

BMJ Open Work-related injuries resulting in death in Chile: a cross-sectional study on 2014 and 2015 registries



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ABSTRACT

Objective To characterise work-related fatal events that occurred in Chile in 2014 and 2015 in workers covered by the Occupational Accidents and Professional Disease No 16.744 Act.

Design Cross-sectional on registries of the Chilean Worker's Health and Safety National Information System, specifically focusing on the Fatal Work Accidents Registry of the Social Security Superintendence.

Study population Secondary data analysis on all 815 cases of occupational injury-related deaths registered in 2014 and 2015 in Chile and that were accredited by the Social Security Superintendence up to March 2016.

Outcome measures Variables relating to employer, workers and the events were analysed.

Results The overall mortality rate for all injuries, both at work and during commuting, per 100 000 workers affiliated to the occupational social security system, was 7.2 for 2014 and 7.3 for 2015. For 2014, the highest mortality rates occurred in the transport and communications sectors (20.15) and the mining sector (18.17), while for 2015 the highest rates were found in the fishing industry (11.3) and in mining (12.1). Seventy-two per cent of cases occurred in small and medium-sized enterprises. Half of the companies that had work-related fatal injuries did not have a risk prevention department. Twenty-two per cent (121) of the companies had previous labour law infractions. The four activities most affected by workers' deaths in the two study years were freight land transport, engineering works under construction, minor works under construction and construction of complete buildings or parts of buildings. Half of all fatal injuries occurred in workers who had been employed for less than a year in their company.

Conclusions This descriptive study provides valuable insight into the current national registry on occupational deaths in Chile. While containing valuable information, the registry was not designed for epidemiological surveillance. Further efforts are needed to achieve a proper epidemiological integration of surveillance data.

INTRODUCTION

Each year, serious and fatal occupational injuries occur in Chile and globally. The International Labour Organization has stated that 2.78 million workers die each year from work-related injuries and illnesses.¹ The global economic impact has been estimated

Strengths and limitations of this study

- First and only study conducted in Chile on the national registry of work-related deaths.
- Mortality rates for fatal occupational injuries are provided, for the first time including deaths commuting to and from work.
- The registry is driven by administrative needs and was not designed for epidemiological surveillance.

to account for approximately 3.94% of global gross domestic product each year.² Governments and social security systems are responsible for preventing this human suffering that affects people during their productive life, the impact of which is carried over to families and loved ones.¹ The introductory session of the fifth World Congress on Occupational Safety and Health in 1999 underscored the need to improve policies and legislation, including the implementation of better recording and notification systems, among other important policy measures.³ Despite the impact on the health and lives of workers arising from preventable occupational hazards, Chile still has not ratified the 1981 No 155 Occupational Safety and Health Convention.⁴

In Chile, the 16.744 National Act on Work-related Accidents and Professional Diseases enacted on 1 February 1968 created the mandatory and universal occupational social security insurance system to provide healthcare and economic compensations to workers who suffer a work-related injury or who develop a professional disease, as well as to set up preventive programmes in the workplace. The system covers all employees, self-employed workers, students who are generating income for their institutions through their work and union leaders exercising their functions.⁵ The insurance is effective from the first day on the job and covers injuries that occur at the workplace and during commuting. The law defines a



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work-related injury as that caused directly or indirectly by workplace activities. Injuries arising from natural disasters are not covered by this social security scheme and instead must be dealt with by the national healthcare systems, either public or private. Military personnel and the armed forces are not covered as they have a separate system.⁶

The administration system is made up of one public entity and three private not-for-profit entities. All four entities are legally mandated to develop and implement programmes to prevent work-related hazards, and to provide health prevention services and treatment of occupational injuries and professional diseases. In 2014, there were 5 594 519 workers protected under the Act,⁷ while in 2015, the population of affiliated workers was 5 647 982.⁸ The World Bank reports that in 2017 Chile had a total labour force of roughly under 9 million,⁹ the difference being accounted for by informal jobs that are not covered by the worker's occupational safety insurance system. In 2013, the unprotected workforce was estimated at 28.7% of the total workforce.¹⁰

Chile lacks epidemiological studies on fatal work-related injuries, a prevalent problem in low/middle-income countries.¹¹ Policymakers and the entities that administer the occupational health and safety insurance scheme are legally mandated to develop preventive strategies to reduce the rates of mortality and disability arising from injuries in the workplace or commuting to and from work. To this effect, there is a need for studies that shed light on the intervening factors and to develop an evidence basis to inform preventive strategies. The purpose of this study, which was specifically commissioned by one of the occupational insurance entities, is to characterise fatal occupational injuries occurring in Chile in workers protected by the 16.744 Act, using the mandatory registration systems of the Social Security Superintendence for the period 2014 and 2015 as data source.

METHODS

Design

A cross-sectional study analysing secondary data from registries of the National Occupational Health and Safety Information System (SISESAT, *Sistema Nacional de Información de Seguridad y Salud en el Trabajo*) for 2014 and 2015 under the purview of the Social Security Superintendence.

Setting and participants

All injuries with a fatal outcome affecting workers and confirmed by the Superintendence of Social Security as work-related by 24 March 2016 were included for the 2 years covered by the study. Each worker insurance entity must classify injuries as occupational or not after conducting an administrative check that relies on different sources, including health authority enquiries, clinical records, witnesses, and so on. After this due diligence, the Superintendence officially confirms the occupational origin of fatal injuries.

Chilean legislation defines a work-related 'accident' (this is the term used in all of the Chilean official documents) in article No 5 of Act 16.744 as any injury that a person suffers caused by or in occasion of work, and that leads to disability or death.⁶ The Act furthermore states that injuries are also considered to be work related when they take place during commuting to and from the job, or commuting between two jobs even if the employers are different. In this case, the event will be linked to the employer where the worker was heading to. Any injury leading to disability or death that affects a union leader while in union activities and duties will also be categorised as work related. Self-inflicted injuries are not included.

In 2012, the Ministry of Health issued the first comprehensive technical report on the mandatory notification system for severe and fatal work-related injuries.¹⁰ Before that, there were numerous regulatory norms but no integrated surveillance system. The National Occupational Health and Safety Information System was then created and the first actual data that the system reports are from 2014.¹² The main purpose of this system is to systematically register serious and fatal work-related injuries in a timely fashion in order to understand and identify risk factors and to implement preventive measures and access to healthcare services.¹⁰ The specific objectives include some of the following regarding occupational injuries: to investigate the causes, to determine epidemiological profiles, to assess risk factors and vulnerable worker groups (types of jobs, economic sectors, industries and activities) and to inform prevention programmes and enforcement policies.

The surveillance system begins with the detection and mandatory notification of a case to the corresponding health authority. The health authority immediately opens an enquiry and an individual work-related 'accident' notification (DIAT, *Notificación Individual de Accidentes del Trabajo*) entry is created within 24 hours of the event. The DIAT entry is then inputted into the National Occupational Health and Safety Information System (SISESAT) in a special module on fatal outcomes called the Registry on Fatal Work-related 'Accidents' (RALF, *Registro de Accidentes Laborales Fatales*) within 15 days.¹³ The registry data used in this study correspond to the RALF module.

Data sources

After signing a legal agreement between the investigator and the Superintendence of Social Security, access to the data contained in the Fatal Work-related Accident Registry (RALF) for 2014 and 2015 was granted. The data were provided digitally in Excel spreadsheet. All case data were anonymised.

The raw database contained 134 variables. After an initial review, 89 were discarded for the following reasons: no data in the fields, repeated data already picked up in other variable fields, variables concerned solely with administrative follow-up that did not answer the study question and many missing data. The resulting database contained 46 variables for the analyses. Of these, fields

were cleaned and validated and secondary variables were obtained.

Contrary to initial expectation, the database that was provided did not contain all the information that the RALF module registers; notably, the text fields that describe the circumstances of the events and other qualitative information were not disclosed. Despite insistence, the authority did not grant access to any other descriptive data on fatal injuries.

Variables

Three variable domains that are included in the registry were used for the purpose of this study: variables concerning the companies where the fatal injury occurred, variables concerning the injured worker and variables concerning the event itself. Not all of the registry fields were included for characterisation as they did not contribute to answering the study question (eg, police officer involvement or presence of witnesses).

The companies are described in terms of number of workers, gender structure of the workforce, ownership (public or private), contracting status (main company, contractor, subcontractor, transient services), regulatory compliance with risk prevention departments (complies or not), health and safety programmes and worker-management joint committees (have or do not have), labour law infractions in the previous 3 years (present or absent), compliance with notification procedures on occupational hazards and internal rules and regulations on safety in accordance with the law (complies or not), including implementation of corrective measures after injuries (number of corrective measures implemented).

Worker-associated variables were demographic (age and sex), International Standard Classification of Occupations (ISCO) code, whether manual worker or office worker, worker's municipality of residence, type of occupation (employer, dependent, self-employed, non-remunerated family member, volunteer), type of remuneration (fixed salary, variable income, honoraria), date of first contract, duration of contract (indefinite, fixed term, per project, seasonal), nationality and healthcare insurance system (public or private).

The variables associated to the event were the following: severity of the injury (fatal, serious and other), police officer involvement, witnesses, whether the injury occurred while in the workplace or commuting, if the injury occurred in the worker's usual workstation, date of occurrence of the event, date of death and whether at the time of the injury the worker was involved in usual tasks or had been assigned to out-of-the-ordinary tasks.

The registry includes many fields for the purpose of administrative follow-up that were excluded from the analysis. No descriptive text fields were provided so this study was not able to include any kind of qualitative characterisation of the events leading to the fatal injuries. No toxicological tests are included in this registry, nor are they routinely performed during case enquiries in Chile.

Statistical analysis

Results are reported with descriptive statistics appropriate for each type of variable: frequency distribution tables and statistics calculations. For the statistical analyses Excel 2013 and STATA V.12 (StataCorp, Texas) were used. No imputations were performed on the database.

Ethics

The accredited ethics committee of the *Mutual de Seguridad* approved the study which was communicated by decision letter dated 19 August 2015.

Patient and public involvement

No patients or public were involved in this study.

RESULTS

The cases included in this study were 401 occupational fatalities for 2014 and 414 for 2015, totalling 815 cases for the 2 years comprised in this study. The rate of fatal injuries per 100 000 workers affiliated to the occupational social security system was calculated at 4.6 for 2014 and 4.4 for 2015, not including commuting injuries. This is also the rate that is officially reported by the statistical bulletins of the Social Security Superintendence. The overall mortality rate for all injuries, both at work and during commuting, per 100 000 workers affiliated to the occupational social security system, was 7.2 for 2014 and 7.3 for 2015.

Worker characteristics

Age is reported for 800 workers. The youngest was 17 at time of death, and the oldest was 85 years old. Median age was 43 and the IQR was 21. Ninety-two per cent of deaths occurred in men (751/815) and 8% (64/815) in women. Regarding nationality, the study found that 98% (798/813) were Chilean, while the remaining 2% were distributed between Argentina (1), Bolivia (4), Colombia (1), Ecuador (1), Peru (7) and Spain (1). Only 293 workers had data for the type of health insurance coverage. Of these, 84% (247) belonged to the public health insurance system and the rest to the private system. The registry also reports the remuneration system that the workers had at the time of their death: 87% (705/813) had fixed salaries, while 13% (108/813) had variable income. In the two study years, there were no fatal cases of freelance workers. **Table 1** summarises some of the primary characteristics of the fatal cases.

Sixty-three per cent (510) of work-related injuries resulting in death occurred in the workplace and 37% (305) occurred while commuting between home and work or between two jobs. In 64% (523) of the cases, the harmful event took place in the worker's usual workstation. Whether the worker was doing his usual tasks at the time of the fatal injury is also reported. On this item, 66% (368/813) of workers were doing their usual work.

The Superintendence of Social Security qualifies injuries as severe when they lead to death (fatal), when

Table 1 Sociodemographic and other characteristics of workers deceased from occupational injuries affiliated to the occupational health and safety social security system

Age group (years)	n=800	%
≤20	17	2
21–30	152	19
31–40	171	21
41–50	193	24
51–60	169	21
61–70	80	10
71–80	17	2
≥81	1	0
Gender	n=815	%
Female	64	8
Male	751	92
Nationality	n=813	%
Chilean	798	98
Peruvian	7	1
Other	8	1
Time with company (years)	n=737	%
<1	374	51
≥1 to <2	108	15
≥2 to <3	60	8
≥3 to <4	34	5
≥4 to <5	31	4
≥5 to <10	72	10
≥10	58	8
Day of the week of injury	n=815	%
Monday	146	18
Tuesday	131	16
Wednesday	140	17
Thursday	143	18
Friday	120	15
Saturday	89	11
Sunday	46	6
Commuting or at work	n=815	%
Commuting injury	305	37
Injury in the course of work	510	63
At usual workstation or not	n=813	%
Usual workstation	523	64
Not at usual workstation	290	36

resuscitation or rescue manoeuvres are performed, when there was a fall from height over 2 m, when an immediate amputation occurs, when the event involves such a number of workers that it affects the operation of the site, or when two or more workers are affected with a common origin and place. The variable 'severity of injury' contains

data on whether any of these conditions were met. Not all the injuries resulted in immediate death, but most did (65%, 528/813). A large category with 220 cases was classified as 'other' and no information was provided on the nature of the event and resulting harms.

The RALF module registers the municipality where the fatal event took place, the municipality of the worker's home address and the municipality where the company headquarters are located. Regarding where the injury occurred, 229 out of 346 municipalities register work-related fatalities. In all, 20 municipalities report a frequency of over 20 deaths in both years.

Concerning the type of contract that the workers had, 79% (642/813) had indefinite contracts, while 13% (102) had a fixed-term contract, 7% (57) had a contract for a specific job or task, and 1% (12) had a seasonal contract. The date and hour of death is also registered for the study years. In six cases, the date of death is reported as prior to the injury, which is a clerical error. Of 809 valid fields, the event that causes the worker's death occurs on the same date as death in 712 cases (88%). Of the remaining, death occurs between 1 and 225 days later.

From the registry, the study was also able to capture for how long the worker had been employed in the company before the fatal incident. Of the 815 cases, there are some that did not have any data associated or had clerical errors (eg, over 100 years). These errors appear in the 2014 registry but not in the 2015 one. Of the 737 cases that had valid data, 51% (374) had been employed in the company for less than 1 year.

The sectors with the greatest mortality rates are agriculture and fishing, mining, transport and construction. The Social Security Superintendence reported the activities differently for both years so it was not possible to aggregate the figures. The rates do not include fatalities during commuting. Table 2 shows the distribution of the deceased by industry per 100 000 workers.

Regarding the economic activity that the worker was involved in, the registry reports data according to the National Classification of Economic Activities issued by the Chilean Internal Revenue Service. This study found that there are 211 activities in which at least one worker died from a work-related injury. Data are captured for 798 cases out of 815. Of the 211 activities, 30 had two cases occurring in the two study years, and 110 activities had one deceased worker for this period. Consequently, there were 71 activities with three or more fatal cases (table 3).

The four activities that concentrate the greatest number of occupational deaths in the two study years were freight land transport, engineering works under construction, minor works under construction (contractors, masons, carpenters) and construction of complete buildings or parts of buildings. These four activities belong to two industries: transport (13.3%) and construction (17.5%). Together, they account for 31% of all of the cases of work-related fatal injuries in these 2 years. Workers of central government—includes the three branches of government but not the military or state

Table 2 Mortality rate of work-related injuries by industry, by year, not including injuries occurring during commuting. n=485

Year	Industry	Rate
2014	Agriculture and fishing	8.80
	Mining	18.17
	Manufacturing industry	3.75
	Electricity, gas and water	6.11
	Construction	7.97
	Retail	2.68
	Transport and communications	20.15
	Services	0.82
2015	Agriculture, livestock, hunting and forestry	7.9
	Fishing	11.3
	Exploitation of mines and quarries	12.1
	Manufacturing industries	3.6
	Power, gas and water utilities	0.0
	Construction	7.3
	Retail, vehicle repair and others	2.4
	Hotels and restaurants	2.9
	Transport, storage and communications	17.0
	Financial services	1.7
	Real estate, business and rental activities	3.7
	Public administration and defence	1.3
	Education	0.3
	Social and health services	0.9
	Other personal, social and community services	1.7

Adapted from the 2015 Statistical Bulletin of the Chilean Social Security Superintendence.

universities—also concentrated a high number of deaths: 15 in 2 years mostly during commuting.

Company characteristics

In Chile, companies are classified according to the number of workers. Accordingly, a microenterprise has one to nine workers, a small enterprise has between 10 and 49 workers, a medium-sized company has from 50 to 199 workers and a large company has over 200 workers. Of the 810 cases in which the RALF module provides the number of workers for the involved companies, the study found that 72% of the cases occurred in small and medium-sized enterprises and only 28% in large companies (table 4).

According to Chilean law, companies with over 100 employees must conduct preventive activities in the workplace and there should be a risk prevention department. The study found that 50% of the companies that should

Table 3 Distribution of cases by economic activity involving 10 or more fatal cases for 2014 and 2015, by injury occurring at work or during commuting. n=798

Economic activity	n	%	Work	Commuting
			%	%
Freight transport by road	106	13.3	89.6	10.4
Engineering works under construction	53	6.6	67.9	32.1
Minor works under construction (contractors, masons, carpenters)	49	6.1	67.3	32.7
Construction of complete buildings or parts of buildings	38	4.8	55.3	44.7
The rest of the other business activities npc	23	2.9	47.8	52.2
Urban transport via bus (public transportation)	15	1.9	86.7	13.3
Central government*	15	1.9	33.3	66.7
Site preparation, excavation and earthworks	13	1.6	53.8	46.2
Copper extraction	12	1.5	91.7	8.3
Other personal service activities npc	12	1.5	50.0	50.0
Cultivation of fruit trees in trees or shrubs with a life cycle greater than one season	12	1.5	33.3	66.7
Wholesale of other products	12	1.5	75.0	25.0

*Includes workers belonging to the three powers of government: judiciary, executive and legislative. Does not include military or state universities.

npc, not previously classified.

have a risk prevention department (278/555) did not have one at the time of the fatal injury.

The registry also reports on whether there was a joint committee on hygiene and safety where the event occurred. Joint committees are mandatory in companies with 15 or

Table 4 Distribution of cases by company size. n=810

Company size	n (%)
Large	233 (29)
Medium	143 (18)
Small	206 (25)
Micro	228 (28)

Table 5 Distribution of cases by occupation with 10 or more fatalities

Occupations according to ISCO	n
Elementary workers not elsewhere classified	168
Heavy truck and lorry drivers	73
Odd job persons	38
Security guards	22
Production clerks	18
Building frame and related trade workers not elsewhere classified	18
Bus and tram driver	14
Crop farm labourer	11
Subsistence crop farmers	11
Traditional chiefs and heads of village	11
Business services and administration managers not elsewhere classified	10

ISCO, International Standard Classification of Occupations.

more workers, are formed by representatives from the workers and from management, and are responsible for detecting and evaluating risks for injuries and professional diseases. In 31% of the companies that had a work-related injury resulting in death, there was a joint committee (174/555), 48% reported not having one (268/555) and 113 companies were not required by law to have one. In other words, of the 442 companies with registered data that must have a joint committee, 60% did not have one at the time of the event. The registry also shows that 24% (122) of the companies did not apply corrective measures after the incident and 23% (119) did. Most of the companies (89%) applied 10 or less corrective measures.

One of the registry fields reports on whether the employer had previously been fined for regulatory non-compliance. The results show that 22% (121/555) of companies had been previously fined. Similarly, 27% (148/555) of the employers did not report occupational hazards according to Chilean law, while 75% (419/555) of the companies had a compliant version of the internal hygiene and safety regulations manual.

Of the 815 cases for 2014 and 2015, a correct occupation was registered for 648 cases. However, 102 cases had to be excluded from the analysis as they all had the same ISCO code number (3141), which is clearly a clerical error. Furthermore, there are 65 cases in which no occupation was registered. Table 5 shows the 11 occupations that have 10 or more deceased workers during the study period. Heavy truck and lorry drivers account for an important number of deaths (73), as well as bus and tram drivers (14). Security guards are also exposed to high fatality rates, with 22 cases in the 2 years of the study.

DISCUSSION

This is the first study conducted in Chile using data from the national mandatory registry for occupational deaths

notified for 2014 and 2015 and reports overall occupational mortality rates for both years—on the job and commuting fatalities. The study characterises the cases using many variables contained in the national registry for occupational deaths, especially taking into account data on health and safety occupational national regulations, which have not been previously reported. This study found that nearly three out of every four fatal cases occur in small and medium-sized enterprises, that 63% of the cases occur on the job and not during commuting, and that little over a half of all fatal injuries occurred in workers who had been employed for less than a year in their company. The sectors with the greatest mortality rates are agriculture and fishing, mining, transport and construction. Importantly, most of the companies that had a fatal injury case during the two study years did not have a risk prevention department, did not have an occupational safety joint committee, and some had been previously fined, indicating an overall laxity with regard to regulatory compliance.

The RALF module became part of the national social security information system on work-related injuries and occupational exposures as an online registry only in 2011. It is now mandatory for the workers' health and safety organisations to immediately notify the occurrence of any kind of work-related injury leading to a fatal outcome.¹⁴ While the implementation of this policy is important, the system still has many shortcomings that hindered the analysis of the circumstances in which the fatal events occurred. Some of these shortcomings are incomplete data, different fields for the two study years, clerical errors, lack of comparability with databases used in other countries for occupational surveillance and many occupations registered with non-specific or incorrect codes, making further characterisation impossible.

Moreover, it was not possible to cross data with other national databases as only anonymised data were provided. Chile has a single identifying number for every person in the country, either foreign or national, but this information was not provided. Consequently, it was not possible to cross information with the health or labour agencies' inquiries on the fatal cases, both of which contain important qualitative detail. Other data sources that could have been included are death certificates, clinical records and histories, autopsy reports and toxicological analyses. The fact that Chile does not centralise this information limits the ability to ascertain if the workers had been exposed to psychotropic substances or other toxic elements before the event. Unfortunately, this type of investigation is not regularly conducted in Chile in the case of fatal work-related injuries.

The RALF module used in this study purportedly contains text fields that describe the mechanism of injury and other information on intervening circumstances. However, these fields were omitted from the database that was provided for the study and since registries are confidential, it was not possible to verify what the registry actually contains, and what could have been

useful for epidemiological analysis. In addition, the database contains several variables that do not specifically address the events, but are focused on the administrative follow-up of the cases. Some of these variables do shed light on the degree of compliance of companies with regulatory norms, which could be correlated with a greater (or lesser) injury rate.

However, for the purpose of extracting information from an existing registry in order to formulate hypotheses on factors associated with fatal events in the workplace, the present study provides valuable input on preventable risk factors, especially when considering management practices, workplace organisation, compliance with existing rules and regulations or other sociodemographic characteristics.

According to international studies that have estimated the frequency of work-related deaths, the incidence of fatal occupational injuries fluctuates between 0.8 and 21.9 per 100 000 workers.^{15–31} For Chile, one study reported a rate of 15.4/100 000 worker fatalities in 2003.²¹ According to the findings of the present study, Chile's mortality rate from work-related injuries, including commuting injuries, is 7.2/100 000 workers for 2014, and 7.3/100 000 workers for 2015. This rate is higher than that reported in other countries such as Germany (2.5/100 000; 2003) and Finland (2.1/100 000; 2003, not reported whether commuting injuries are excluded or not),²¹ or in Australia (1.9/100 000; 2009–2010, includes commuter fatalities).³² On the other hand, rates reported for countries similar to Chile are consistently higher, such as Argentina (14.9/100 000; 2003), Bolivia (19.6/100 000; 2003) or Brazil (16.1/100 000; 2003) according to the same study on global trends.²¹

The analysis of worker fatality from occupational injuries in Chile in 2014 and 2015 reveals that more workers die from incidents on the job than during commuting. This is consistent with a New South Wales, Australia, study that reported that for the 1989–1992 period, 78.3% of all fatalities were work-related versus 21.7% that occurred during commuting.³³ Another study from France for the 2002–2004 period reported that 44% of fatal injuries occurred while commuting to work.¹⁹

Several studies describe the frequency of work-related deaths according to economic sectors or activities. A study from California³⁴ reports that the economic activities with the greatest number of occupational deaths were the petroleum industry (51.4/100 000), followed by transport (23.6/100 000), government (21.5/100 000), agriculture (18.6/100 000) and construction (14.4/100 000). A study from Taiwan reports that the sectors with the greatest frequency of work-related fatalities were agriculture, forestry and fishing.²⁰ In the case of Chile, this study found that the industries that concentrated a larger number of fatalities were transport and communications (20.2/100 000), mining (18.2/100 000), agriculture and fishing (8.8/100 000), construction (8/100 000) and power/gas/water utilities (6.11/100 000).

The comparison of rates between countries is particularly difficult because each country reports differently.

Some countries include fatal injuries while commuting, or deaths from exposure to hazardous substances and other fatal conditions. Sadly, many countries do not even have national statistics on occupational fatalities.¹¹ There is consensus that proper inquiries into the causes of harmful events in the workplace is essential to obtain useful information to help prevent injuries from happening and that the enquiries often lack detail and depth in determining what caused the incidents, which must also include company management and organisation systems.³⁵ These observations are consistent with the findings of this study on the quality of the Chilean registry. The registries on work-related fatal injuries in Chile were set up to follow-up on the entitlements of workers and their families, but not necessarily to provide insight into the epidemiology of the problem.

There are very little data on the incidence of fatal occupational injuries in the informal sector, as under-reporting is a critical problem¹¹ even when these kinds of jobs are associated with a higher incidence of fatal outcomes compared with formal occupations.³⁶ Informal jobs are also related to lower training levels of its workers and reduced levels of enforcement of social security laws. Human development indicators also play out in how a country values and protects the health of its workers. Poor workers generally have lower educational levels and this will lead to employment in less qualified jobs, which in turn is associated with a higher risk of work-related injuries and professional diseases.³⁷

CONCLUSIONS

This study, while descriptive, provides valuable insight into the current national registry on occupational deaths in Chile. More specifically, some of the variables that are currently picked up from mandatory notifications of fatal occupational cases on working and employment conditions, and economic sectors and organisation characteristics, could be useful to establish associations with the occurrence of a fatal occupational injury. Those implicated variables should be analysed with regression models to estimate the strength of the association with fatal outcomes. To do so, we would need the complete work-related injury database, including those with and without fatal outcome. This approach could help develop a risk prediction model that would include factors that are strongly associated with serious and fatal injuries, thus also setting the basis for preventive policies geared towards monitoring more intensely those factors.

In order to better understand the circumstances associated with fatal outcomes from work-related injuries, we need to have integrated and internationally equivalent electronic records. Accurate and timely information must be collected from several perspectives, including the description of the mechanism that caused the injury and harm, autopsy records, toxicological exams and comprehensive data on the workers and the companies. Although Chile has made large inroads in improving

the lot of workers in recent decades, much still has to be done to achieve a proper epidemiological integration of the surveillance data needed to input into risk prediction models from a public health perspective.

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Competing interests VCB has conducted other research projects for the occupational safety and health authorities in the past 3 years on different aspects of worker health and safety.

Patient consent Not required.

Ethics approval Comité de Ética de la Mutua de Seguridad de la Cámara Chilena de la Construcción.

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