For information on
15 June 2021

# Legislative Council Panel on Manpower

## Study on Relationship between Workplace Deaths and Work Condition

## Purpose

This paper reports key findings of the Study on Relationship between Workplace Deaths and Work Condition undertaken by the Occupational Safety and Health Council, and the Labour Department's observations on the matter.

## Background

2. Like any other places in the world, there are cases of sudden death of workers at workplace in Hong Kong which is not caused by work accidents. Questions have been raised as to whether some of these sudden deaths are caused by "overexertion at work". "Overexertion at work" is not a medical diagnosis. The International Labour Organisation (ILO) has not drawn up any definition or guidelines on workplace deaths caused by "overexertion at work", nor are there any internationally recognized criteria in this regard. There is also no such definition in Hong Kong[1]. This notwithstanding, the Labour Department (LD) has undertaken to conduct a study to understand more about the characteristics and circumstances of sudden deaths at workplace in Hong Kong.

3. In October 2017, LD commissioned the Occupational Safety and Health Council (OSHC) to undertake the study. The study focused on notified workplace deaths[2] not arising from work-related accidents and caused by cardiovascular and cerebrovascular diseases (CCVDs) (hereafter referred to as "workplace CCVD deaths") which account for the majority of workplace sudden

---

[1] Under the Employees' Compensation Ordinance (ECO), the employer of an employee who suffers from a personal injury, including a disease such as cardiovascular and cerebrovascular disease, resulting in incapacitation or death by accident arising out of and in the course of the employment, shall be liable to pay compensation in accordance with the law.

[2] As notified by employers under the ECO.

deaths[3]. OSHC completed the field work in 2020 and finalized the study report in early 2021. LD has carefully studied the report findings. Key study findings and LD's observations are set out in this paper.

## Study Objective and Methodology

4. As a precursor to the study, OSHC conducted a comprehensive international literature review on the risk factors associated with CCVDs. OSHC observed that international research findings consistently suggest that the causes of CCVDs are multi-factorial, with various risk factors associated with both work and non-work related circumstances. In other words, both work and non-work factors can contribute to the onset and development of CCVDs. Work-related factors include working hours, work nature, work environment, stressors at work, etc., whereas non-work related factors mainly involve ageing, medical history, pre-existing medical conditions and lifestyle factors such as diet, body weight, physical activity as well as tobacco and alcohol use. In view of the multi-factorial nature of CCVDs, OSHC conducted the study based on a holistic approach, collecting information on both work-related and non-worked related factors that might be relevant to workplace CCVD deaths, with a view to assessing the possible relationship between work conditions and the workplace CCVD deaths.

5. LD referred a total of 200 workplace CCVD death cases to OSHC for the study. These cases were drawn from notifications of workplace death made to LD from September 2017 to November 2019 with consent for referral to OSHC secured from the concerned family members[4].

6. For each deceased worker, OSHC collected information relating to his/her work condition (including working hours, physical burden and mental stress associated with the work as well as work-related unusual events causing extreme psychological or physical overload) and personal risk factors (including age, gender, personal and family medical history, pre-existing medical conditions, lifestyle factors and non-work unusual event causing psychological or physical

---

[3] Most of the deaths notified by employers not caused by accidents were caused by CCVDs. In 2020, of 100 such workplace deaths notified to LD, 73 were caused by CCVDs. The rest were caused by a range of other illnesses or diseases like cancer, pneumonia, gastrointestinal tract bleeding, etc. In its literature review, OSHC observed that in different parts of the world, CCVDs are also the main cause of sudden workplace deaths.

[4] The 200 cases comprise 36, 96 and 68 cases of the workplace CCVD deaths that occurred in 2017 (notified in the last four months of the year), 2018 and 2019 respectively.

impact to the deceased). To do so, OSHC approached the deceased worker's close family member as well as employer and close co-worker of his/her last employment and interviewed them by using questionnaires covering all the mentioned work and non-work related factors. Participation in the study was voluntary. There were 26 cases (13%) where family members, employer representatives and co-workers of the deceased employees were all successfully interviewed. Either one or two of the target interviewees were successfully interviewed for the remaining cases, except for one[5].

7. The study is a descriptive observational one aimed to collect information on the characteristics of possible attributes to such deaths. It is not designed to assess causal relationship (if any) between workplace CCVD deaths and such possible attributes, nor to determine conclusively to what the extent the different attributes might have contributed to the studied deaths. To achieve this would require comprehensive medical input and the conduct of a case control study or a cohort study.

## Study Findings

8. The following sets out key findings of the study and OSHC's observations.

### General profile of the cases

9. Age of the cases studied ranged from 25 to 78 years old. More than half of them (56%) were between the age of 50 and 64. The median age is 56 years old. According to the World Health Organization (WHO), ageing is the most significant independent risk factor for CCVDs. Beyond the age of 55, the risk of stroke doubles every 10 years. The median age of the deceased in this study was higher than that of the city's general employees (56 years old vs. 43 years old).

10. The majority (90%) of them (181 cases) were male and 19 (10%) were female. Most of the cases were from the administrative and support service industries (26%) and the construction industry (25%). In terms of occupation, 42 were construction workers (21%) and 37 were security guards (18.5%), with the rest from a range of other occupations. Tables showing the general profile of the 200 cases are at Annex 1.

---

[5] No interview was conducted for one case as the employer declined the interview, the co-workers were unavailable and the deceased had no close family members in Hong Kong.

Work-related factors

11. OSHC analysed the work and non-work characteristics of all the cases. OSHC observed that a majority of the cases had multiple risk factors which could lead to an increased chance of developing CCVDs. The work-related factors identified include long working hours, work stress, shift/night work and physical workload. Non-work related risk factors identified include personal medical history, pre-existing medical condition, advanced age, unhealthy lifestyle (i.e. tobacco and alcohol use, physical inactivity, and unhealthy diet). OSHC considered the study results are consistent with the international research findings that workplace deaths caused by CCVDs are multi-factorial.

12. Of the 200 cases referred to OSHC for study, two-thirds (135 in total) did not present/were not reported with any work-related factors[6], including 116 cases which only presented personal CCVD risk factors like personal medical history, old age, weight problem, smoking etc. For the remaining one-third (65 cases in total), they were found to have both work-related and non-work related risk factors. In other words, none of the cases was found to have only work-related risk factors.

*Working hour*

13. The average daily working hours of the cases ranged from 6 to 12.9 hours in the week prior to death. Most of them worked 5 to 6 days per week and 22 to 26 days per month. Working hours of the cases varied across different industries and occupations. In terms of occupations, security guards in the study worked longer hours than cases in other occupations. While the working hours of the studied cases and those of the general Hong Kong working population are not strictly comparable, comparison analyses conducted by OSHC revealed that the median weekly working hours/daily and monthly average working hours of the cases in different industries/occupations were similar to those of general employees of the same industries/occupations.

14. As mentioned in paragraph 2 above, there is no medical nor internationally accepted definition of "overexertion at work". For the purpose of sorting out cases from the 200 referrals for in-depth analysis which might involve long working hours and thus might be perceived to be associated with "overexertion at work", OSHC made reference to the working hour levels

---

[6] The 135 cases include 17 cases the working hours of which were unknown.

mentioned in the relevant guidelines in Japan, Korea and Taiwan[7]. Referencing the working hour levels in these guidelines, the study identified a total of 44 cases (i.e. 22%) that would have been regarded as long working hours in Japan, Korea and Taiwan. Of these 44 cases, 29 had worked more than 276 hours in the month prior to death (294 hours on average). 42 of the 44 cases had worked more than 256 hours on average per month during any of the 2 to 6 months period before their death. Among these 44 employees, 22 were security guards, and 5 were construction workers with the rest from a range of other occupations.

15. Mirroring the guidelines in Japan, Korea and Taiwan, OSHC also looked into non-work and personal factors that could have caused these deaths in a holistic manner. The study revealed that all these 43 cases were reported to also present the following personal CCVD risk factors :-

(i) 20 cases had known history of chronic medical illness (such as hypertension, high cholesterol, heart diseases, diabetes, history of stroke, history of myocardial infarction, etc) which are known to be associated with high risk of CCVDs. Autopsy were conducted for 6 of the cases. 5 of them showed 70-100% occlusion of coronary arteries and the remaining one showed chronic pathological change of heart;

(ii) 19 had no known medical history but autopsy reports of 18 cases showed that they had severe atherosclerotic change[8] with 70% to 100% occlusion of major coronary arteries. The autopsy report of 1 case showed atherosclerotic change with 40–70% occlusion of major coronary arteries and chronic pathological change of the heart;

(iii) for the 5 cases without known medical history nor autopsy reports, 3 were obese, physically inactive, and aged 64, 70 and 77. Another case is a chronic smoker for 20 years and had a family history of diabetes.

---

[7] Japan, Korea and Taiwan are the very few jurisdictions that promulgate guidelines to assess "work-relatedness" of workplace CCVD deaths for compensation purpose. The key criteria are generally the same in Japan, Korea and Taiwan. Generally speaking, according to these guidelines, employees who work more than 276 hours in the month before death or more than 256 hours on average per month in the two or more consecutive months (up to six months) before death are considered to be working long hours. These guidelines require other work-related factors and personal factors to be looked at holistically to assess the work-relatedness of the deaths.

[8] Atherosclerotic change and narrowing of arteries is a slow pathological process that takes time to develop.

16. Three-fourths (34 in total) of the 44 cases were obese or overweight. 18 were chronic smokers (with 13 of them having smoked for over 20 years), and 12 had drinking habits. These 44 cases were between 32-77 years old with an average age of 57. General profile of these 44 cases is set out in Annex 2.

*Work Stress and Work Conditions*

17. 12 of the 200 cases studied were reported to have to perform manual handling operation with high or very high physical workload. 7 of them performed manual tasks outdoor but none of them were found to have symptoms of heat stroke. The cases covered a wide range of occupations including security guards, construction workers, cleaners, etc. The physical demands as reported include outdoor gardening work, manual handling operation, climbing steps to conduct inspections, fast work pace, etc. OSHC cannot conclude whether these reported physical exertions had reached a level that directly triggered the onset of CCVDs, as such an assessment would require clinical medical input. None of the cases involved excessive physical burden or physical overload resulting from unpredictable work incidents or significant changes in their physical burden or workload within 24 hours before death.

18. 27 of the 200 cases were reported to have significant work stress, involving mental stress at normal daily work and/or stressful situations close to CCVD onset. For reported mental stressors at daily work, they mainly concerned manpower shortage, heavy workload, stressful job nature, etc. 7 of the cases are covered in paras. 14-16 above. For the remaining 20 cases, the average working hours one month before death was 189 hours. None of the 27 cases were reported to have experienced a sudden increase in physical burden or overload before their deaths.

Non-work related factors

*Medical History*

19. The majority of cases (104 cases) were reported to have known history of chronic medical diseases such as hypertension (62 cases), diabetes (26 cases), heart disease (25 cases), cerebrovascular accident/stroke (7 cases) and high cholesterol (5 cases), which were all linked to an increased cardiovascular risk. Such chronic diseases are well-documented risk factors of CCVDs. Among these 104 cases, 15 cases had no medical follow-ups, which could possibly lead to increased risk of health deterioration. Most of these 15 cases were obese, lacked exercises and were smokers. Autopsy reports were available in 9 of these 15 cases which were found to have 40-100% occlusion of coronary arteries. It is unknown whether another 33 of these 104 cases had been receiving medical treatment.

20. For the remaining 96 cases, the medical history of 25 cases was unknown and 71 were reported to have no history of medical illness. Autopsy reports are available for 65 of these cases. Although reported to have no medical history or such is unknown (and hence without any medical follow-up), autopsy reports of 62 cases revealed that the deceased showed an atherosclerotic change with up to 40-100% occlusion of major coronary arteries and/or, enlarged heart with left ventricular hypertrophy and dilation, all of which increased the risk of CCVDs. The absence of medical follow-up of these cases further heightened their risk of CCVD onset.

21. It should be noted that not all deaths required to be reported to the Coroner under the Coroners Ordinance need to undergo an autopsy. The decision rests with the Coroner with reference to the pathologist's assessment upon examination of the deceased's external body, including whether the cause of death can be ascertained. In other words, autopsy is not generally necessary if the causes of death can be ascertained without it. Without an autopsy report for some of the studied cases, OSHC was unable to assess whether there had been pathological change of the deceased's body which might contribute to the onset and development of CCVDs. Of the 200 cases studied, autopsy was done for 122 cases. 99 of them showed severe atherosclerotic change up to 70-100%, and 7 of them showed atherosclerotic change up to 40-70%.

*Lifestyle factors*

22. It is found that a majority of the cases with the relevant information provided lacked physical activities, had smoking habits (with more than half being chronic smokers) and had weight problems. As far as bodyweight is concerned, a high percentage (77%) of the cases did not have a healthy weight according to the Asian Body Mass Index (BMI) standard. Of the 179 cases with the relevant information provided, 107 were obese (BMI $\geq$ 25) and 31 were overweight (BMI $\geq$ 23 - <25). The rate of obesity in this study (i.e. 54%) is higher than the obesity rate of the general population of Hong Kong (i.e. 21%). 52% of the cases had smoking habits, compared with 11% amongst the general population. Smoking is widely researched to be a major cause of CCVDs due to an increased risk for thrombosis of narrowed vessels and an increased degree of atherosclerosis in those vessels. According to WHO, smoking is responsible for 10% of all CCVD cases. These findings are in line with general medical observations that an unhealthy lifestyle coupled with high BMIs would make an individual more prone to CCVDs.

*Personal and family issues*

23. 24 cases were reported to be experiencing non-work related stressful issues within 6 month before death. About half of these cases were reported to sustain high degree of stress level because of personal or family issues such as taking care of ailing or elderly family members, financial difficulties, marital issues, etc.

Study Conclusions

24. OSHC observed that the study findings point to the direction that multiple risk factors are in play in the development of CCVDs of the studied cases. No single factor could be pinpointed as solely responsible for the workplace CCVD deaths. These observations are consistent with the findings of relevant international researches. OSHC also observed that none of the cases was found to have work-related risk factors alone. In fact, 135 cases were not found to have any work-related factors at all. OSHC therefore concluded that work-related risk factors were not prevalently identifiable among the cases studied.

25. Executive Summary of OSHC's Report is at Annex 3.

**LD's Observations**

26. We subscribe to OSHC's observation supported by international researches that causes of CCVDs are multi-factorial with risk factors related to both work-related and non-work circumstances. Findings of the study are also consistent with this notion.

27. CCVDs have become the leading cause of death across the globe, accounting for 31% of all deaths globally in 2016. CCVDs are prevalent among the Hong Kong general population and they have for a very long time been the leading causes of death. In 2019, some 1,500 CCVD deaths were reported between the age of 15-65. Compared with the rate of registered deaths due to CCVDs in Hong Kong population in the seven 5-year age bands between 30 and 64, the rate of workplace CCVD deaths in the Hong Kong working population in 2019 is vastly below the rate of overall CCVD deaths in the general population in the corresponding age bands. Details can be found at Annex 4. The vast difference of the two rates seems to illustrate that the risk of workplace deaths due to CCVDs in the working population is much less than the risk of overall CCVD deaths in the general population. This observation echoes OSHC's findings that work-related factors were not prevalently identifiable in the study.

28. It is also noted that the median age of the studied cases was 56, whereas the median age of the general employees in Hong Kong is 43 years old. The older age of the cases is consistent with the well-researched notion that older people generally have a higher risk of CCVDs.

29. As far as working hours are concerned, it is noted that "overexertion at work" is generally perceived to be associated with long working hours. LD noted that the study results do not show there are significant differences between the working hours of the cases studied and those of the employees in the same industries or occupations. LD also noticed that for the 44 cases regarded as having long working hours for the purpose of this study, all of them had personal risk factors that (many to a significant degree) increased their risk of CCVD onset. 39 of these cases had related medical history and pre-existing conditions that had caused a chronic pathological changes to their bodies, and their CCVD onset could therefore be largely attributed to a natural progression of their underlying medical conditions. It should, however, be noted that the study was not designed to establish nor eliminate conclusively the degree of work-relatedness of the cases. Most of the remaining cases were in advanced age and/or associated with lifestyle factors like chronic smoking, overweight and physical inactivity which are widely known contributors to CCVD development and onset.

30. The study revealed that 37 of the 200 studied cases were security guards. Security guards constitute a relatively high proportion of workplace CCVD deaths. In 2016-2020, 16% to 20% of workplace CCVD deaths were from this occupation and more than half were aged 60 or above. Old age itself is a well-recognised yet non-modifiable risk factor for CCVDs. The average age of the 37 security guards is 62 years, whereas the average age of the 163 remaining cases from other occupations is 55. 17 of these 37 security guards had underlying medical problems like hypertension, diabetes mellitus, heart diseases, old stroke, polycystic kidney disease, etc. Another 17 had autopsy reports with most showing 70-100% of coronary arteries occlusion by athermanous plagues. The remaining 3 were all obese and physically inactive, with 2 of them at or over 70 years of age. For these 37 cases, 25 of them were overweight/obese, 15 had smoking history and 7 had drinking habits. Most of them were physically inactive.

31. We also notice that 42 of the 200 studied cases were construction workers. Their average age was 54 years old. In fact, construction workers constituted a large portion of the workplace CCVD death cases in the past few years. In 2017-2020, 15-21% of the workplace CCVD deaths involved construction workers. Males are known to be more prone to CCVD and chronic smoking is another known CCVD risk factor. For the 42 construction workers covered in the study, all of them were male and 29 of them were chronic smokers (with 16 having smoked for more than 20 years). Of these 42 cases, 22 were

reported to have underlying medical problems like hypertension, diabetes mellitus heart diseases, but 11 of them had no or known medical follow up. Of the 20 remaining cases, autopsy reports of 18 showed in most cases 70-100% coronary arteries occlusion by athermanous plagues. 27 of the cases were overweight/obese/underweight.

32. The study revealed that 77% of the cases reported with the relevant information had weight problem according to the Asian BMI standard (with 107 cases being obese and 31 cases overweight). Most of the cases studied lacked physical activities and had unhealthy diet. These lifestyle choices coupled with high BMIs would make an individual more prone to CCVDs. Besides, 80 cases either had no medical follow-up despite having known history of chronic medical diseases (e.g. hypertension, diabetes, heart disease, etc.), or found to have actually developed chronic pathological changes of cardiovascular system without their knowing. It is noted that for the 47 cases with no personal medical history indicated, all of them had occlusion of coronary arteries, and 44 of them had severe vascular occlusions. These findings underline the following important elements for proper CCVD management :-

(a) to be aware of risk factors relevant to CCVD prevention;

(b) to practise a healthy lifestyle to prevent or manage CCVDs; and

(c) to undergo regular medical check-up in order to identify the existence of any chronic cardiovascular conditions, so that early diagnosis and timely treatment can be arranged.

33. In the light of the above-mentioned study findings, LD will step up our efforts in strengthening, in the workplace setting, the awareness of employers and employees on the risk factors associated with CCVDs and the importance of their proper management and intervention. Workplace is well-recognized as an ideal environment for educating and helping employees manage their health. We will ride on the platform of the "Joyful@Healthy Workplace" Programme jointly implemented by LD, OSHC and the Department of Health to pursue the initiative.

34. The "Joyful@Healthy Workplace" Programme was launched in 2018 to assist employers and employees to create a joyful and healthy working environment through in-house workshops, physical and on-line seminars, tailor-made advice for enterprises, health check-up kit on-loan scheme, etc. So far, over 2,000 organisations (employing some 600,000 workers) have joined the promotional activities under the programme.

35. Capitalising on the success of the Programme, we will promote the importance of physical and mental well-being at workplace and the importance of early identification of risks associated with developing CCVDs so that timely intervention can be taken. The enhanced initiative will initially target security guards and construction workers, the two occupations that contributed about 40% of the cases under this study. Apart from employees, the initiative will target employers at the organisation level, with a view integrating work place health programmes into the organisational health culture. In order to achieve the best impact, programme details will be tailor-made to befit the nature and characteristics of the occupations as well as the need of the employers and employees in terms of how the messages and services are designed and disseminated/provided. A high-level Working Group is planned to be set up under OSHC with participation of LD, DH and major employer and employee stakeholder organisations (e.g. Hong Kong Association of Property Management and Hong Kong Construction Association) to take forward the initiative. Our initiative is in line with government's efforts to promote primary healthcare services to prevent, and to achieve early detection of chronic illnesses including CCVDs. Through the initiative, we aim to identify cases for referral to District Health Centres or the Hospital Authority's General Outpatient Clinics for follow up.

**Advice Sought**

36. Members are invited to note the findings of OSHC's study and LD's observations.

Labour and Welfare Bureau
Labour Department
June 2021

# Profile of 200 cases

## Table 1.1 Age

| Age | Cardiovascular disease | | Cerebrovascular disease | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| <30 | 0 | 0.0% | 1 | 2.4% | 1 | 0.5% |
| 30-34 | 2 | 1.3% | 1 | 2.4% | 3 | 1.5% |
| 35-39 | 6 | 3.8% | 1 | 2.4% | 7 | 3.5% |
| 40-44 | 12 | 7.6% | 8 | 19.0% | 20 | 10.0% |
| 45-49 | 14 | 8.9% | 9 | 21.4% | 23 | 11.5% |
| 50-54 | 31 | 19.6% | 7 | 16.7% | 38 | 19.0% |
| 55-59 | 40 | 25.3% | 8 | 19.0% | 48 | 24.0% |
| 60-64 | 23 | 14.6% | 3 | 7.1% | 26 | 13.0% |
| 65-69 | 18 | 11.4% | 2 | 4.8% | 20 | 10.0% |
| 70+ | 12 | 7.6% | 2 | 4.8% | 14 | 7.0% |
| **Total** | **158** | **100.0%** | **42** | **100.0%** | **200** | **100.0%** |

## Table 1.2 Industry

| Industry | No. | % |
|---|---|---|
| Administrative and support service activities | 52 | 26.0% |
| Construction | 50 | 25.0% |
| Accommodation and food service activities | 23 | 11.5% |
| Transportation, storage, postal and courier services | 21 | 10.5% |
| Import/export, wholesale and retail trades | 18 | 9.0% |
| Manufacturing | 11 | 5.5% |
| Professional, scientific and technical activities | 6 | 3.0% |
| Human health and social work activities | 5 | 2.5% |
| Government | 4 | 2.0% |
| Education | 3 | 1.5% |
| Information and communications | 2 | 1.0% |
| Work activities within domestic households | 2 | 1.0% |
| Agriculture, forestry and fishing | 1 | 0.5% |
| Real estate activities | 1 | 0.5% |
| Other service activities | 1 | 0.5% |
| **Total** | **200** | **100.0%** |

**Table 1.3 Occupation**

| Occupation | No. | % |
|---|---|---|
| Construction worker | 42 | 21.0% |
| Security guard | 37 | 18.5% |
| Driver | 22 | 11.0% |
| Catering staff | 15 | 7.5% |
| Cleaner | 12 | 6.0% |
| Manager | 12 | 6.0% |
| Warehouse/ Loading / Delivery worker | 11 | 5.5% |
| Supervisor | 9 | 4.5% |
| Professional | 7 | 3.5% |
| Salesperson | 4 | 2.0% |
| Administrative staff | 4 | 2.0% |
| Technician | 4 | 2.0% |
| Operator | 4 | 2.0% |
| Customer service staff | 3 | 1.5% |
| General worker | 3 | 1.5% |
| Gardener | 3 | 1.5% |
| Health worker | 2 | 1.0% |
| Domestic helper | 2 | 1.0% |
| Others | 4 | 2.0% |
| **Total** | **200** | **100%** |

**Table 1.4 Working hours in the month before death**

| Working hours | No. of cases | % |
|---|---|---|
| < 176 | 34 | 18.6% |
| 176-200 | 36 | 19.7% |
| >200-225 | 40 | 21.9% |
| >225-250 | 24 | 13.1% |
| >250-276 | 20 | 10.9% |
| >276 | 29 | 15.8% |
| **Total** | **183*** | **100%** |

** Working hours of 17 cases were unknown.*

**Table 1.5 Maximum working hours on average per month in any of the two or more consecutive months (up to six months) before death**

| Maximum working hours on average per month in any of the two or more consecutive months (up to six months) | No. of cases | Remark | |
|---|---|---|---|
| | | No. of cases | Number of months calculated for the average monthly working hours |
| >256 | 42 | 1 | 1-2 months before death |
| | | 1 | 1-3 months before death |
| | | 40 | 1-6 months before death |
| 256 or less | 138 | | |
| **Total** | **180*** | | |

**Relevant information was not avngailable for 20 other cases.*

Annex 2

# Profile of 44 cases

## Table 2.1 Age

| Age | Cardiovascular disease | | Cerebrovascular disease | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| < 45 | 5 | 12.8% | 0 | 0.0% | 5 | 11.4% |
| 45-49 | 1 | 2.6% | 1 | 20.0% | 2 | 4.5% |
| 50-54 | 9 | 23.1% | 2 | 40.0% | 11 | 25.0% |
| 55-59 | 11 | 28.2% | 0 | 0.0% | 11 | 25.0% |
| 60-64 | 5 | 12.8% | 0 | 0.0% | 5 | 11.4% |
| 65-69 | 3 | 7.7% | 0 | 0.0% | 3 | 6.8% |
| 70+ | 5 | 12.8% | 2 | 40.0% | 7 | 15.9% |
| **Total** | **39** | **100.0%** | **5** | **100.0%** | **44** | **100.0%** |

## Table 2.2 Industry

| Industry | No. | % |
|---|---|---|
| Administrative and support service activities | 26 | 59.1% |
| Construction | 5 | 11.4% |
| Accommodation and food services | 4 | 9.1% |
| Transportation, storage, postal and courier services | 4 | 9.1% |
| Manufacturing | 2 | 4.5% |
| Professional, scientific and technical activities | 1 | 2.3% |
| Information and communications | 1 | 2.3% |
| Government | 1 | 2.3% |
| **Total** | **44** | **100.0%** |

**Table 2.3 Occupation**

| Occupation | No. | % |
|---|---|---|
| Security guard | 22 | 50% |
| Construction worker | 5 | 11.4% |
| Catering staff | 4 | 9.1% |
| Cleaner | 2 | 4.5% |
| Customer service staff | 2 | 4.5% |
| Manager | 2 | 4.5% |
| Assistant coxswain | 1 | 2.3% |
| Crane operator | 1 | 2.3% |
| Driver | 1 | 2.3% |
| Gardener | 1 | 2.3% |
| Mechanic | 1 | 2.3% |
| Officer | 1 | 2.3% |
| Warehouse worker | 1 | 2.3% |
| **Total** | **44** | **100%** |

**Table 2.4 Working hours in the month before death**

| Working hours in the month before death | No. | % |
|---|---|---|
| = or <276 | 15 | 22.7% |
| >276-<280 hours | 1 | 2.3% |
| 280-<290 hours | 17 | 38.6% |
| 290-<300 hours | 3 | 6.8% |
| 300-<310 hours | 1 | 2.3% |
| 310-<320 hours | 5 | 11.4% |
| 322 hours | 1 | 2.3% |
| 330 hours | 1 | 2.3% |
| **Total** | **44** | **100.0%** |

**Table 2.5 Maximum working hours on average per month in any of the two or more consecutive months (up to six months) before death**

| Maximum working hours on average per month in the two or more consecutive months (up to six months) | No. | % |
|---|---|---|
| 246 | 1 | 2.3% |
| 255 | 1 | 2.3% |
| 260 - <270 | 11 | 25.0% |
| 270 - <280 | 14 | 31.8% |
| 280 - <290 | 8 | 18.2% |
| 290 - <300 | 2 | 4.5% |
| 300 - <310 | 4 | 9.1% |
| 310 - <320 | 1 | 2.3% |
| 320 - 322 | 2 | 4.5% |
| **Total** | **44** | **100.0%** |

## Executive Summary

### 1. Background of the Study

The Occupational Safety and Health Council (OSHC) was commissioned by the Labour Department (LD) to conduct a consultancy study on the possible relationship between work conditions and notified workplace deaths not arising from work-related accidents. Cases of workplace death were referred to OSHC by the LD for study and analysis. Workplace deaths not caused by work accidents are mainly deaths due to cerebro-cardiovascular diseases (CCVDs). However, it is unknown to what extent work factors might have contributed to these CCVD death cases. The aim of this study is to collect information on factors that might be relevant to workplace deaths due to CCVDs so as to assess possible relationship between different work conditions and these death cases.

The International Labour Organization (ILO) does not include work-related CCVDs in the list of occupational diseases and the CCVDs due to overexertion are generally not compensable as occupational disease in most of the foreign countries. That said, Japan, South Korea and Taiwan are among the few exceptions, where relevant guidelines have been developed for the assessment and recognition of work-relatedness of CCVDs for employee compensation purpose. We have reviewed the recognition criteria among these regions and noticed that the Taiwan guideline (TWGL)（also known as 職業促發腦血管及心臟疾病（外傷導致者除外）之認定參考指引）is a useful reference for evaluation of CCVD cases. The holistic approach for assessment of the CCVDs cases based on the TWGL was therefore adopted in this study.

### 2. Methodology

As this is the first study of its kind in Hong Kong, a comprehensive literature review on (1) global trend and mortality of CCVDs; and (2) risk factors (both work and non-work related) associated with CCVDs was conducted. Then, main part of the study involves interviews with relevant parties (including immediate family members, employers/employer representatives and co-workers who worked closely with deceased employees) to collect information on work conditions and lifestyle of the deceased employees and analysis of the data so collected. With reference to the TWGL, two sets of questionnaire, both similar in structure, were designed for use in the study. The questionnaire covers: (1) basic information of interviewee, (2) work conditions of the deceased employee (which include working hours, changes in work content, stress levels at normal daily work, stressful incident close to the onset of CCVD death, working environment, etc.), and (3) non work-related factors of the deceased employee (which include personal and family medical history, lifestyle and stressful life events, etc.).

A total of 200 CCVD death cases notified to LD by employers were referred to OSHC. Interviews were conducted on all but one case, with a completion rate of 99.5%. The one case where no interviews could be conducted was due to that no close family member was in Hong Kong, and the employer declined to be interviewed on ground of lack of time and did not provide contacts of co-workers for follow up.

A total of 359 individual interviews were conducted. Family members accounted for 139 of these interviews; 178 interviews were completed with the employers or employer

representatives, and 42 were with co-workers of the deceased. The lowest response rate obtained from co-workers could partly be attributed to work-alone job nature of the deceased, employers' reluctance to refer co-workers for interviews, or lacking close contacts with the deceased employees. For the latter part of the study, the COVID-19 pandemic had made this research study more challenging and tremendously slowed down the study schedule.

Whenever possible, response inconsistencies among different groups were checked. When such inconsistencies were detected, an evidence-based approach (i.e. Evidential Reasoning) was adopted so that more representative and trustworthy data could be compiled for analysis.

## 3. Literature Review

### 3.1 Global and Local Situation of CCVDs

CCVDs have become the leading cause of death across the globe. According to World Health Organization (WHO), an estimated 17.9 million people died of CCVDs in 2016, accounting for 31% of all deaths globally. Between the years 2000 to 2016, over 80% of CCVD deaths were due to ischemic heart disease (IHD) (51.6%) and stroke (33.9%). CCVDs are also prevalent among the Hong Kong general population and are one of the leading causes of death. Number of deaths due to heart and cerebrovascular diseases were 6,088 (age-standardized death rate per 100,000 population: 33.8) and 3,016 (age-standardized death rate: 16.6) respectively in 2018.

Consistent research findings suggest that causes of CCVD diseases are multifactorial, with various risk factors related to both work and non-work related factors in the development of CCVD risk.

### 3.2 Work-related Risk Factors

The association between long working hours and increased risk of cardiovascular diseases has long been addressed. Recent publications from WHO and International Labour Organisation (ILO) jointly estimated the work-related burden of disease and injury suggested that exposure to long working hours may have led to increased risk of ischaemic heart disease incidence and mortality as well as stroke incidence. Yet, some researchers doubt that those findings may be more applicable to low socioeconomic status occupations and more researches are required to verify harmfulness as well as to determine clinical relevance.

Besides working hours, work stress is another work-related risk factor that has drawn substantial amount of attention to its impact on CCVD risk. A combination of high work demands and low job control at work would be regarded as job strain and it is commonly known as one of the stressful components of the psychosocial work environment. In general, research findings seem to converge to the conclusion of a positive association between work stress and CCVDs, such that people who have high job strain normally have higher risk of CCVD than those with low job strain.

Studies showed that physically demanding and exhaustive activities during work as well as exposure to different substandard work environments such as workplace noise, hazardous chemicals, and extreme temperature may also increase the risk of CCVDs in the workplace.

### 3.3 Non-work Related Factors

Looking into research on the association between non-work related factors and CCVDs, consistent findings have shown that unhealthy diet, physical inactivity, tobacco use and harmful use of alcohol (i.e. a pattern of over consumption or addictive use of alcohol that is causing damage to health either physically or mentally) are the most important behavioral risk factors contributing to heart disease and stroke.

Other non-work related factors such as sleep duration, body weight and pre-existing medical conditions are also reported to be associated with CCVD risks. For instance, it is found that those sleeping less than 5 hours per day was associated with an elevated risk of CCVDs as compared with those sleeping 7 hours per day, with the relative risk ranging from 1.05 to 1.57. As for body weight, not only overweight and obesity are of particular concern, people who are underweight are also found to be associated with increased risk of CCVDs. In addition, people who have pre-existing medical condition such as hypercholesterolemia, diabetes and hypertension are found to be associated with higher risk of CCVDs.

### 3.4 Interrelationships between Work and Non-work Related Factors

WHO/ILO issued a paper (Descatha et al., 2020) and postulated that the impact of exposure to long working hours on IHD or stroke is far from simple. Both work and non-work related factors could possibly contribute to the onset of CCVD diseases, and individuals who have multiple risk factors are expected to be more susceptible to develop such diseases. Hence, a holistic approach should be adopted to identify the relationships between various work and non-work related factors and the development of CCVD disease by comprehensively examining, but not limited to, lifestyle, state of worker's health, extent of pre-existing disease, workload and work conditions.

## 4. Findings of the Study

### 4.1 Age, Gender and Occupation Distributions of the Deceased Employees

Age of the deceased employees ranged between 25 to 78 years old, with an average age of 55. More than half of them were between 50 and 64 (56.0%). Among all the deceased employees under the current study, average age of frontline security guards was higher than that of other occupations. Eleven (5.5%) deceased were less than 40 years old. There were 19 (9.5%) females and the rest were males (90.5%). Most of the deceased were from administrative and support service activities[1] (26.0%) and construction industry (25.0%), followed by accommodation and food service activities (11.5%), transportation, storage, postal and courier services (10.5%), import/export, wholesale and retail trades (9.0%), and the rest from other industries (including manufacturing, professional, scientific and technical activities, etc.). In terms of occupation, most of the deceased were construction workers (21.0%) and frontline security guards (18.5%), followed by drivers (11.0%), catering staff (7.5%) and cleaners (6.0%), etc.

[1] It covers workers from property management or security services, cleaning services, landscape care and greenery services, and management of human resources functions in this study.

## 4.2 General Findings on Work-Related and Non-Work Related Factors

The work and non-work characteristics of the deceased were analyzed. Majority of the deceased had multiple risk factors which could lead to an increased chance of developing CCVDs. The work-related factors included long working hours, work stress, business trip, shift/night work and physical overload. Non-work related risk factors included personal medical history, family medical history, advanced age, unhealthy lifestyle (tobacco and alcohol use, physical inactivity, and unhealthy diet).

Most of the deceased (197 cases) had at least one risk factor (including work-related and/or non-work related risk factors), except 3 cases (1.5%). The 3 exceptions were all female employees, including a part-time saleswoman (age 25), a domestic helper (age 39) and a clerk (age 55). Based on information gathered, two of them were not associated with any work or non-work related risk factors, whereas the remaining one case did not have personal risk factors and her working hours were unknown.

There were 116 deceased employees (58.0%) who had risk factors only related to personal medical history, family medical history or unhealthy lifestyles. In other words, no work-related risk factors were observed for 58.0% of CCVD death cases in this study. Besides, 16 deceased (8.0%) had personal risk factors, but their working hours were unknown. Discounting the 3 exceptions, the remaining 65 deceased employees (32.5%) were found to have both work-related risk factors and non-work related factors. None of the deceased was found to solely have work-related risk factors. The study results are consistent with the international research findings that workplace deaths caused by CCVDs are multi-factorial. The findings are summarized in the following sections.

### 4.2.1 Findings related to work-related factors

#### 4.2.1.1 Working hours

The average daily working hours of the deceased ranged from 6 to 12.9 hours in the week prior to death. Most of them worked 5 to 6 days per week and 22 to 26 days per month. Working hours varied across different industries and occupations. Deceased employees working in administrative and support service activities (including frontline security guards, cleaners and gardeners) had the longest working hours within 6 months before death as compared to that of the other deceased employees. In terms of occupations, deceased employees who were frontline security guards worked longer hours than those of other occupations. Catering staff came second, followed by cleaners, drivers, etc.

With reference to the TWGL, 44 deceased employees (24.0% of 183 cases[2]) met the criteria for working long hours. Among them, 42 deceased (23.3 % of the 180 cases[3]) with known working

[2] *The 183 cases cover all those cases where working hours for the immediate preceding month and/ or preceding 6 months where known.*

[3] *Three cases, where only working hours for the immediate preceding month were known, were taken out.*

hours for the preceding 6 months) had worked more than 256 hours on average per month during any of the 2 to 6 months period before the onset of CCVD death, and 29 of the deceased (15.8% of the 183 cases) had worked more than 276 hours in the month prior to death. Among these 44 workers, 22 were frontline security guards, 5 were construction workers and 4 were catering staff. The rest were cleaners, customer service staff, managers, operators and driver, etc. The 44 workers were between 32-77 years old with an average of 57 years. Twenty of them had known history of chronic medical illness (such as hypertension, heart disease or high cholesterol, etc.). Although the remaining 24 cases were being reported as having no/unknown history of chronic medical illness, the autopsy reports showed that 18 out of these 24 employees (75.0%) had severe atherosclerotic change with 70% to 100% occlusion of major coronary arteries and 1 deceased (4.2%) had atherosclerotic change with 40-70% occlusion of major coronary arteries and chronic pathological change of the heart. The remaining 5 deceased did not have autopsy reports and had either no or unknown history of chronic medical illness but they all had various personal risk factors for CCVDs.

For these 44 cases who met the long working time criteria, 34 (77.3%) were obese or overweight, 18 (40.9%) were chronic smokers and 12 (27.3%) had drinking habits.

#### 4.2.1.2 Work conditions

Twenty-seven deceased employees (13.6% out of 199) were reported to have significant work stress. Among them, some were being reported to endure heavy workload as the main stressor due to insufficient manpower. Some of the deceased experienced other stressors such as handling important projects, safety issues arising from work, mental stress caused by previous work injuries, complaints from clients, highly disciplined work, company financial problems and rushing to meet work deadlines. Among the 199 cases, 12 (6.0%) of them were shift workers who worked 2-3 different time slots alternately, and with one of them experienced a high degree of work stress. Another 11 (5.5%) cases were required to go for business trips in mainland China, Singapore, Australia, etc. and two of them were reported to be suffering from excessive work pressure. The noise levels in the deceased's workplaces were generally regarded as normal.

Thirty-three deceased employees were required to work outdoor and perform manual handling operations (with various degrees of physical demand). However, symptoms of heat stroke during work duty were not observed. On the other hand, 12 of the deceased employees (6%) were required to perform manual work where physical demands were deemed as high to extremely high which might have exceeded the workers' physical capacity limits as reported by the interviewees. Their physical overloads were reported to be mainly related to outdoor work, manual handling operation, inspection/patrol, shortage of manpower or fast work pace, etc.

### 4.2.2 Findings related to non-work related factors

Personal and family medical history, BMI, sleep conditions, family and interpersonal relationships, financial issues and lifestyles were studied in this study. Not all respondents were able to provide information about each of the factors mentioned.

#### 4.2.2.1 Personal medical history

Medical history of 25 deceased employees (12.5%) were unknown (including the one where no interviews were conducted) and 71 (35.5%) were being reported by their family as having no history of medical illness. The majority of cases, 104 (52.0%) in total, were being reported to have known history of chronic medical diseases such as hypertension (62 cases, 59.6% of 104), diabetes (26 cases, 25.0% of 104), heart disease (25 cases, 24.0% of 104), cerebrovascular accident/stroke (7 cases, 6.7% of 104) and high cholesterol (5 cases, 4.8% of 104). All these medical conditions could have increased the risk of CCVD deaths. Among these 104 cases (52%), 15 of them (14.4% of 104) had no medical follow-ups, which could lead to increased risk of health deterioration. For the remaining 96 cases (48.0%) where there was no known medical history, 65 were with autopsy reports. Among them, 95.4% (i.e. 62 cases) showed an atherosclerotic change with up to 40-100% occlusion of major coronary arteries, enlarged heart with left ventricular hypertrophy and dilation- all of which increased the risk of sudden death.

The study also found that deceased employees who were being reported by family members as having no history of medical illness had already developed chronic pathological changes of cardiovascular system. Hence, it is of paramount importance for individuals with risk factors for CCVDs, even if asymptomatic, to have early medical checkups for health monitoring (risk factor reduction) and appropriate medical treatment.

#### 4.2.2.2 Lifestyle and other personal factors

Regarding eating habit, diet of 35.0% of the deceased with known eating habit (48 out of 137 cases) tended to be high in sodium or sugar, or heavy on meat and less on vegetables. About 96% (131 out of 137) of the deceased had less than 5 servings of vegetables and fruit a day.

As for physical activities, it is reported that 75.2% of the cases (121 out of 161 cases) have no regular physical activities. Only 5 deceased (3.1%) had sufficient level of physical activities as per recommendation of WHO.

When bodyweight was considered, an alarmingly high percentage of the deceased did not have a healthy weight according to the Asian BMI criteria. 107 of them were obese (Body Mass Index (BMI) $\geq$ 25) and 31 were overweight (BMI $\geq$ 23), accounting for 77.1% of the 179 deceased where bodyweight and height were provided. These findings are in line with general medical observations that unhealthy lifestyle coupled with high BMIs would make an individual more prone to CCVDs.

Eleven deceased employees (5.6% out 196 cases) were reported to experience high stressful life events within 6 months before death. These stressful events include taking care of sick elderly or mentally disabled family members, preparing for daughter's marriage, indebtedness and worries about finances, experiencing family members/relatives passing away, or dealing with marital problems and domestic violence, etc.

### 4.3 Further Observations from the Study

The project team noticed the median working hours of the deceased engaged in estate management, security and cleaning services were apparently longer than that of workers in the same industries (66 hours vs. 50.2 hours per week). However, it should be noted that working hours between the samples in this study and that of employees from the general population in Hong Kong as provided by the Census and Statistics Department (C&SD) were not strictly comparable. Apart from the non-random sampling nature of this study and the small sample size, the issue of occupation, gender and age have not been taken into account. In fact, the project team noted that the higher proportion of frontline security guards in our "non-random sample" as compared with the distribution of occupations in C&SD's database for the estate management, security and cleaning services industrial group could be the main reason for the difference in the working hours mentioned above. When comparing the daily average working hours for frontline security guards and cleaners in our study vs their counterparts in the general population, we found that the two were similar, where actual figures were 10.4 vs 10 hours and 8.5 vs 8 hours respectively.

It is also observed that median age of the deceased in this study was higher than that of the city's general employees (56 years old vs. 43 years old). A higher proportion of the deceased was found to have smoking habits and was obese or overweight as compared with the general population. The results echoed with conclusions from studies that old age, tobacco use and obesity as traditional risk factors of CCVDs.

Overall, findings from this study points to the direction that *multiple risk factors* are in play in the development of CCVDs. No single factor could be pinpointed as solely responsible for work-related CCVDs. Eleven out of the 199 deceased in the study had multiple work-related risk factors (long working hours, stressful work events or shift work, etc.), but they also had non-work related risk factors at the same time. None of them was found to have work-related risk factors alone. Results revealed that 116 deceased employees (58.0%) in this study did not have any work-related factors. The study findings are consistent with our literature review that CCVD is a multifactorial disease with various risk factors related to work and non-work related factors. The information collected from the current study was not sufficient to determine the effects of work factors and non-work related factors on CCVDs. To achieve this would require comprehensive medical input and adopting an analytic approach such as case control or cohort studies, which are beyond the scope of this study.

## 5. Limitations of the Study

This study is a descriptive research where no control group was included. The investigations into any causal relationships between workplace CCVD deaths and work conditions require more complex research design and sampling strategy, such as case control study. Hence this study was not able to determine any causal relationship between workplace CCVD death and different conditions.

Moreover, accuracy of data obtained from the interviews depends on interviewees' subjective memories, gut feelings, judgments, as well as their familiarity with the deceased. These are further complicated by the time lags between the death incidents and interviews, and other

uncertainties (especially with working time and overtime hours). Hence data collected from the interviews could only be a rough proxy of the real picture. In addition, CCVD death cases in this study were mainly cases reported in the workplace; death cases outside the workplace were not covered, rendering this set of data not being strictly comprehensive, and hence not comparable to employees in the general working population. As a result, this study was mainly to give a descriptive report of the characteristics of the CCVD deaths in the workplace. Nevertheless, being the first study of its kind in Hong Kong, the study provides important reference for future studies on the effect of work conditions on CCVD deaths.

## 6. Conclusion and Recommendations

This study aims to identify the characteristics of CCVD deaths in workplaces including working hours, work nature, work environment, stressors at work, medical history and lifestyle, etc. Major findings of the study are summarized below.

Apart from work-related risk factors, individual factors, such as personal medical history and unhealthy lifestyle may also increase the risk of CCVD deaths. Among the deceased, majority of them (116 out of 200 cases) had risk factors solely related to individual factors. While 32.5% (65 out of 200 cases) of the deceased employees had work-related risk factors, they also had non-work related risk factors. 104 cases (52.0%) had pre-existing conditions such as heart disease, hypertension, diabetes and high cholesterol, which would lead to the progression of CCVDs. Among deceased employees whose autopsy reports were available, even for 65 cases who were being reported as not having any personal medical history or their medical history was unknown in the survey, most of them (more than 90%) had moderate to severe atherosclerotic change with occlusion of major coronary arteries. These findings emphasized the importance of having regular physical examinations in order to understand personal health conditions, so that early diagnosis and timely treatment could be made possible.

It can be concluded that more than half of the CCVD deaths in this study were not involved in any work-related risk factors. In addition, none of the cases investigated was found to have only work-related risk factor without individual risk factors. In other words, work-related risk factors were not prevalently identifiable among the deceased.

In fact, we did not find any particular difference in personal risk factors (medical history, unhealthy lifestyle, BMI, etc.) among those with long or short working hours. The findings showed that multiple factors were involved in the development of workplace CCVDs, including work-related and non-work related ones. On the positive side, most of the risk factors can be controlled by making lifestyle changes (such as quit smoking, reduce alcohol use, incorporate physical activities into daily routines, healthy diet, and maintain healthy weight) and work management (such as managing workload and work stress). This forms the basis of mitigating CCVD deaths at workplaces and some recommendations are suggested below.

Having regard to the deceased employees' characteristics, the project team recommends that promotions of workplace health should be strengthened, and health awareness of employees should be enhanced. Such measures could include implementing workplace health programme and integrating it as part of the organizational health culture, such as setting annual organizational objectives for health promotion and making health promotion programmes

(including activities such as healthy eating, physical activity promotions, meditation, health check-up subsidies, etc.) available to employees. The provision of health guidance should be considered for employees who have higher risks for developing CCVDs and where their occupations demand irregular/long working hours and involve high physical demand from labour work. Moreover, employers are encouraged to subsidize health checks, especially for employees who met the criteria of high BMI and having personal and family medical history.

All in all, to effectively reduce risks of workplace deaths due to CCVDs, employers and employees should work together to develop good health management in the workplace as well as outside the workplace.

Lastly, this study also reviewed different work-related CCVD recognition guidelines (Japanese, Korean and Taiwan). The TWGL is found to be a useful reference for evaluating CCVD cases. According the TWGL, work-related and non-work related factors are assessed in a holistic manner. Working hour plays an important role in evaluating the workload and work stress of deceased, but individual factors such as lifestyles, personal medical history are also important factors.

Annex 4

## (I) Number of registered deaths due to CCVDs with age breakdown for those aged 30 and above in 2019

| Age group | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | ≥ 65 |
|---|---|---|---|---|---|---|---|---|
| Registered deaths by disease of heart | 15 | 24 | 49 | 109 | 189 | 255 | 393 | 5 032 |
| Registered deaths by cerebrovascular diseases | 9 | 13 | 28 | 58 | 89 | 119 | 159 | 2 488 |
| Combined CCVDs (a) | 24 | 37 | 77 | 167 | 278 | 374 | 552 | 7 520 |
| General population (b)* | 557 100 | 611 200 | 566 600 | 582 200 | 579 900 | 647 900 | 574 800 | 1 322 000 |
| **(a) / (b) x 100%** | **0.43x $10^{-2}$ %** | **0.61 x $10^{-2}$ %** | **1.36 x $10^{-2}$ %** | **2.87 x $10^{-2}$ %** | **4.79 x $10^{-2}$ %** | **5.77 x $10^{-2}$ %** | **9.60 x $10^{-2}$ %** | **56.88 x $10^{-2}$ %** |

* Mid-year general population in Hong Kong in 2019

## (II) Number of workplace CCVD deaths with age breakdown for those aged 30 and above in 2019

| Age group | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | ≥ 65 |
|---|---|---|---|---|---|---|---|---|
| No. of Cases^ (c) | 2 | 1 | 8 | 16 | 14 | 27 | 13 | 18 |
| No. of employees (d) | 445 600 | 475 900 | 423 500 | 415 900 | 390 200 | 373 400 | 222 400 | 120 300 |
| **(c) / (d) x 100%** | **0.04 x $10^{-2}$ %** | **0.02 x $10^{-2}$ %** | **0.19 x $10^{-2}$ %** | **0.38 x $10^{-2}$ %** | **0.36 x $10^{-2}$ %** | **0.72 x $10^{-2}$ %** | **0.58 x $10^{-2}$ %** | **1.50 x $10^{-2}$ %** |

^ The number of cases of workplace CCVD deaths in 2019 are provisional.