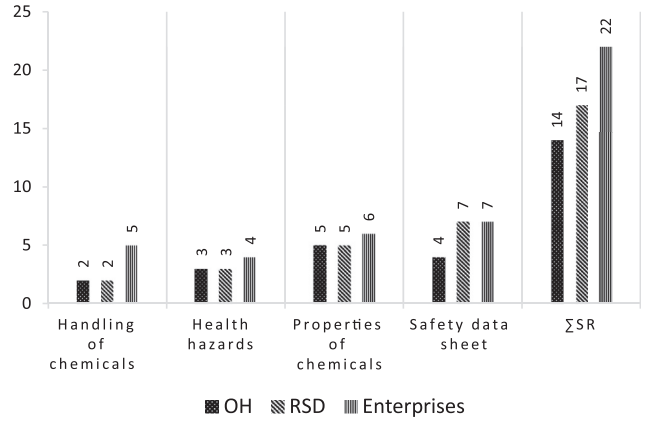

Fig. 1. Comparison of average ranking of category 3 elements by occupational hygienists, regional safety delegates, and enterprises, and their respective ΣS_R values where low rankings indicate high priority. OH, occupational hygienists; RSD, regional safety delegates.

the RI gives the relative risk level for exposure based on organizational paradigms. These two conceptual measurements ought not to be construed as measurements of level of exposure to chemicals, but should be viewed as methods for qualitative assessment of the risk of exposure cleaners may be subjected to in the said companies. Determination of the extent of exposure would require a more elaborate mapping of the determinants of exposure, cleaners working patterns, and the use of exposure measurement or modeling data which is beyond the scope of this study.

As seen from the results, in most of the enterprises, experienced workers train other workers, while supervisors/owner of the enterprises or facility managers train employees in only a few cases. The number of supervisors/owners or facility managers training the workers decreases as the size of the enterprise increases (Table 3).

Table 5
Comparison of risk indices of the different-sized groups; the lower the index the lower the risk level. ΣS_{R3} and conceptual level of importance also shown

Size of enterprise*	RIR.i (mode alternatives)	Risk level	ΣS_{R3}/CLI
1–5	1.11	Medium	24/medium
6–10	0.89	Medium	25/medium
11–50	1.00	Medium	22/medium
51–100	1.00	Medium	22/medium
>100	1.00	Medium	25/medium

* Size is according to the reported number of workers.
CLI, conceptual level of importance.

The relative higher number of supervisors training others in the 1–5 group is explained by the fact that owners of these do all the administrative work themselves and take the responsibility of the training. With the assumption made when deriving RI, inference from the results would be that training on chemical hazards has a particularly minimum effect because training is by workers themselves during task performance. This negatively impacts on the effectiveness of the training.

Despite the assertion of language proficiency in 84.1% cases, many had difficulties in understanding Norwegian or English. This shows disparity between what employers acknowledge as the level of their employees' language competence and what it actually is. The low language proficiency thus compounds the non-effectiveness of the training. Since Norwegian is the working language for the majority of the enterprises, it is correct to presume that workers' training is conducted in Norwegian as long as the workers understand some Norwegian. The experienced employees, most of whom are themselves of other ethnic backgrounds, may themselves have difficulties in communicating chemical health hazards due to their own low language proficiency. This and the lack of other necessary competences and the organization of the training, further diminishes the suitability and effectuality of the training as a measure in countering risk of exposure to chemicals. Questions can also be raised on whether those tasked with the responsibility of training others are assigned specified work hours for this purpose, and how much time is spent conducting the trainings. There is no assurance on quality and adequacy of the training, and whether the priorities of the employers regarding the importance of chemical health hazards are met. Moreover, both the labels of the chemicals and the safety data sheets required are supplied in Norwegian. It is consequently inconceivable that cleaning workers would have prerequisites for safe handling of chemicals any more than what an individual cleaner would have picked up with acquired experience.

Table 6
Distribution of Norwegian language proficiency among the different size enterprises

Size of Enterprise*	All speak well	Majority speak well	Few speak well	None speak Norwegian
1–5	8 (29.6)	15 (55.6)	1 (3.7)	3 (11.1)
6–10	22 (40.0)	27 (49.1)	4 (7.3)	2 (3.6)
11–50	26 (14.4)	127 (70.2)	16 (8.8)	12 (6.6)
51–100	2 (7.4)	18 (66.7)	4 (14.8)	3 (11.1)
>100	2 (6.3)	24 (75.0)	6 (18.8)	0 (0)
Total	60 (18.6)	211 (65.5)	31 (9.6)	20 (6.2)

Data are presented as *n* (%).
* Size is according to the reported number of workers.

Workers' training is a management prerogative, and to the management high production would be the more desirable actuality. Distinctly, job performance and work ethics, parameters essential in achieving a high-level production, had better overall ranking among the different enterprises groups than chemical health hazards. Reports show that cleaning workers are overwhelmed with work and do not have time for proper training [13]. One enterprise indicated that workers training could take place more than once during the employment period, and that different people conduct the training at different times. But this isolated case is an exception, not the rule.

Workers' training is an important form of workplace risk communication. For effective training, a trainer needs to have pedagogic competence in addition to a well-thought of training methodology [7]. Awareness of hazards and knowledge of risk reduction measures improves with a training program that includes written information, person-person training, or workshops [15]. Additionally, effective communication on risk to health requires familiarity with the risk discourse and awareness of the unapparent challenges [16]. Considerations such as trainees' risk perception and influences that would affect those perceptions [17], the personalities of the trainees, cognitive inclining, and trust [18], are important factors. Furthermore, motivation, the content of the training, and the ability to transfer skills from the training to actual work are other factors that might limit work safety performance in a work situation [19]. All these elements are implausible to fulfill when workers conduct the training during task performance. Enehaug et al [20] reported that in a limited survey on psychosocial work environment, 33% of participants declared improved working environment in view of training and work adaptation. The need for adaptation can be extended to chemical health hazards. Adaptation and training include written information, person–person training, or workshops, and need to be anchored in management strategies and prerogatives. This would make a foundation for attaining improved competence among the workers, and, hence, a reduction of risk. However, due to owner/manager roles in the small enterprises [21] and other enterprises where management is not involved in training, such adaptations become elusive.

The enterprises had an overall medium level of importance of the chemical hazard (cat.3) elements. The low priority given to the cat.3 elements indicates enterprises' low focus on chemical health hazards. The significant correlation coefficients between the enterprises groups confirm the common trend in the sector. For the enterprises' owners, survival of the enterprise is more important than promoting health of workers, thus higher priority of job performance and work ethics across the groups.

In formulating the RI model, cleaning tasks as determinants of exposure to chemicals [22] and risk of exposure to chemicals as related to the function of the cleaning location [17,23], were the basis for assigning scores to the different tasks. Cleaning tasks in hospitals/nursing homes and industrial cleaning are considered most hazardous due to the nature of the work and the type and amounts of chemicals used (Sc = 5). Strong chemicals are also used for eateries and in other places in the food industry [8]. However, schools, offices, and shops would be the places where a minimum of chemicals are used.

The RI values obtained show similarity between enterprises of different sizes, as all had a medium risk level. However, the smallest enterprises (1–5) are on the higher side of the RI spectrum, with RI = 1.11, i.e., highest risk. The 6–10 group showed a slightly lower risk level with RI = 0.89, while the remaining groups had, similarly, RI = 1.00. Earlier supposition of better safety performance by the largest enterprises with more resources than their smaller counterparts has, thus, been disproved. This similarity in risk level of all the enterprises despite size and task performed is a good indication that there is a general need to improve the safety paradigms in the cleaning sector. Microsize enterprises, i.e., 1–10 employees [24], were purposely split into two subgroups (1–5 and 6–10). This was in order to separately consider the lower and upper ends of the group. These subgroups gave different RI values and sex profiles. The medium-sized enterprises were split in a similar fashion, and the RI values were similar for the upper and lower ends.

A possible limitation of this study would be the use of the RI model, in that it does not take into consideration the frequency and duration of the use of chemicals. However, this is not problematic as the ability to handle chemicals safely as an outcome of good and well organized training reduces the significance frequency and duration of use.

The number of the operating cleaning enterprises is larger than the group in this study. A considerable number of enterprises had status of their approval application either as "under consideration" or "deficient", and others "withdrawn." The response rate is considered significant as experiences by NLIA inspectors show that many of the owners of cleaning enterprises also double as cleaners and minimum time is allocated for administrative purposes. Earlier studies of the sector had also reported low response rates [25] and a 17.7% response was considered within reasonable expectation. Besides, 59% of enterprises tasked with the cleaning of buildings as registered in the national enterprise register are without any employees [25], thus, rendering training requirement irrelevant in these enterprises.

Since the study group was approved enterprises considered to be "serious enterprises", the results give a picture of the situation of this group. These enterprises can be viewed as the valid standards to measure the cleaning sector by. The "not serious enterprises", most of which are probably not even approved, would be expected to have much lower standards than the serious enterprises.

For the smaller enterprises, the owner/manager role is important in the implementation of systematic occupational health and safety measures [20]. This role, together with their limited resources, could explain their low contribution in this study.

The training offered to cleaning workers in the cleaning sector lacks the prerequisites to facilitate for a suitable and effective design that can counter the risk of chemical health hazards. There is an apparent dereliction of duty by management of enterprises in assigning training tasks to their experienced workers. This inadequacy in the facilitation of effective training programs affects mostly women aged $\geq$ 36 years. With a general lack of competence among the trainers and relatively lower priority given to chemicals health hazards, workers' understanding of the risks and prevention of exposure to the chemicals in the sector remains an uphill task. In the reduction of the risk of chemical health hazards based on the studied paradigms, no significant differentiation across the sector was observed.

Chemical health hazards, being a major reason for occupational disability and employees' turnover in the sector, needs to be given more attention. Much lower CLI and RI values would be more ideal for the sector considering the large amounts of hazardous chemicals used. Instituting an acceptable level of competence on chemical health hazards among cleaning workers attainable without the arduous and costly certification, could be a suitable model for the sector. This is more likely to be achieved through continuous in-service workers' training and adaptation. A closer follow-up by authorities to ensure the attainment of the competence level would be a positive way forward.

Conflicts of interest

All authors have no conflicts of interest to declare.

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