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Original article

Respirable Silica Dust Exposure of Migrant Workers Informing Regulatory Intervention in Engineered Stone Fabrication

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ABSTRACT

Background: Silicosis among workers who fabricate engineered stone products in micro or small-sized enterprises (MSEs) was reported from several countries. Workplace exposure data of these workers at high risk of exposure to respirable crystalline silica (RCS) dust are limited.
Methods: We surveyed workers performing cutting, shaping and polishing tasks at 6 engineered stone fabricating MSEs in Sydney, Australia prior to regulatory intervention. Personal exposure to airborne RCS dust in 34 workers was measured, work practices were observed using a checklist and worker demography recorded.
Results: Personal respirable dust measurements showed exposures above the Australian workplace exposure standard (WES) of 0.1 mg/m^3 TWA-8 hours for RCS in 85% of workers who performed dry tasks and amongst 71% using water-fed tools. Dust exposure controls were inadequate with ineffective ventilation and inappropriate respiratory protection. All 34 workers sampled were identified as overseas-born migrants, mostly from three linguistic groups.
Conclusions: Workplace exposure data from this survey showed that workers in engineered stone fabricating MSEs were exposed to RCS dust levels which may be associated with a high risk of developing silicosis. The survey findings were useful to inform a comprehensive regulatory intervention program involving diverse hazard communication tools and enforcing improved exposure controls. We conclude that modest occupational hygiene surveys in MSEs, with attention to workers' demographic factors can influence the effectiveness of intervention programs. Occupational health practitioners should address these potential determinants of hazardous exposures in their workplace surveys to prevent illness such as silicosis in vulnerable workers.

1. Introduction

Silicosis caused by exposure to respirable crystalline silica (RCS) dust is the oldest known occupational lung disease [1]. It kills thousands of workers every year globally, especially in India, China, and South Africa [2] but for many years silicosis was considered [3] less common in industrialised countries where, with other occupational pneumoconiosis, were likely to reduce in future years.

In 2017, sentinel cases of accelerated silicosis among engineered stone fabricators were reported in major capital cities in Australia [4,5]. Later, cases were reported from Beijing [6] and Shanghai [7] in China and in several states in USA [8]. Silicosis cases amongst engineered stone workers were first reported from Spain [9] and Israel [10], source countries of major engineered stone brands.

Engineered stone, an artificial agglomerate of crushed fine quartz silica and resins, became the fastest growing countertop material worldwide with Australia projected as the second largest consumer behind the USA [11].

The engineered stone fabrication industry in Australia consists predominantly of micro or small-sized enterprises (MSEs) with a high number of workers born overseas. There is limited workplace data on workers' exposure to respirable crystalline silica (RCS) in this industry, with only relative exposure intensity, that is subjectively estimated from job task analysis data, available as a surrogate

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[12]. Lack of real workplace information exacerbates the challenges to implement preventive measures in these MSEs.

We report on workplace exposure monitoring and work practices survey conducted at 6 MSEs in metropolitan Sydney by SafeWork NSW, the state Work Health and Safety (WHS) regulator in New South Wales (NSW), Australia. The aim of this study was to assess the personal exposures to RCS of engineered stone workers and identify workplace factors in MSEs that can inform regulatory action to prevent unsafe exposures. The application of the survey findings in developing an intervention program is described and implications of this approach in preventing occupational illness among vulnerable workers in MSEs are discussed.

2. Materials and methods

An occupational hygiene survey, involving measurement of workers' personal exposure to airborne RCS and gathering information on their work practices and demography was conducted at 6 randomly selected engineered stone fabricating enterprises in metropolitan Sydney. This survey, originally planned as part of an exploratory study of silica exposures in NSW State, was initiated in May 2017 after respiratory physicians reported on the initial cases of accelerated silicosis in this industry to health ministers in the three major States of Australia. All the workplaces surveyed were in the western region of metropolitan Sydney and selected randomly, being the first six engineered stone fabricating sites identified from a public listing.

2.1. Workplaces

All 6 workplaces (WP1—WP6) fabricated kitchen bench tops and bathroom vanities using engineered (manufactured) stone slabs supplied by one or more of 5 main importers. The slabs were initially cut to size using bridge saws with dust-suppressing water attachments. The cut stone was then fabricated for sinks and taps openings and other design requirements. Automated, water-fed computer numerical controlled (CNC) machines with routers or water jets (WP 2 only) and hand-held power tools (grinders) without on-tool dust extraction attachments were used. The product was finished dry with powered hand tools or with water-fed, pneumatic handheld polishers.

A checklist 'Workplace Visit Tool', based on an original developed by the Hygiene Team at Worksafe Victoria (the state WHS Regulator in Victoria, Australia), was used to record workplace details, work processes (wet and dry work), control measures and other factors related to the stone fabrication work (copy provided in Appendix I).

2.2. Workers and their tasks

Thirty-four workers were sampled at the 6 workplaces over a full work shift period of approximately 6 hours. These workers had specific roles and predominantly performed a single fabrication task. Three exposure groups (EG1—EG3) were identified from their fabrication tasks.

(1) **Wet cutting (EG1):** Machine operators who cut the stone slabs initially with a bridge saw or with water jet or cut openings for sinks etc with computer numeric controlled (CNC) routers
(2) **Dry finishing (EG2):** Shapers who prepared cut slabs for lamination or finished edges using hand-held dry power tools with diamond blades or grinders and used water spray bottles or sponges for wetting
(3) **Wet finishing (EG3):** Polishers who used water-fed pneumatic hand tools with resin discs or larger wet polishing machines

2.3. Worker demography

Length of work in current job, age and first language spoken by each worker were noted together with a description of their work practices during the hygiene sampling. This information was gathered to assist the regulator in developing suitable hazard communication and other intervention tools for an engineered stone fabrication industry program across the state of NSW.

2.4. Air sampling

Air monitoring for RCS was carried out as per the Australian Standard for measuring respirable dust (*AS 2985 — 2009 Workplace Atmospheres — Method for Sampling and Gravimetric Determination of Respirable Dust*, Standards Australia, 2009). Respirable dust samples were collected using battery-operated SKC Aircheck Model 224-PCXR8 sampling pumps (SKC Inc, Philadelphia, USA) drawing air at a flow rate of 2.2 liters per minute through a pre-weighed membrane filter. The 25 mm diameter PVC filters, held in a plastic cyclone 225-69 reusable sampling head (SKC Limited, Dorset, UK) for particle size selection, were mounted in the worker's breathing zone. The sampling pumps were calibrated pre- and post-sampling using a glass rotameter. Sealed filter cassettes (field blanks) were transported to/from each workplace with the samples.

2.5. Sample analysis

All samples were transported to a nationally accredited laboratory TestSafe Chemical Analysis Branch for gravimetric determination of respirable dust and analysis for crystalline silica. Filters were weighed with Australian Standard method AS 2985:2009 with a 6-digit balance XP-6 (Metter-Toledo, Greifensee, Switzerland). The limit of quantitation (LOQ) for respirable dust was 0.01 mg/filter. The amount of α-quartz and cristobalite types of crystalline silica in each sample was analysed by X-ray diffractometry (XRD) with international standard ISO 16258-1 Direct on-filter method using X'Pert PRO XRD machine (PANalytical B.V., Almelo, Netherlands). The LOQ for α-quartz was 0.010 mg/25 mm filter. The estimated uncertainty of measurement was reported at a confidence level of approximately 95%.

2.6. Data analysis

RCS exposure results of each worker were separated into the three similar exposure groups (EG1—EG3) identified in the stone fabrication process. A Box & Whiskers graph was plotted to show the variance of RCS exposure between dry and wet work tasks. The RCS content of each respirable dust sample was calculated per volume of air sampled (in milligrams per cubic meter). The results were adjusted with each worker's sampling time to compare with the Australian Workplace Exposure Standard (WES) for RCS of 0.1 mg/m^3 time weighted average (TWA) 8-hours.

The percentage of RCS in each respirable dust sample was calculated as RCS mass $\times$ 100/Respirable dust mass to identify the quartz silica content in the airborne workplace dust.

Table 1
Summary of the six workplaces sampled (WP1–WP6)

	Size*	Workers sampled ($n = 34$)	Work processes for stone fabrication	Dust exposure controls
WP 1	Micro	5	Wet bridge saw, Dry powered grinders, Water-fed pneumatic hand polishers	†LEV, Pedestal fans
WP 2	Medium	9	Wet bridge saw, Water jets, Wet CNC router, Dry powered grinders, Powered hand polishers	LEV, Pedestal and wall fans, Spray water bottles
WP 3	Small	7	Wet bridge saw, Wet CNC router, Automated wet polisher, Dry powered grinders, Water-fed pneumatic hand polishers	Pedestal and wall fans
WP 4	Micro	3	Wet bridge saw, Dry powered grinders, Powered hand polishers	Pedestal fans, Spray water bottles
WP 5	Micro	4	Wet bridge saw, Dry powered grinders, Powered dry hand polishers	Pedestal fans, Spray water bottles
WP 6	Small	6	Wet bridge saw, Dry powered hand tools, Powered dry hand polishers	Pedestal fans, Wet sponge, Booth with LEV

* Workplace size: Micro <10 workers; Small >10 and <25 workers; Medium >25 and <100 workers.
† LEV = Local Exhaust Ventilation.

3. Results

Workplace characteristics, stone fabrication processes and their dust exposure controls are summarised in Table 1 from Checklist data and recorded workplace observations.

Workers performing wet cutting used a bridge saw or a CNC machine, with continuous water supplied for dust suppression at all 6 workplaces. Workers who did finishing tasks used an automated wet polisher or water-fed pneumatic hand tools only at WP1 and WP3. Finishers at all other workplaces worked dry using powered hand tools with no wet methods for dust suppression, other than the crude water spray bottle or wet sponge.

All workers who were monitored performed stone fabrication tasks at their workplace during the day of sampling and did not attend any off-site installation work. The three exposure groups, with the tools used by each of them and specific dust exposure controls, including respiratory protective equipment (RPE) worn, are summarised in Table 2.

Personal exposures of 79% of the 34 workers sampled were above the then Australian Workplace Exposure Standard (WES) for RCS of 0.1 mg/m^3 TWA-8 hours (*Workplace Exposure Standards for Airborne Contaminants*. Safe Work Australia, 2018). The RCS levels in the respirable dust sample of each worker in the three exposure groups are shown in Fig. 1.

Results showed that workers performing dry finishing tasks (shaping and polishing) were exposed to RCS levels several magnitudes above the Australian WES of 0.1 mg/m^3 for RCS applicable at the time of the survey. Among them, those using hand-held power tools were exposed to levels more than 7 to 14 times above the WES.

Most Wet Finishing workers also had exposures above the WES but not as high as the Dry Finishing group. One worker who had very high RCS levels nearly 20 times the WES used a high-pressure water-fed pneumatic grinder. Some Wet Cutting bridge saw operators who were also exposed to RCS levels above the WES worked without the fencing or other protective safety barriers.

The content of crystalline silica in thirty of the 34 respirable dust samples exceeded 40% with many between 60% and 90%, as shown in Fig. 2. The RCS type was predominantly α-quartz with cristobalite present in only a few samples from WP1–WP3. Results are therefore presented as total RCS.

From information verbally provided by each worker, all 34 workers sampled were overseas-born migrants for whom English was not their first language. Informal noting of their first language for hazard communication purposes identified three distinct linguistic groups, Arabic, Chinese (Mandarin) and Vietnamese, as shown in Fig. 3. All workers were males and more than 50% of them were middle-aged between 35 and 50 years old, indicating possibly a longer period of employment in this industry.

The checklist verifications showed that sampled workers had not received nor seen any information or training regarding the health hazards of the dust that would be emitted when fabricating engineered stone. Prior to the hygiene survey, the workers overall were not aware of the adverse health effects of exposure to crystalline silica dust, including the serious health effects of silicosis. A safety data sheet (SDS) for engineered stone products used was evident in only one workplace.

Our survey noted that none of the six workplaces had ever undertaken air monitoring to assess workers' exposures to RCS dust. In addition, none of the workers surveyed had ever undergone health monitoring, involving chest x-rays and lung function tests for adverse health effects from exposure to crystalline silica.

4. Discussion

This occupational hygiene survey provided a useful "snapshot" of RCS exposures among a group of workers in metropolitan Sydney fabricating engineered stone into kitchen bench tops and other countertops. Workers performing dry work, without wet dust suppression or other dust minimisation methods, as well as some doing wet work with the stone, were exposed to RCS levels well above the then Australian WES of 0.1 g/m^3 TWA-8 hours.

Table 2
Summary of the three exposure groups sampled

Exposure Group (EG)	Workers ($n = 34$)	Tools used and dust controls	RPE worn
EG1 Wet Cutting	8	Bridge saw or CNC machine with water spray and safety fencing	Disposable mask or no RPE
EG2 Dry Finishing	6	Hand-held powered grinder or Diamond saw with no dust controls*	Disposable mask or Half-face with cartridge
EG3 Wet Finishing	20	Automated water-fed polisher or Water-fed pneumatic hand-held grinder	Disposable mask or Half-face with cartridge

* Included use of water sprayed from a bottle or wet sponge to dampen stone surface.

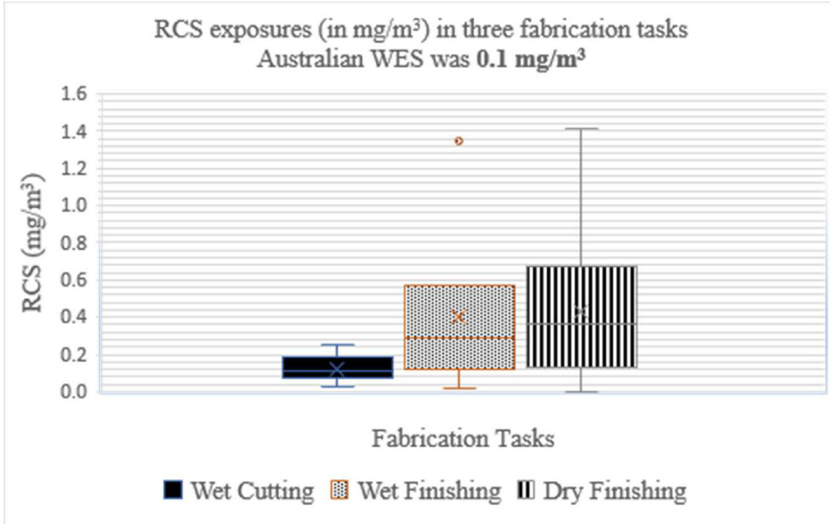

Fig. 1. RCS exposures of workers performing three stone fabrication tasks ($n = 34$).

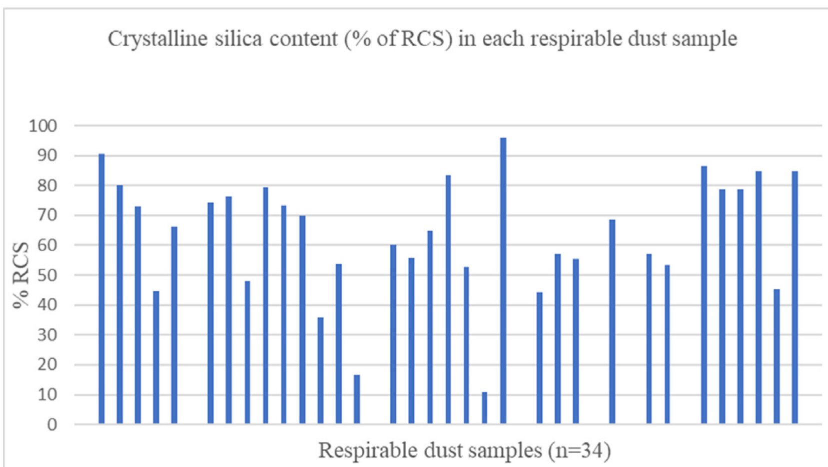

Fig. 2. Respirable crystalline silica (RCS) content (%) in each respirable dust sample.

Most workers performing wet cutting tasks involving bridge saw and CNC machines or shaping and finishing with automated polishers or hand-held water-fed pneumatic tools had lower RCS levels. However, a few wet work samples also showed high RCS levels above the WES. These were identified as workers who worked close to the contaminated airborne aerosols (water spray). They did not have, or overrode, safety fencing or other safety barriers such as sensor curtains during bridge saw or CNC operation. Most of these operators were also not using any form of respiratory protective equipment.

The Wet Finishing workers with RCS above the WES were those using water-fed pneumatic grinders and worked closer to the stone to check the fine finishing tasks. They worked on the stone placed on poorly designed work surfaces (such as non-adjustable metal frames or benches) that required them to work in awkward postures at close proximity to the fabricated stone.

There is a lack of workplace exposure surveys on engineered stone fabrication tasks, with few measurements reported on exposure to dry work tasks. Published Australian exposure data is based on estimates of relative exposure intensity to RCS using the proportion of time spent on different tasks [12]. There are no published workplace data in NSW State on RCS exposures of workers prior to regulatory intervention, which resulted in a ban on dry cutting tasks in this industry. The workers in each task group in this survey performed the same stone fabricating task on the sampling day and as solely fabricators, did so the whole working week. Despite limitations due to exposure variations, their exposure measurements can therefore be indicative of regular exposures for those occupations in this industry.

A short-term, task-based study of respirable dust exposures at a workplace in Minnesota, USA [13] found RCS levels among polishers who used water-fed pneumatic tools as high as 0.45 mg/m^3 which can be comparable to those reported here.

In our survey, there was a high content of airborne RCS in the respirable dust samples, as illustrated as a percentage in Fig. 2. A material safety data sheet (MSDS) for engineered stone that was

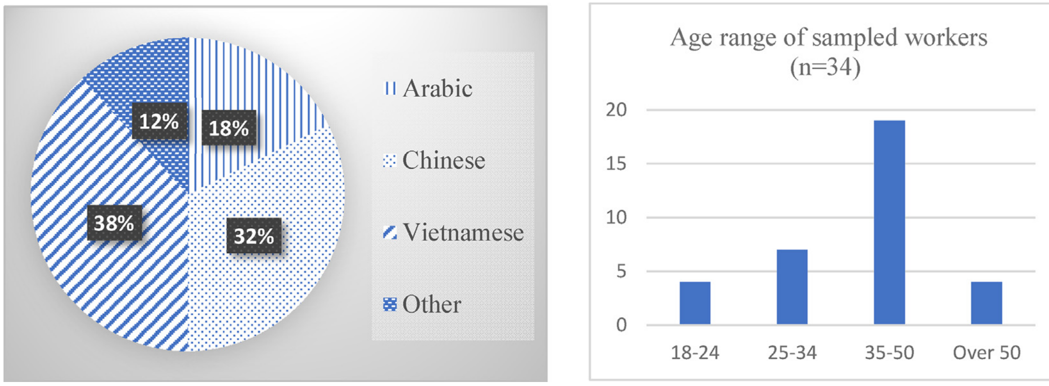

Fig. 3. First language spoken by the overseas-born workers and their age range (n = 34).

available at one workplace identified >60% crystalline-quartz silica content in the product [14]. This high RCS content in workers' dust samples can therefore be attributed to dust from the engineered stone, which they almost exclusively worked with.

All six workplaces surveyed relied on natural ventilation from open doors and from pedestal or wall fans to remove airborne dust in fabrication areas. Only two workplaces (WP1 and WP2) had any engineering controls but both local exhaust ventilation (LEV) systems were noted to be ineffective because they were not suitably designed for the work environment and had poorly maintained, overloaded filters.

Respiratory protection among this highly exposed group was inadequate and ineffective and thus exposed them to a high risk of adverse health effects on their lungs from RCS dust inhalation. Most workers who did Wet Cutting did not use any respiratory protective equipment (RPE), because it was not considered as 'dusty work' to wear RPE with its discomforts. The Finishing workers generally wore disposable dust masks or half-face respirators with filter cartridges, as their tasks generated highly visible airborne dust but none had been fit-tested for tight-fitting RPE. If not properly fitted, this RPE would not offer the necessary protection for workers from RCS levels that were several times greater than the WES. Therefore, fit-testing of RPE received much attention in the intervention program with high levels of enforcement.

MSEs typically account for about 90% of all businesses in many countries and contribute significantly to a nation's Gross Domestic Product but generally have poor quality jobs performed by less skilled, vulnerable workers [15]. There are more than 140 million international migrant workers globally, with many of them in what are recognised as '3D jobs' – dangerous, dirty, and demanding. The few studies that have investigated occupational injury and illness among immigrant populations indicate higher rates of morbidity and mortality among immigrant workers [16].

A disproportionately high number of silicosis cases reported in the engineered stone fabrication industry so far in some countries were recognised to be vulnerable migrant workers [6,10,17]. The RCS exposure results from this survey, and worker demographic data reported in Fig. 3 indicate that this may very likely be the trend across Australia.

Ahonen et al. [18] in a review of occupational health studies of migrant workers identified that very few investigations were published on hazard exposures of migrant workers. This lack of exposure data does not appear to have changed much since, largely due to the very limited access to occupational hygiene services in industries with predominantly MSEs where these workers mostly work. Lack of attention to, and failure of research to focus on occupational illness in workplaces with these vulnerable workers may also contribute to the dearth of exposure data.

The RCS exposure measurements in this survey were limited to a single shift of dust monitoring at six randomly selected workplaces in metropolitan Sydney. The fabrication process and work practices, as well as the size of workplaces and demography of the sampled workforce however, closely resembled the spectrum of over one hundred engineered stone fabrication facilities that operated at that time in the greater Sydney region [19].

Therefore, these findings could be applied to understand typical work practices and potentially, typical RCS exposures among most engineered stone fabricators prior to SafeWork NSW regulatory interventions across this industry. Such information will be useful to determine an association with previous high RCS exposures when investigating cases of silicosis in workers who had worked in the engineered stone industry.

Findings from this occupational hygiene survey were also valuable for the regulator in developing a program of interventions across the engineered stone fabrication industry in the State of NSW. This multi-pronged targeted compliance and stakeholder engagements program [20] included (a) fact sheets and audio-visual resources on the health hazards of crystalline silica, (b) local workshops targeted to MSE operators to promote practical exposure controls and (c) enforcement action to comply with regulatory requirements.

Inspector visits to 259 fabrication workplaces in NSW across two rounds of inspections indicated consistent implementation of engineering controls across the industry but challenges were faced with industry engagement [21]. Despite increased hazard awareness through targeted multilingual pathways, it appeared effective cross-cultural communication with the culturally & linguistically diverse industry remains critical to address ongoing compliance issues, in particular with health monitoring and respirator fit-testing.

Basic occupational health services such as hygiene surveys with air monitoring, health monitoring (surveillance) of at-risk workers and appropriate hazard communication resources were previously not accessible to the MSEs and their workers for whom these services are crucial.

More exposure monitoring of vulnerable workers in MSEs would undoubtedly be useful in recognising the distribution of occupational illness risks. Occupational hygienists should also give attention to demographic factors and other determinants of exposure in the surveyed worker populations that can lead to risks of occupational illness.

An editorial in the *Annals of Work Exposure and Hygiene* in 2020 called for a New Era for Occupational Hygiene to embrace the deep social inequities in the distribution of risk at work [23]. This required '… a recognition of the social context within which work and working conditions confers risk to specific groups of workers.'

MSEs fabricating engineered stone grew and expanded in metropolitan Sydney in response to high popular demand for stone kitchen bench tops. This was during a period of rapid growth in high-rise apartment construction and home renovations in the greater Sydney region. These MSEs employed a predominantly overseas-born workforce performing unsafe work practices and with no knowledge of RCS dust health risks including the serious lung disease silicosis. Our study showed that these vulnerable workers, whose first language was not English, were at high risk of silicosis due to the working conditions in a rapidly growing industry with poor WHS capabilities.

While workers in MSEs face higher risk for occupational diseases and fatalities, Hasle [22] noted that owner-managers lack the resources and knowledge on what action to take and are known to look to business peers and regulatory inspectors on what is required to be done.

Our occupational hygiene survey had recognised that although workers in this industry had significant risk of exposure to RCS over a long period, none of the sampled workers had undergone health monitoring.

Health monitoring (surveillance) for crystalline silica exposure, mandated under the WHS legislation in Australia was enforced by the intervention program and facilitated through a free (State subsidised) program to most of the industry workforce.

Occupational health professionals, WHS regulators and policy makers need to identify factors related to workplace capabilities and the socio-economic characteristics of the workforces and act upon them. As evident from this survey, these factors can impact the working conditions in MSEs and influence high risks to the health of their vulnerable workers.

This study of a random selection of MSEs in the engineered stone fabrication industry in metropolitan Sydney showed that uninformed vulnerable workers were exposed to high levels of RCS dust well above the Australian WES. By undertaking an occupational hygiene survey that gathered information on work processes as well as worker demography, we demonstrated that such a multifaceted survey can be a powerful tool to identify key criteria for targeted preventive programs.

We conclude that recognising the multiple factors that determine work-related health outcomes can help regulators design and tailor targeted intervention programs. Those with limited resources could apply this approach in developing programs in MSEs for exposure prevention and to assist early detection of occupational diseases such as silicosis in vulnerable working populations.

Disclaimer

The opinions expressed, and conclusions made are those of the authors.

Conflicts of interest

We declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary data Supplementary data to this article can be found online at https://doi.org/10.1016/j.shaw.2024.01.003.

References

[1] Parker J, Wagner GR. Silicosis in ILO Encyclopaedia of Occupational Safety and Health. Available from: www.iloencyclopaedia.org/part-i-47946/respiratory-system/10/silicosis.
[2] Chen S, Liu M, Xie F. Global and national burden and trends of mortality and disability-adjusted life years for silicosis, from 1990 to 2019: results from the Global Burden of Disease study 2019. BMC Pulm Med 2022;22:240.
[3] Australian Safety and Compensation Commission. Occupational Respiratory Disease in Australia; 2005. Canberra (Australia). 2005. ISBN 0 642 32701 7.
[4] Matar E, Frankel A, McCowan Blake LK, Silverstone E, Johnson AR, Yates DH. Complicated silicosis resulting from occupational exposure to engineered stone products. Med J Aust 2017;206(9):385–6.
[5] Hoy RF, Baird T, Hammerschlag G, Hart D, Johnson AR, King P, Putt M, Yates DH. Artificial stone-associated silicosis: a rapidly emerging occupational lung disease. Occup Environ Med 2017;0:1–3.
[6] Wu N, Xue C, Yu S, Ye Q. Artificial stone-associated silicosis in China: a prospective comparison with natural stone-associated silicosis. Respirology 2019:1–5. Original Article.
[7] Mao L, Zhou S, Chen Z, Shi J, Bian L, Jun W. Investigation of silicosis caused by agglomerated quartz stone processing. Respirology 2019;24(Suppl. 2):4–97.
[8] Rose C, Heinzerling A, Patel K, Sack C, Wolff J, Zell-Baran L, Weissman D, Hall E, Sooriash R, McCarthy RB, Bojes H, Korotzer B, Flattery J, Weinberg JL, Potocko J, Jones KD, Reeb-Whitaker CK, Reul NK, LaSee CR, Materna BL, Raghu G, Harrison R. Severe silicosis in engineered stone fabrication workers – California, Colorado, Texas and Washington, 2017-2019. MMWR 2019;68:38.
[9] Martínez C, Prieto A, García L, Quero A, González S, Casan P. Silicosis: a disease with an active present. Arch Bronconeumol 2010;46(2):97–100.
[10] Kramer MR, Blanc PD, Fireman E, Amital A, Guber A, Rhahman NA, Shitrit D. Artificial stone silicosis: disease resurgence among artificial stone workers. Chest 2012;142(2):419–24.
[11] Global Countertops Market report. Global demand for countertops projected to rise 2.3% annually through 2021 to nearly 500 million m^2. Reported in, www.Stone-Ideas.com 2017. [Accessed 15 January 2021]; 2017.
[12] Glass DC, Dimitriadis C, Hansen J, Hoy RF, Hore-Lacy F, Sim MR. Silica exposure estimates in artificial stone benchtop fabrication and adverse respiratory outcomes. Ann Work Expo Health 2021:1–9.
[13] Phillips ML, Johnson DL, Johnson AC. Determinants of respirable silica exposure in stone countertop fabrication: a preliminary study. J Occup Environ Hyg 2013;10(7):368–73.
[14] Caesarstone Australia Pty Ltd. Material safety data sheet. Product name Caesarstone; 2008.
[15] European Agency for Safety and Health at Work. Context and arrangements for occupational safety and health in micro and small enterprises in the EU-SESAME project; 2018.
[16] Schenker MB. A global perspective of migration and occupational health. Am J Ind Med 2010;53:329–37.
[17] Harrison R. Severe silicosis in engineered stone fabrication workers – US Perspectives. Berkley: Centre for Occupational and Environmental Health webinar, University of California; 2019.
[18] Ahonen EQ, Benavides FG, Benach J. Immigrant populations, work and health – a systematic literature review. Scand J Work Environ Health 2007;33(2):96–104.
[19] SafeWork NSW. Silica dashboard. Available at: https://www.nsw.gov.au/customer-service/publications-and-reports/silica-dashboard 2021. [Accessed 20 January 2021]; 2021.
[20] SafeWork NSW. Crystalline silica. Accessed at, https://www.safework.nsw.gov.au/hazards-a-z/hazardous-chemical/priority-chemicals/crystalline-silica.
[21] Kreitals N, Weller M, Nand A. Industry change in the NSW Manufactured Stone Benchtop Industry – SafeWork NSW's Compliance and Awareness program. In: Proc. AIOH 2021 Annual Conference, Sydney, Australia 2021.
[22] Hasle P. Between a Rock and a Hard Place – the small business dilemmas in the control of occupational health and safety. In: Keynote presentation at Understanding Small Enterprises (USE 2017) Symposium, Denver, Colorado, USA 2017.
[23] Seixas N. Editorial. A new era for occupational hygiene. Ann Work Expo Health 2020;64(9):913–4.