

# Are material safety data sheets (MSDS) useful in the diagnosis and management of occupational contact dermatitis?

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**Objectives:** This study assesses both the success of medical practitioners in accessing hazardous substances' information from product manufacturers and the accuracy and clinical usefulness of Material Safety Data Sheets (MSDS) presented by workers with suspected occupational contact dermatitis (OCD).

**Patients/Methods:** 100 consecutively presented MSDS were collected from 42 workers attending an occupational dermatology clinic. Product manufacturers were contacted to verify ingredients. MSDS were evaluated for compliance with the Australian criteria for listing of OCD relevant information (sensitizers present at a concentration  $\geq 1\%$ , irritants present at a concentration  $\geq 20\%$ ), and for clinical usefulness. All sensitizers were checked for clinical relevance to the worker's dermatitis.

**Results:** Manufacturers supplied product constituents for 77/100 MSDS. 58 MSDS satisfied the Australian standard. 57/58 MSDS were deemed clinically useful. Irritants were listed for 19/23 MSDS and sensitizers were listed for 30/68 MSDS ( $P = 0.001$ ). 3 MSDS contained sensitizers, which were clinically relevant to the presenting worker's dermatitis, 1 appropriately listed, 1 present at  $\geq 1\%$  but not listed, and 1 present at  $< 1\%$  in the product and therefore, not required to be listed.

**Conclusions:** Sensitizers are frequently omitted from MSDS and clinicians are often unsuccessful in obtaining crucial information from manufacturers. MSDS are inadequate for the protection and diagnosis of workers with suspected OCD.

**Key words:** allergic contact dermatitis; globally harmonized system; hand dermatitis; hazardous substances; irritants; patch testing; sensitizers; worker. © Blackwell Munksgaard, 2007.

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## Background

Effective communication regarding hazardous substances is fundamental for the adequate protection of human health and the environment. Hazard communication legislation has been passed in many industrialized countries, which has been designed to inform employers, workers, and the community (1). Legislation generally consists of criteria for the classification of hazard, the provision of communication tools such as Material Safety Data Sheets (MSDS) and appropriate labelling and placarding. The importance of international consistency with information provision

has been recognized through the development of the Globally Harmonized System for the Classification and Labelling of Chemicals (GHS) (2, 3). With the advent of the GHS, under which a combined system of Safety Data Sheets (SDS) and labelling will supersede the MSDS, it is timely to consider how the model of information delivery operates and its effectiveness across all stages of the hazard communication pathway.

Both MSDS and SDS describe the properties of a substance and provide information on safe use and handling from the manufacturer/supplier through to the employer and the employee. Most

hazardous substances' legislation in industrialized countries requires that employers obtain MSDS for hazardous substances to be used in the workplace and that these are made available to all employees (1, 4). According to the Australian *Approved criteria for classifying hazardous substances*, sensitizers present at a concentration  $\geq 1\%$  weight per water (% w/w) and irritants present at a concentration  $\geq 20\%$  w/w must be listed on an MSDS and identified with the designated risk phrases, R43 'may cause sensitization by skin contact' or R38 'irritating to the skin' (5). At present in Australia it is not a legal requirement for MSDS to list sensitizers present in a substance at less than 1%.

Most previous studies of hazard communication and MSDS examine readability (6, 7), uptake by workers (8, 9) or accuracy of reporting of specified health effects information (10–17). Pearson (8) reports an Australian study where 12 building sites of various sizes were surveyed regarding use of hazardous substances. The study team found that for 90%, of 80 products audited, MSDS were not available in the workplace and that the majority of MSDS were available only on the larger sites. The study concluded that there was little knowledge of the chemicals used on the construction sites, nor was there any information relating to basic issues such as worker training in the use of hazardous substances or the correct use of personal protective equipment (PPE).

Frazier (18) assessed the quality of health information regarding asthma on a random sample of 61 MSDS for toluene diisocyanate (TDI) from 30 manufacturers. The study team audited MSDS, abstracting data onto a standardized audit form. 1 MSDS for TDI from each manufacturer was randomly chosen for inclusion in the analysis.

Asthma was listed as a potential health effect by only 15 of the 30 manufacturers. Allergic or sensitizing respiratory reactions were listed by 21 manufacturers. Another study undertaken by Kolp assessed 150 MSDS and only 37% were found to have accurate health effects data (13).

Our study looks at the use of MSDS as an aid for the diagnosis and management of workers with suspected occupational contact dermatitis (OCD) in an occupational dermatology clinic in the state of Victoria, Australia. Under the implied policy logic of hazard communication, as illustrated in Fig. 1, correct and comprehensible information about hazardous substances is provided by the manufacturer/supplier of the product. This information is supplied through the medium of SDS/MSDS as well as by other components such as product labelling. Information is read by employers/management and according to Victorian state legislative requirements, hazardous substances should be substituted by the least harmful products available (19). If substitution options are not feasible, appropriate safe work systems should be established including enclosed systems to reduce exposure, training for workers, and as a least preferred option, adequate PPE should be supplied. Under Victorian state legislation (19) employers are required to consult with workplace Health and Safety Representatives about any new products to be used in the workplace, which may affect health and safety. Management is also required to have a register of hazardous substances where details of substances used, including all MSDS, are kept. As Fig. 1 illustrates, theoretically all of these processes lead to safe systems of work, decreased workplace exposure and decreased occupational injury, and disease.

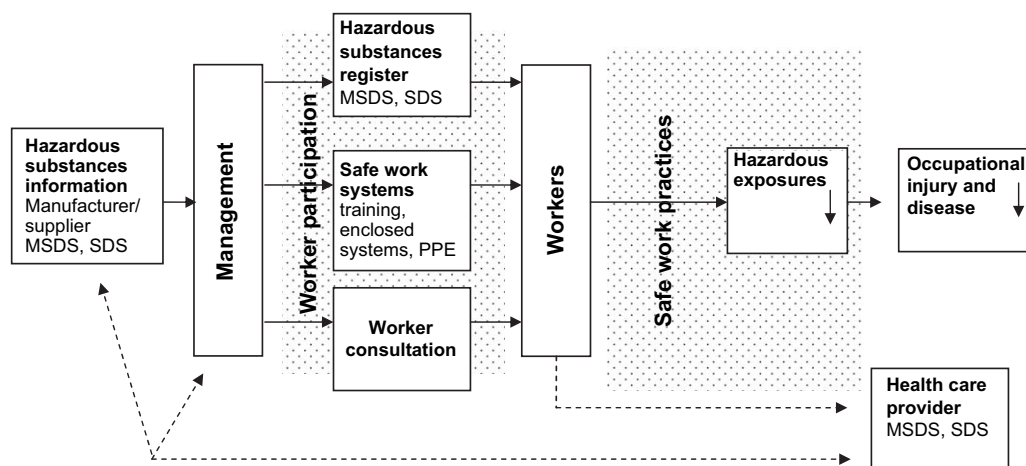


Fig. 1. Implied policy logic of hazard communication. MSDS, Material Safety Data Sheets; PPE, personal protective equipment; SDS, Safety Data Sheets.

Another important component of the hazard communication system is the flow of information from manufacturers to health care providers of potentially exposed workers (Fig. 1). Australian occupational health and safety (OH&S) legislation requires that all ingredients of a substance must be disclosed at the request of a treating medical practitioner (20). This information is used both in the ascertainment of a clinical diagnosis and for the management of affected workers. If the MSDS provides accurate ingredient listing and information on health effects which can be accessed by a medical practitioner, a worker with an illness related to exposure to a hazardous substance, can be diagnosed, receive adequate care and compensation, and make a successful return to the workforce.

This study assesses the success of specialist medical practitioners in accessing information regarding the hazardous constituents of substances used in workplaces. In addition, MSDS compliance with Australian legal requirements and the clinical usefulness of MSDS with respect to the reporting of skin sensitizers and skin irritants is examined.

### Methods

The setting for the study was the tertiary referral occupational dermatology clinic, which services the state of Victoria, Australia. At the time of making their initial appointment, workers attending the clinic are requested to bring along available MSDS for all substances to which they come into contact as part of their usual work. After thorough assessment with patch testing, if an allergic reaction is either found or suspected, a clinician contacts the manufacturers of the substance and requests verification of listed ingredients, as well as details of unlisted ingredients. If requested by the manufacturer, the relevant section of the Victorian OH&S (Hazardous Substances) Regulation detailing the requirement to disclose all ingredients is provided in writing (20).

For the purposes of this study, the same clinician (H. S.) using a standard protocol, contacted the manufacturer of each of the substances for which an MSDS was provided. The clinician requested verification of ingredients, including the names and %w/w of unlisted sensitizers and irritants for products with risk phrases or partial risk phrases. At least 3 attempts were made by the clinician to request verification information for each of the MSDS provided. If the manufacturer failed to provide this information after 3 requests, the MSDS was classified as 'not verified'. Information provided on the MSDS and the success of the clinician in obtaining this information was analysed for 100

different consecutively presented MSDS. Patients who presented the MSDS attended the clinic between April and August 2002.

De Groot's *Patch Testing: Test Concentrations and Vehicles for 3700 Chemicals* (21) was used as the gold standard listing of sensitizers. Ingredients on the MSDS and provided from manufacturer follow-up were checked against De Groot's lists of sensitizers. Irritants were classified from reference to standard contact dermatitis textbooks and personal experience of the attending specialist occupational dermatologist (R. N.). Dermal sensitizers or dermal irritants were identified from the MSDS ingredients and each ingredient was checked for % w/w. MSDS were audited for compliance with the Australian *Approved criteria for classifying hazardous substances* (22) with respect to the listing of ingredients recognized as skin irritants and skin sensitizers and with the reporting of health effects caused by exposure to these ingredients.

All positive patch tests to sensitizers were checked for clinical relevance to the presenting worker's dermatitis. All workers were tested to our extended European standard series (Chemotechnique Diagnostics<sup>®</sup>, Malmo, Sweden), as well as other relevant patch test series and the workers' own samples appropriately diluted. Patch tests were applied using Finn chambers<sup>®</sup> on Scanpor<sup>®</sup> tape (Epitest, Tuusula, Finland).

### Results

100 consecutively provided different MSDS were collected from 42 workers attending the clinic. The clinician who contacted the manufacturer was provided with details of product ingredients and %w/w for 77/100 MSDS. Table 1 lists the details of the MSDS. On gold standard assessment of the ingredient information provided, 58/100 MSDS clearly met the Australian Approved Criteria for the listing of hazardous substances (5). This included 3 MSDS, which contained sensitizers

Table 1. Accuracy of sensitizers and irritants listed on MSDS according to the Australian Approved Criteria

|                           | Total MSDS | Total verified by the manufacturer | MSDS compliant with the Australian Approved Criteria |
|---------------------------|------------|------------------------------------|------------------------------------------------------|
| ≥1% sensitizers           | 68         | 46                                 | 30                                                   |
| <1% sensitizers           | 3          | 3                                  | 3                                                    |
| ≥20% irritant             | 23         | 22                                 | 19                                                   |
| Severe irritant/<br>burns | 4          | 4                                  | 4                                                    |
| Non-harmful               | 2          | 2                                  | 2                                                    |
| Total (%)                 | 100        | 77                                 | 58 (58%)                                             |

MSDS, Material Safety Data Sheets.

at <1%. Although not required by the Australian standard, 2 of these sensitizers (benzotriazole and sodium dichromate) were listed as ingredients on the MSDS. The remaining sensitizer methyl-dibromoglutaronitrile (MDG) was unlisted and only discovered as a result of disclosure after approaching the manufacturer. Irritants were specified correctly for 19/23 MSDS, whereas correct specification of sensitizers was significantly less probable 30/68 MSDS ( $P = 0.001$ ).

Table 2 lists the inaccurate MSDS, both verified and not verified by the manufacturer on clinician follow-up. Names of sensitizers and irritants and/or appropriate R43 and R38 risk phrases were missing from 42 MSDS. The sensitizers, which were most commonly unlisted or not identified as sensitizers in MSDS with verified ingredients were epoxy resin (4), chromate (4), and propylene glycol (4). 38 other sensitizers were also unlisted and/or not identified, with 12 MSDS having more than 1 unlisted sensitizer. Of the MSDS not verified, 10 had the R43 risk phrase 'May cause sensitization by skin contact' but did not list names of sensitizer(s) or provide any additional information. 12 other MSDS had a variation of the R43 such as 'may cause allergic dermatitis' or 'contains skin sensitizer', without any additional information. 1 MSDS had the R38 risk phrase 'Irritating to the skin' without any additional information.

3 of the 42 workers had clinically relevant patch test reactions to sensitizers listed in their MSDS. 1 sensitizer (formaldehyde) was appropriately listed and labelled. Information regarding the 2 other relevant sensitizers was volunteered by the manufacturers when contacted by the clinician. 1 sensitizer (sodium sulfite) was not listed nor did the MSDS have an R43 risk phrase. For the

remaining sensitizer methyl-dibromoglutaronitrile (MDG) the manufacturer specified that the sensitizer was present in the product at less than 1% and therefore, did not require listing or a risk phrase under current Australian legislation.

## Discussion

This study provides information about how MSDS are actually used by clinicians when diagnosing occupational dermatitis in Australia. Because of the unique context of the study we were able to observe *in vivo* how the accuracy of an MSDS might be associated with ascertaining the diagnosis of a worker's contact dermatitis. The study audited MSDS with respect to compliance with Australian legal requirements and with the provision of useful clinical information; it also tested the success of hazard communication between manufacturers and clinicians.

Only 58% of the MSDS audited in the study complied with the level of hazardous substances information required by the Australian Approved Criteria (5). This represents a poor level of accuracy from the manufacturers responsible for the preparation of MSDS. Irritants were specified correctly significantly more often than sensitizers. Although 58% of MSDS met Australian legal requirements for reporting sensitizers, it is uncertain, given Australian sensitizer percentage thresholds, if they provided adequate clinical information regarding potential sensitizing ingredients. The GHS recommendation for products that contain skin sensitizers at a concentration of  $\geq 0.1\%$  are for the product to be classified as containing a skin sensitizer, for the product to have a SDS and for the product to be labelled as containing a skin sensitizer, with the appropriate GHS symbol, signal word, and hazard statement (Table 3.4.1 page 155 and Table 3.4.2 page 156, *Globally Harmonized System of Classification and Labelling of Chemicals*) (2). However, this recommendation contrasts with the current Australian guidelines which require only skin sensitizers present in a substance at  $\geq 1\%$  to be classified. Our study provides an example where a sensitizer at less than 1% was clinically relevant to a worker's dermatitis. The sensitizer methyl-dibromoglutaronitrile (MDG), was only discovered when the clinician followed up ingredients with the manufacturer. Although the MSDS met Australian legal requirements, it did not provide sufficient detail for diagnosis or management of the worker's dermatitis. This presents an argument for reducing the Australian threshold for listing to be consistent with the GHS ( $\geq 0.1\%$ ). Thus, only 57% of the

Table 2. Inaccuracies of sensitizer and irritant listings on MSDS according to the Australian Approved Criteria

|                                                              | N inaccurate MSDS |
|--------------------------------------------------------------|-------------------|
| Verified by manufacturer                                     |                   |
| Missing R43 $\geq 1\%$ <sup>a</sup>                          | 2 <sup>a</sup>    |
| Missing R38 $> 20\%$                                         | 1                 |
| Unlisted sensitizer(s) $\geq 1\%$ <sup>a</sup>               | 15 <sup>a</sup>   |
| Unlisted irritant $\geq 20\%$                                | 2                 |
| Subtotal verified <sup>a</sup>                               | 19 <sup>a</sup>   |
| Verification unavailable from manufacturer                   |                   |
| Unlisted sensitizer(s) % not listed and details not supplied | 22                |
| Unlisted irritant % not listed and details not supplied      | 1                 |
| Subtotal verification unavailable                            | 23                |

MSDS, Material Safety Data Sheets.

<sup>a</sup>Verified subtotal does not equal 19 because 1 MSDS had a missing risk phrase in addition to an unlisted sensitizer.

MSDS presented in this study provided sufficient information for the diagnosis and management of workers' dermatitis.

The study also provided data regarding the transfer of information between product manufacturers and clinicians. As depicted in Fig. 1, an important component of the Australian hazard communication system is the exchange of information between manufacturers and clinicians. This can take place along 2 distinct pathways. Along 1 pathway a worker accesses an MSDS in the workplace and brings it to their health care practitioner. Unfortunately, collection of information regarding the accessibility of MSDS by workers in the workplace was outside the scope of this study. However, Pearson's 1995 Australian study reported that up to 90% of products found in workplaces in the construction industry did not have associated MSDS available for workers (8). The success of this pathway is also dependent on the accuracy and clinical usefulness of MSDS information. Along the second pathway the clinician contacts the manufacturer of a substance, which is suspected to be involved in a worker's dermatitis and directly seeks information. As reported in our study, even though repeated requests were made of manufacturers and a copy was provided of the relevant legislation, which requires full product disclosure at the request of a treating clinician, information was forthcoming from only 77% of the manufacturers contacted.

The study has some limitations. The sample is based on data from an Australian tertiary referral occupational dermatology clinic and as such may have restricted applicability to other situations. Another limitation is that the only audited MSDS information was in relation to substances, which could potentially cause OCD. There may be other inaccurate information on the MSDS related to agents potentially causing cancer, adverse reproductive consequences, asthma etc. This is possibly reflected in the slightly increased level of MSDS accuracy in this study compared with other studies which reported between 37% and 50% of MSDS supply accurate health information (11, 13, 23).

A surprising finding from the study was that only 3 sensitizers relevant to occupational allergic contact dermatitis were listed in MSDS from 42 workers. However, some occupational groups with high rates of dermatitis such as nurses, hairdressers, and food handlers almost never bring MSDS to the clinic.

MSDS were first developed as a policy response to the 'right-to-know' legislation in the USA (6) and Canada (24), European hazard classification regulations (1), and the hazardous substances regulations in Australia (25). When the hazard com-

munication model operates effectively it not only provides information for disease prevention, diagnosis and management, it also enables a two-way flow of information, with clinicians able to report back to workplaces and product manufacturers thereby 'closing the loop' (Fig. 1). Feedback from clinicians to workplaces regarding hazardous substances can lead to primary prevention through substitution in the workplace. Similarly manufacturers need to be aware that inaccurate MSDS can have harmful effects on the health of workers, as only 58% of the MSDS audited in our study complied with the Australian Approved Criteria. Accurate and accessible MSDS can be used by both management and workers for exposure reduction and by clinicians for recognition of work-related disease, exposure surveillance and notification activity. The success of the hazard communication system depends upon 2 factors, the quality of the information available regarding hazardous substances and the effectiveness of communicating this information to managers, workers, and health care providers.

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