

A Review of Back Injury Cases Notified to the Ministry of Manpower from 2011 to 2012

Shiu Hong Wong, ¹*MBBS, MPH*, Kenneth KY Choy, ²*MBBS, MMed (Occ Med), FAMS*

Abstract

Introduction: In Singapore, the notification of workplace accidents and occupational diseases is a legal requirement under the Workplace Safety and Health (Incident Reporting) Regulations. This review is to identify back injury cases with physical work stresses and propose recommendations for preventive measures. **Materials and Methods:** Cases involving back injuries notified to the Ministry of Manpower (MOM) from 1 January 2011 to 31 December 2012 were reviewed. Using predefined criteria, cases with physical work stresses were identified and the associated variables analysed. **Results:** A total of 1124 notifications involving back injuries were received from 2011 to 2012; 579 cases (52%) were identified to have physical work stresses, of which 447 cases (77%) were males and 375 (64%) of them were between the ages of 21 to 40 years. The commonest physical work stresses were carrying (35%), awkward postures (22%) and lifting (20%). Majority of the cases came from the following sectors: construction (14%), accommodation and food services (12%), transport and storage (12%), manufacturing (10%) and wholesale and retail trade (10%). **Conclusion:** We identified the main physical work stresses in the back injury cases as carrying, awkward postures and lifting. The common industries involved were construction, accommodation and food services, and transport and storage sectors. This is useful for programmes aimed at reducing physical work stresses which can lead to improved work and health outcomes for our workers.

Ann Acad Med Singapore 2015;44:244-51

Key words: Notification, Physical work stresses, Singapore

Introduction

Work-related low back disorders consist of both low back pain (LBP) and low back injuries. They are a significant and increasing problem all over the world. Studies estimate that between 60% and 90% of people will suffer from low back disorders at some point in their life.¹ Among the working population, many of the factors causing LBP can be associated with the workplace. Worldwide, about 37% of LBP can be attributed to occupation.² In Singapore, over 80% of the adult population will suffer from back pain at some time or other in their lives.³ Apart from resulting morbidity, and in some cases, permanent disability, LBP also incurs high societal costs.⁴ Estimates of the total societal cost of LBP are in the range of 20 to 50 billion dollars in the United States and proportionately comparable amounts in Sweden and Canada.^{5,6}

Low back disorders include spinal disc problems such as hernias and spondylolisthesis, muscle and soft tissue injuries. On top of the physiological degenerative ageing process, epidemiological studies have shown that physical work stresses in the workplace can result in accelerated degenerative changes in the discs and other structures.⁷ The understanding of mechanical factors involved in disc degeneration is important for evaluating LBP aetiologies and implementing preventive measures.

The purpose of this review is to identify cases of LBP with underlying physical work stresses at the workplace. With knowledge of these risk factors, preventive measures can be recommended and implemented to reduce the occurrence of LBP among the working population.

In Singapore, the notification of workplace accidents and occupational diseases is a legal requirement under

¹Occupational Medicine Unit, Singapore General Hospital, Singapore

²Occupational Safety and Health Division, Ministry of Manpower, Singapore

Address for Correspondence: Dr Wong Shiu Hong, Occupational Medicine Unit, Singapore General Hospital, 226 Outram Road, Singapore 169039.

Email: joshuawong99@yahoo.com

Table 1. Internal Criteria for Physical Work Stresses

Inclusion Criteria to Determine if Case has Physical Work Stresses	Exclusion Criteria
1. No direct trauma involved	1. Accident type: collapse/failure of structures, exposure to extreme temperatures, fires and explosion, electrical current, falling from height, traffic accidents, slips and trips
2. Presence of one or more risk factors: - manual handling - lifting of heavy objects - frequent bending or twisting (back) - prolonged awkward postures (back) - whole body vibration	2. Nature of injury: bites and stings, burns, concussions, crushing, cuts and bruises

Table 2. Summary of Epidemiological Evidence with Risk Estimates (Attributable Fraction) of Associations with Work-related Factors Associated with LBDs Resulting in LBP⁶

Work-related Risk Factor	Attributable Fraction (%) Range
Manual material handling	11 – 66
Frequent bending and twisting	19 – 57
Heavy physical load	31 – 58
Static work posture	14 – 32
Repetitive movements	41
Whole body vibration	18 – 80

the Workplace Safety and Health (Incident Reporting) Regulations. All workplaces are covered under these Regulations and employers have to report work-related deaths, injuries, dangerous occurrences and occupational diseases to the Ministry of Manpower (MOM). As such, LBP due to injuries sustained by employees at work would be notified to MOM under the category of ‘Work Accidents’ (Appendix 1).

Materials and Methods

Cases involving back injuries notified to MOM from 1 January 2011 to 31 December 2012 were reviewed. To determine if a case has any underlying physical work stresses, an internal criteria was developed (Table 1) with reference from National Research Council’s list of work-related factors associated with lower back disorders resulting in LBP (Table 2).⁸

Based on the criteria, all back pain cases were divided into those that were non-traumatic and those that were trauma-related. For the non-traumatic cases, we then attempted to determine the underlying physical work stresses.

Figure 1 summarises the methodology involved. Presence of physical work stress/es is based on the description of the incident or accident, for example: “At about 3pm after

making a few trips of disposing the debris and loading the cement bags (about 5 to 6 bags) each at a time, suddenly I sprained my back when I was about to load heavy materials. I slowly tried to control my back and immediately informed my boss, who then told me to go to XXX Hospital”.

In this case, the physical work stresses was identified

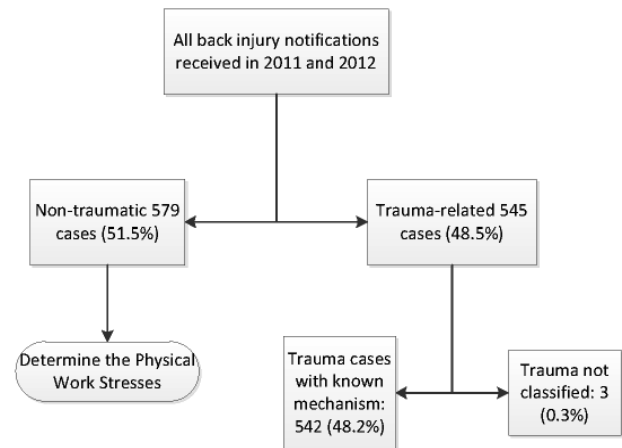


Fig. 1. Flowchart showing the methodology used to determine cases with underlying physical work stresses.

as handling heavy loads. Cases fulfilling the criteria were analysed for demographics and risk factors. Difference in median medical certificate (MC) days between back injuries due to physical work stresses and trauma cases was analysed using STATA data analysis and statistical software version 13 (StataCorp LP, Texas, USA).

Results

A total of 1124 back injury cases were notified to MOM from 2011 to 2012; 579 cases (52%) were identified to be 'non-trauma' and to have physical work stresses. Of these, 447 cases (77%) were males and 471 (87%) of them were between the ages of 21 to 40 years. The majority of the remaining 545 cases were deemed to have occurred as a result of accidents or of a nature not associated with physical work stresses. Among these, 3 cases did not have sufficient information and could not be classified (Table 3).

Among the cases fulfilling criteria, the commonest physical work stresses were carrying (35%), awkward postures (22%) and lifting (20%). Some cases had more than one physical work stress. For example, some cases had both frequent bending of the back and lifting of heavy loads. We were, however, not able to specify the physical work stresses for some of these cases due to limited information in the description. Given that the notification system allows the user to enter free text for the description of the incident, there were 72 cases (12%) classified as those with physical

work stresses because, firstly the presence of trauma were excluded by the investigating officers who reviewed the cases. Secondly, these cases had very brief descriptions about the incidents, e.g. "hurt his back during work" without giving additional details. Thus, the mechanism was deemed unspecified (Table 4).

Industries with the highest prevalence of back injuries due to physical work stresses were construction (14%), accommodation and food services (12%), transport and storage excluding logistics and transport (12%), manufacturing (10%) and wholesale and retail trade (10%). These categories are classifications of economic activities which have been standardised and published as the Singapore Standard Industrial Classification (SSIC) since 1958. The SSIC is used for censuses of population, household and establishment surveys and increasingly, in administrative databases. The SSIC adopts the basic framework and principles of the International Standard Industrial Classification of All Economic Activities (ISIC) developed by the United Nations Statistics Division. It is reviewed and updated regularly to reflect significant changes in the structure of the Singapore economy and the emergence of new activities as well as to align with changes in the international standard.

Occupations with the highest prevalence are construction workers (16%), airline cabin crew (7%), technician (5%), courier (3%) and cleaner (3%) (Table 5). The prevalence rate was obtained with reference to the 2012 statistics on Singapore's resident labour force published by MOM.⁹ The results are tabulated in Table 6.

Comparing Tables 5 and 6, there might be some discrepancies with regards to the high incidence of cases among construction workers in this dataset but the prevalence is actually relatively low among local residents. The report on Labour Force in Singapore, 2012 only covered private households and excluded workers living in construction worksites, dormitories and workers' quarters at

Table 3. Demographics of Cases Fulfilling Inclusion Criteria for Physical Work Stresses

Variables	No. of Cases in 2011	No. of Cases in 2012
Gender	262	317
Male	202 (77%)	245 (77%)
Female	60 (23%)	72 (23%)
Age		
≤20	0	3
21 – 30	94 (36%)	104 (33%)
31 – 40	68 (26%)	107 (33%)
41 – 50	69 (26%)	62 (20%)
51 – 60	20	35
≥61	8	6
Unknown	2	0
Nationality		
Singapore	NA	151 (48%)
Malaysia	NA	30 (9%)
Bangladesh	NA	65 (21%)
India	NA	16 (5%)
China	NA	20 (6%)
Others	NA	31 (10%)

NA: Not available

Table 4. Physical Work Stresses among Cases Fulfilling Criteria

Physical Work Stresses	Total
Manual handling	
Carrying	217 (35%)
Lifting	129 (21%)
Pulling	21 (3%)
Pushing	17 (3%)
Awkward postures	135 (22%)
Frequent bending/twisting	21 (3%)
Unspecified*	72 (12%)

*Some of the cases were deemed unspecified as the physical work stresses could not be determined with certainty from the description of the work activities.

Table 5. Ranking of Industries with Cases Fulfilling Criteria

Industry	n = 579
Construction	82 (14%)
Transport and storage excluding logistics and transport	72 (12%)
Manufacturing	71 (12%)
Wholesale and retail trade	59 (10%)
Accommodation and food services	56 (10%)
Administrative and support activities (excluding landscaping)	32 (6%)
Education	10 (2%)
Health activities	25 (4%)
Logistics and transport	16 (3%)
Real estate services	18 (3%)
Marine	21 (4%)
Others	117 (20%)
Top 5 Occupations	
Construction worker	79 (14%)
Air steward/stewardess	38 (7%)
Technician	32 (6%)
Courier	21 (4%)
Cleaner	17 (3%)

Table 6. Prevalence of Cases among the Top 5 Industries for 2012 (Residents)

Industry	No. of Cases (Residents)	Total Workforce (Residents, in Thousands)	Prevalence (Per 100,000)
Construction	3	104.5	2.87
Transport and storage	29*	189.5	15.3
Manufacturing	15	288.2	5.2
Wholesale and retail trade	26	306.3	8.49
Accommodation and food services	12	129.3	9.28

*These 29 cases exclude those working in the logistics and transport sectors.

the workplace and persons commuting from abroad to work in Singapore. Among the cases of construction workers, it is likely that the majority of them were foreign workers residing in dormitories and construction worksites.

The majority (56%) of cases were given medical leave between 0 to 7 days (Table 7). STATA data analysis and statistical software version 13 (StataCorp LP, Texas, USA) was used to analyse the median MC days between back injuries due to physical work stresses and trauma causes.

Table 7. Number of Days of Medical Leave among Cases Fulfilling Criteria

No. of MC Days	Total (579)
0 – 3	33 (6%)
4 – 7	281 (49%)
8 – 14	80 (14%)
15 – 30	96 (16%)
31 – 60	56 (10%)
61 – 90	16 (3%)
91 – 180	12 (2%)
>180	5 (<1%)
Average Length of MC in Days (Median)	
Male	17 (7)
Female	21 (7.5)

MC: Medical certificate

Table 8. Two-sample Mann Whitley U Test* on the Equality of Medians of MC Days

No. of MC Days	Physical Work Stresses (579)	Trauma/Others (542)
0 – 3	33 (6%)	134 (25%)
4 – 7	281 (49%)	151 (28%)
8 – 14	80 (14%)	74 (13%)
15 – 30	96 (16%)	85 (16%)
31 – 60	56 (10%)	63 (12%)
61 – 90	16 (3%)	17 (3%)
91 – 180	12 (2%)	13 (2%)
>180	5 (<1%)	5 (1%)

MC: Medical certificate

*Two-sample Mann-Whitney U test: $z = -0.392$; $\text{Prob} > z = 0.6953$.

Slightly more than half of cases for both groups had taken medical leave of 7 days duration or less. There appeared to be a need for longer duration of medical leave among cases with physical work stresses than the trauma group for those who had taken 7 days of medical leave or less. Using Mann-Whitley U test for 2 unmatched groups comparing their medians of MC days, we found that there was no statistical difference detected in the outcome (Table 8).

Discussion

This review gives us an estimate of the prevalence of work-related LBP with underlying physical work stresses among the working population. LBP has a substantial impact on workers and their employers in terms of loss of income and increased healthcare expenditures. There is a strong epidemiological evidence that physical demands of

work (manual materials handling, lifting, bending, twisting and whole body vibration) can be associated with increased incidence of back symptoms and back injuries.^{10,11}

Majority of the cases are male (78%) as it is more likely for employers to engage male workers for jobs that involve more physically demanding work. Conversely, female workers are more likely to be in jobs that are more sedentary and less physically demanding. Most of the workers are in the younger age groups. The average age for males is 36.8 years old and females 36.7 years old. The median age is the same for both genders at 35 years old.

The current study shows most common risk factors among these workers were carrying, awkward postures and lifting, which is in line with findings from the National Research Council. Studies conducted in the US and Europe showed that industries with the most cases are all associated with high physical demands and are similar to that observed in this analysis.^{12,13} With regards to the occupations, Leigh and Sheetz² conducted a national survey in the US measuring LBP among occupational groups. In their study, the category of 'operators' would apply for the 5 occupations listed in Table 5. The relative risk for LBP for this group of workers was 2.39 as compared to managers and professionals who were assigned with a relative risk of 1.0.

By identifying the industries and occupations with the most work-related back injuries due to physical work stresses, the next step is to review these workplaces and job scopes to see if these cases can be prevented. One example would be to introduce ergonomic programmes in these industries for companies and workers. Guidance can be provided for employers in doing risk assessments and implementing control measures to protect their workers. Employers should be encouraged to share good practices.

The temporary incapacity payout under the Work Injury Compensation Act covers medical leave wages and medical expenses. For cases that have permanent incapacity, a lump sum is also payable based on the extent of the incapacity determined by the doctor. With regards to the length of medical leave, most workers (54%) only required short durations of sick leave between 0 to 7 days. There were 23 out of 759 workers who did not require any medical leave. Generally for minor back injuries, studies by Andersson and Burton have shown that workers should be encouraged to continue to work or return to work within a few days or weeks, even if they still have symptoms because giving them longer medical leave than necessary may not help improve their symptoms.^{14,15} In practice, physicians should advise workers on the proper work postures and monitoring of backache symptoms during the recovery process. In order to make more meaningful analysis, it would be worthwhile to classify the diagnoses of the individuals and correlate that with the length of medical leave. A recent study by

Rainville et al has revealed variations in physician advice on return to work and that recommendations often reflect personal attitudes of the physicians and their perception of the seriousness of symptoms.¹⁶ Healthcare professionals treating workers with work-related back injuries should familiarise themselves with the workers' work environment and prescribe appropriate return-to-work advice, or even suspend them if the injury warrants it. Assisting workers to remain at work, or in early return to work, has proven to be the most effective means of minimising future symptoms, sickness absence and claims.^{17,18} At times, workers may require temporary work modifications or re-assignments, e.g. being excused from carrying heavy load while awaiting symptoms to improve and also to allow workers to regain confidence in their abilities. It might also be necessary to take the differences in physiques between the 2 genders into account during the design and layout of the work stations or processes, in other words, fitting the work to the worker.

A literature review undertaken by Peninsula Medical School in the United Kingdom (UK) found that early intervention for workers with lower back pain not only enabled them to return to work up to 5 weeks sooner than under normal care, but also helped to minimise recurrence of back pain in the following year by up to 40%.¹⁹ The 3 key principles for effective early intervention are:

1. Holistic care based on the biopsychosocial model. Biological refers to the disease or condition; psychological refers to the impact and perceived impact on mental health and well-being; and the social refers to broader determinants that can have a negative impact on health and well-being including work, home or family situation. This model integrates these components simultaneously.
2. Multidisciplinary teams. They can provide a range of services according to individual's needs. Some examples of successful interventions include exercise, cognitive behavioural therapy, organisational changes, educational input plus other ancillary resources to address housing and financial concerns, if necessary.
3. Case managers or social workers who can assist the individual navigate the system and facilitate communication between workers, employers and their clinicians.

Healthcare professionals should also be proactive in giving ergonomic advice to workers involved in physically demanding jobs. Opportunities for such advice to be given can happen during pre-employment screening or annual medical examination for certain industries dealing with known hazards. They are also in position to give feedback to employers, especially those with more workers suffering from LBP or back injuries due to physical work stresses at work. Healthcare professions like occupational medicine

specialists can assist employers by conducting workplace ergonomic assessments to give recommendations on improving workstation designs or perform task analysis to modify the tasks involved.

Work-related musculoskeletal disorders (WRMSDs), of which work-related LBP is a subset of, can affect workers across all industries. To highlight the significance of WRMSDs, back injury cases with ergonomic risks were included as occupational diseases into the Workplace Safety and Health Report, 2013, National Statistics report. This signals the importance to drive efforts to prevent WRMSDs at the workplace.²⁰

MOM and the Workplace Safety and Health Council (WSHC) have also launched a set of Workplace Safety and Health (WSH) guidelines on ergonomics 'Improving Ergonomics in the Workplace' to provide guidance on establishing and implementing an in-house ergonomics programme and developing good ergonomic practices in the workplace.²¹ In addition to the guidelines, employers and employees can also refer to the Approved Codes of Practice for Office Ergonomics and Manual Handling published by SPRING Singapore.

In addition, companies that wish to embark on work redesign to eliminate or reduce ergonomic risks can also apply for the relevant funding under WorkPro which is a scheme jointly developed by MOM and the Singapore Workforce Development Agency (WDA) to augment local manpower, foster progressive workplaces and strengthen the Singaporean core in our workforce.

Strengths and Limitations

This is the first review of the notifications of back injury cases to MOM. It has highlighted industries with higher prevalence and the associated occupations and job scopes that resulted in the workers' symptoms and injuries. However, there is likely to be under-notification of cases. We are also not able to extrapolate the data to estimate the prevalence of LBP or back injuries among our working population.

Given that the aetiology of LBP is so extensive, to assume that all back injury cases were directly associated with work can be imprudent. Even though there is strong evidence that physical demands of work are a risk factor for the onset of LBP and back injuries, there are studies to show that overall, the size of the effect is less than that of other constitutional, non-work-related and unknown factors.²² No data is available on non-work-related factors for this group of workers such as previous back injuries or underlying medical disorders.

The decision to determine whether a case has underlying

physical work stresses or not was based on the incident description provided by the informant. In order to minimise under-estimation, the inclusion criteria was set broadly to identify cases. For most of the cases, we can deduce the potential physical work stresses from the descriptions. For cases with limited information, the practical decision was to refer to similar job scopes and make reasonable assumptions. Some cases that were obviously non-traumatic had limited information about the mechanism of injury and the physical work stresses were deemed to be unspecific. Such cases accounted for 12% of all the cases meeting our criteria and are randomly distributed amongst different industries.

Conclusion

From the study, we have identified cases of LBP with physical work stresses which can help in the implementation of preventive measures. Both employers and employees should be familiar with their work processes and understand the hazards involved. Employers can apply the hierarchy of controls to minimise such injuries. When necessary, training can be provided for employees to educate them on manual handling techniques. In this era of workplace health promotion and prevention, everyone from healthcare professionals, employers to workers have to play their part to adopt safe work practices in order to prevent these injuries from happening. This will lead to improved productivity and savings for both employers and employees and better health outcomes for the employees.

REFERENCES

1. Andersson GB. Epidemiological features of chronic low-back pain. *Lancet* 1999;354:581-5.
2. Punnett L, Pruss-Ustun A, Nelson DI, Fingerhut MA, Leigh J, Tak S, et al. Estimating the global burden of low back pain attributable to combined occupational exposure. *Am J Ind Med* 2005;48:459-69.
3. National Health Survey 2010. Epidemiology and Disease Control Division, Ministry of Health; 2011.
4. Webster BS, Snook SH. The cost of 1989 workers' compensation low back pain claims. *Spine (Phila Pa 1976)* 1994;19:1111-6.
5. Nachemson AL. Newest knowledge of low back pain. A critical look. *Clin Orthop Relat Res* 1992;279:8-20.
6. Manga P, Angus DE, Papadopoulos C, Swan W. The Effectiveness and Cost-effectiveness of Chiropractic Management of Low-back Pain. Ottawa: Pran Magna and Associates; 1993.
7. Riihimäki H. Low-back pain, its origin and risk indicators. *Scand J Work Environ Health* 1991;17:81-90.
8. National Research Council (NRC). Musculoskeletal Disorders and the Workplace. Washington: National Academy of Science; 2001.
9. Labour Force in Singapore 2012. Ministry of Manpower 2012. Available at: <http://stats.mom.gov.sg/Pages/Labour-Force-in-Singapore-2012.aspx>. Accessed on 10 January 2015.

10. Ferguson SS, Marras WS. A literature review of low back disorder surveillance measures and risk factors. *Clin Biomech* 1997;12:211-66.
11. Bigos SJ, Wilson MR, Davis GE. Reliable science about avoiding low back problems at work. In: Wolter D, Seide K, editors. *Berufsbedingte Erkrankungen der Lendenwirbelsäule*. Hamburg: Springer-Verlag; 1998. p. 415-25.
12. Bevan S, Quadrello T, McGee R, Mahdon M, Vavrovsky A, Barham L. Fit for work? Musculoskeletal disorders in the European workforce. The Work Foundation; 2009. Available at: <http://www.fitforworkeurope.eu/Website-Documents/Fit%20for%20Work%20pan-European%20report.pdf>. Accessed on 8 January 2015.
13. Guo HR, Tanaka S, Halperin WE, Cameron LL. Back pain prevalence in US industry and estimates of lost workdays. *Am J Public Health* 1999;89:1029-35.
14. Andersson GBJ. The epidemiology of spinal disorders. In: Frymoyer JW, editor. *The Adult Spine: Principles and Practice*. Philadelphia: Lippincott-Raven; 1997. p. 83-141.
15. Burton AK, Main CJ. Relevance of biomechanics in occupational musculoskeletal disorders. In: Mayer TG, Gatchel RJ, Polatin PB, editors. *Occupational Musculoskeletal Disorders: Function, Outcomes and Evidence*. Philadelphia: Lippincott-Raven; 2000. p. 157-66.
16. Rainville J, Carlson N, Polatin P, Gatchel RJ, Indahl A. Exploration of physicians' recommendations for activities in chronic back pain. *Spine* 2000;25:2210-9.
17. Waddell G, Feder G, Lewis M. Systematic reviews of bed rest and advice to stay active for acute low back pain. *Br J Gen Pract* 1997;47:647-52.
18. Abenhaim L, Rossignol M, Valat JP, Nordin M, Avouac B, Blotman F, et al. The role of activity in the therapeutic management of back pain. Report of the International Paris Task Force on Back Pain. *Spine (Phila Pa 1976)* 2000;25:1S-33S.
19. Peninsula Medical School Report. Available at: www.workingforhealth.gov.uk. Accessed on 20 September 2013.
20. Workplace Safety and Health Report, 2013 National Statistics. Available at: www.wshc.sg/files/wshc/upload/cms/file/2014/WSH2013.pdf. Accessed on 14 January 2015.
21. Workplace Safety and Health Guidelines – Improving Ergonomics in the Workplace. Available at: www.wshc.sg/files/wshc/upload/cms/file/2014/WSH_Guidelines_ImprovingErgonomicsintheWorkplace.pdf. Accessed on 10 January 2015.
22. Dionne CE. Low back pain. In: Crombie IK, Croft PR, Linton SJ, LeRsche L, Von Korff M, editors. *Epidemiology of Pain*. Seattle: IASP Press; 1999. p. 283-97.

Appendix 1

Incident Reporting Requirements

Category	What Needs to Be Reported	Who to Report	Need to Notify Commissioner Immediately?	Need to Submit Report within 10 Days from Accident/Diagnosis of Disease?
Work accident	Employee was injured in accident and:	Employer		
	• Died, or		Yes	Yes
	• Hospitalised for at least 24 hours; or		No	Yes*
	• Given MC for more than 3 calendar days (consecutive or otherwise)		No	Yes,*within 10 days from the 4 th day of medical leave
Work accident	A member of public or self-employed contractor was injured and:	Workplace occupier		
	• Died, or		Yes	Yes
	• Sent to hospital for treatment		Yes	Yes

*If the employee subsequently dies from the injury, the employer must notify the Commissioner as soon as he knows of the death.