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Physical and Mental Health of Construction Workers: A Worse Status?

Yang YANG[1], Albert Ping-Chuen CHAN[1], Joanne Wai-Yee Chung[2]

[1] The Hong Kong Polytechnic University, Hong Kong, China
[2] The Education University of Hong Kong, China
yyang@polyu.edu.hk

Abstract. A physical and mental health profile of construction workers is lacking in Hong Kong. This paper aims to compare the behavioural risk factors, biomedical risk factors and self-rated health status between construction workers and the general population. A basic medical examination and a questionnaire survey were administered at 117 construction sites December 2017 to March 2019. A total of 2,396 Chinese workers were included for analysis. The data of the general population were derived from the published papers and reports. The results showed that construction workers consumed less alcoholic beverages and more fruit-vegetable than the general population but had heavier smoking and consumed less milk products. Although construction workers tended to have less working hours per day than the general population, they had less rest days per month. In general, objective and subjective physical health of construction workers was worse than the general population. But female workers had better self-rated mental health. Gender-specific health programmes should be developed in future.

Keywords: Behavioural Risk Factors, Biomedical Risk Factors, Self-rated Health Status, Construction Workers, General Population.

1 Introduction

Safety and health in the construction industry has received ample attention by industry practitioners and academics. In addition to fatalities and injuries caused by construction accidents, work-related illnesses and diseases have posed considerable threats to workers' health and their quality of life [1]. Male construction workers have higher incidence of cancer, disease and musculoskeletal disorders than the general population [1-2]. This is probably because the worse working conditions in the construction industry, such as physically demanding work, harsh environment, noise and dust, pose greater strains to construction workers [1]. More recently, research showed that male construction workers had higher incidence of mental distress than the general male population [3]. A higher suicide rate among construction workers than that among other occupations has been observed in many countries [4-6]. Mental health problem is one of the key risk factors causing suicide [7-8].

Despite abundant studies on investigating physical and mental health of construction workers in Western countries, relevant research is limited in Hong Kong. Prior studies mainly focused on physical health of the Hong Kong construction workers [9-11], whilst studies on mental health are rare. To bridge the research gap, the aim of the present paper is to develop a physical and mental health profile of construction workers by comparing behavioural risk factors, biomedical risk factors and self-rated health status between construction workers and the general population.

2 Materials and Methods

2.1 Participants

This paper is part of a large-scale study aiming to promote physical and mental health of construction workers in Hong Kong. The volunteers who have registered under the Construction Worker Registration System were invited to participate in the study. The participants were briefly introduced with the research purpose and procedures and were requested to fill in a consent form prior to the study. The study was approved by the Human Subjects Ethics Sub-committee of authors' organisations. To ensure a representative sample size, the study population was sampled based on the total number of registered construction workers in Hong Kong, confidence level, and margin error (Equ. (1)).

$$n = \frac{P(1-P) \times z^2}{\frac{P(1-P) \times z^2}{N} + e^2} \quad (1)$$

where n is the sample size required, N=465,735 is the number of participants in the population in 2018 [12], z=1.96 for desired confidence level at 95%, e=2% is margin of error, P=0.5 is the estimated variance in population. Thus, the required sample size is 2,389.

A total of 2,437 construction workers have been involved in the study. However, the current study focused on the Hong Kong Chinese population (n=2,396), while ethnic minorities were excluded in terms of a small sample size (n=41).

2.2 Procedures

The study consists of a basic medical examination and a questionnaire survey at each construction site. The study was administered at 117 construction sites between 11:00 am and 1:00 pm from December 2017 to March 2019. Medical examinations including blood sampling and blood pressure measurement were conducted by a professional clinic. Blood samples were analysed by a certificated laboratory to examine workers' glucose and total cholesterol. The questionnaire survey was administered by the research team to assess workers' demographic characteristics and lifestyle behaviours. Workers' self-rated health status was assessed by the 12-item Chinese (Hong Kong) Short Form Health Survey (version 2) (SF-12v2 (HK), Optum®). The SF-12v2 is one of the most widely used generic tools to examine

74 health-related quality of life [13]. Workers' height, weight, and peak expiratory flow
75 rate (PEFR) were also measured by the research team.

76 **2.3 Measurements**

77 Three of eight sections of the questionnaire were included for analysis. The first
78 section is demographic characteristics which investigates workers' age, trade,
79 educational attainment, working experience, and work trade. The second section is to
80 assess workers lifestyle behaviours including daily sleeping time, working time,
81 working days, the current smoking and alcohol drinking habits, and dietary. Table 1
82 summerises a number of questions about the quantity and frequency of eating,
83 tobacco smoking and alcohol drinking consumption during past four weeks. The third
84 section is the SF-12v2 (HK). The SF-12v2 (HK) scores are made of eight domains,
85 namely, physical functioning (PF), role physical (RP), bodily pain (BP), general
86 health (GH), vitality (VT), social function (SF), role emotional (RE), and mental
87 health (MH).

88 **Table 1.** Summary of questions about eating, smoking and drinking habits (four-week recall).

Question	Answer
On average, how many days do you eat or drink fruit/vegetables/ milk products within a week, respectively?	None, 1-3 times per month, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days
On the day(s) that you have eaten or drunk fruit/vegetables/milk products, how many fruit/ bowls of vegetables/milk products do you eat or drink, respectively?	0, 1, 2, 3, 4, 5 or above[a]
On average, how many days do you drink beer/wine/liquor within a week, respectively?	None, 1-3 times per month, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days
On the day(s) that you have drunk beer/wine/liquor, how many standard drinks do you drink, respectively?	0, 1, 2, 3, 4, 5 or above[b]
On average, how many days do you smoke cigarettes?	None, 1-3 times per month, 1 day, 2 days, 3 days, 4 days, 5 days, 6 days, 7 days
If yes, how many cigarettes do you smoke on average per day?	

89 Note: [a] A fruit equals to a medium-sized apple or orange, or half bowl of small fruit. A bowl
90 refers to the size of a rice bowl. One serving of milk product is roughly equal to: 1 cup of milk,
91 150 ml of yogurt, or two slices of cheese, according to [15].
92 [b] Three types of alcoholic beverages, namely, beer, wine, and liquor, are typically consumed in
93 Hong Kong [14]. A standard drink equivalent to 10 g of ethanol of each type of beverage is 1.3
94 units of beer (1 can of 330 ml), 1 unit of wine (1 glass of 125 ml), or 1 unit of liquor (1 glass of
95 30 ml).

PEFR test was performed to assess the airway obstruction and lung function of construction workers. PEFR (in liters per minute (L/min)) was the highest value of the repeated measurement with three times by a portable peak flow meter (Mini-Wright™, Clement Clarke International Ltd.). Systolic (SBP) and diastolic blood pressure (DBP) were measured from workers in the sitting position of workers after they took a rest for at least of 5 min.

Lifestyle behaviours and SF-12v2 scores of the Hong Kong general population were obtained from Statistics on Behavioural Risk Factors [15] and the Report of Population Health Survey 2014/2015 [16], respectively. SBP, DBP, random plasma glucose, total cholesterol, daily sleeping time, daily working time, and rest days per month of Hong Kong Chinese were collected from Ko et al. [17]. PEFR reference values in Chinese in Hong Kong were extracted from Yip and Chan [18].

2.4 Data analysis

Descriptive analysis (mean and standard deviation SD) of the studied variables was presented. Lifestyle behaviours and health status between construction workers and the general population in Hong Kong were compared by Chi-square test. Non-linear regression analysis was performed to determine the relationship between PEFR, age and height. Effect sizes (Cohen's d) were calculated to determine the mean difference of biomedical factors between construction workers and the general population. A Cohen's d of <0.2 is classified as a trivial effect, 0.2–0.4 as a small effect, 0.4–0.7 as a moderate effect and >0.8 as a large effect [19]. A simple t-test was performed to detect any significant difference in SF-12v2 domain scores between construction workers and the general population.

3 Results

The mean age of the 2,396 participants was 46.7 (12.08) years. Their average working experience was 13.6 (11.52) years. The majority of the participants were obtained secondary education (65.1%). 23.4% and 11.5% of them were obtained primary education or below and post-secondary education, respectively. 10.9% of the participants were engaged in bar bender and fixer, concrete, and formwork that are regarded as the most physically demanding work trades in Hong Kong. The percentages of outdoor workers other than the above three trades, indoor workers (such as electrical and mechanical workers, painters and plumbers), and general labour were 30.0%, 23.9%, and 35.3%, respectively.

Behavioural risk factors included smoking (Fig. 1a), alcohol-drinking (Fig. 1b), eating, sleep, and rest habits. While there was no significant difference in smoking habits between male and female construction workers, construction workers tended to have heavier smoking than the general population regardless of gender ($p<0.001$). Male construction workers drank alcohol more frequently than female workers ($p<0.05$). Female workers drank less than the female population in terms of a significantly higher proportion of none alcohol drinking and a significantly lower

frequency of drinking less than once per week ($p<0.001$). Male construction workers tended to drink alcohol less frequently than the male population given that nearly half of them did not drink alcohol. However, higher frequencies in drinking "daily" and "4-6 times per week" among male construction workers than the male population were found ($p<0.001$). Construction workers ate more fruit and vegetables per day than the general population, but less milk products ($p<0.001$). Daily sleeping time between construction workers and the general population was identical (i.e., about 7 hours). The male population tended to have longer daily working hours than male constructions (9.4 hours vs. 8.9 hours), while female construction workers worked slightly longer than the female population (8.9 hours vs. 8.5 hours). Rest days per month of construction workers were shorter than the general population (4.0 days vs. 4.7 days).

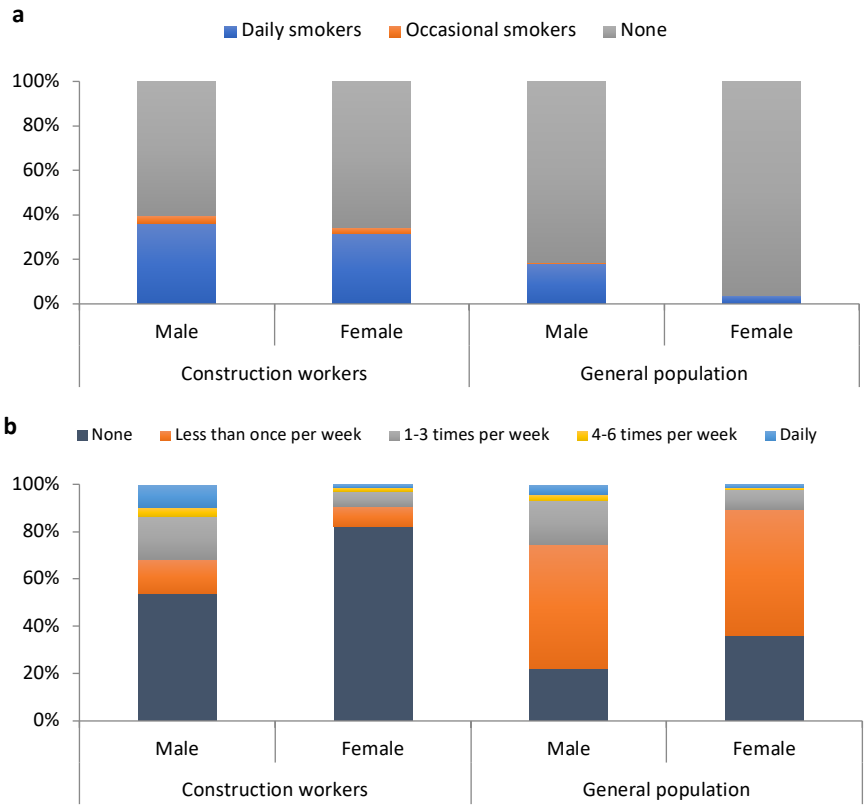

Fig. 1. Smoking (a) and alcohol-drinking (b) habits among construction workers and the general population[15]

Biomedical risk factors included BMI, SBP, DBP, random glucose, total cholesterol, and PEFR. Construction workers had higher SBP and random glucose than the general population (moderate effect), while male construction workers had higher blood pressure than females (moderate effect) (Table 2). The frequency of

156 construction workers being overweight and obese was significantly higher than that of
157 the general population, regardless of gender ($p<0.001$, Fig. 2). The results of the non-
158 linear regression analysis showed that PEFR was positively related to body height but
159 negatively related to age (Fig. 3). The relationship between PEFR, age, and height for
160 the general population [18] was also shown in Fig. 3. Given the same body height,
161 PEFR of construction workers decreased with the increase of age, whereas that of the
162 general population increased. PEFR of male construction workers was larger than that
163 of the male population at their younger ages, whilst it became lower than the general
164 population at their older ages. Given the same body height, PEFR of female
165 construction workers was always lower than the female population.

166 **Table 2.** Means and standard deviations of biomedical risk factors

Factors	Male construction workers	Male General Population 2000-2002[17]	Female construction workers	Female General Population 2000-2002[17]	All construction workers	General population 2000-2002[17]
SBP (mmHg)	135 (16)	131 (18)	128 (18)#	119 (18)*	134 (17)	125 (19)*
DBP (mmHg)	79 (10)	80 (11)	74 (11)#	72 (11)	78 (11)	76 (12)
Random glucose (mmol/L)	5.5 (1.8)	4.8 (1.6)*	5.4 (1.6)	4.5 (1.5)*	5.4 (1.7)	4.7 (1.6)*
Total cholesterol (mmol/L)	4.9 (0.9)	5.0 (0.9)	5.0 (0.8)	4.8 (0.8)	5.0 (0.9)	4.9 (0.8)

167 Note: # donates the moderate effect between male and female construction workers;
168 * donates the moderate effect between construction workers and the general population.

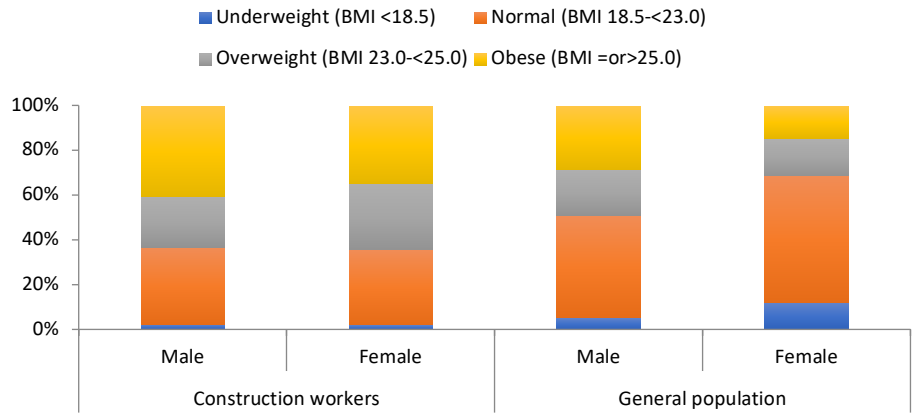

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Fig. 2. BMI distribution of construction workers and the general population[15]

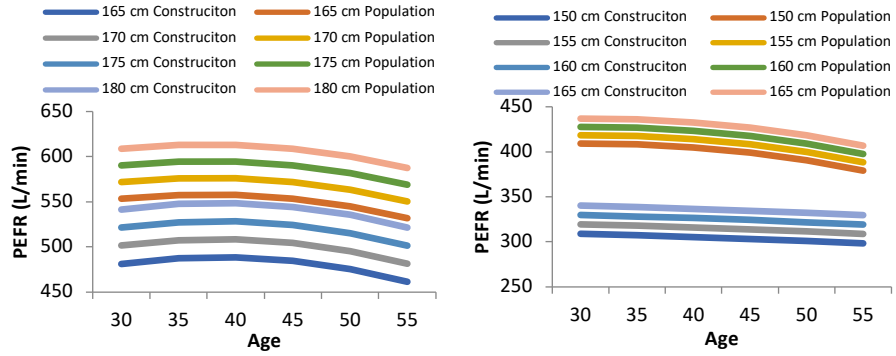

Fig. 3. Relationship between age, body height and PEFR of construction workers and the general population[18] (left: male; right: female)

Note: Solid line indicates construction workers, dotted line indicates the general population.

Self-rated health status of construction workers and the general population was shown in Table 3. Female workers had significantly better health conditions than male workers in terms of RP, BP, VT, SF, RE and MH. Generally, construction workers had significantly worse health status than the general population ($p<0.05$). Female construction workers tended to have better PF, RP, BP, SF, RE, and MH than the female population, whereas male workers had worse health status than the male population.

Table 3. Means and standard deviations of health components

Health conditions	Male construction workers (n=2,016)	Male HK 2014 General Population (N=5,665) [16]	Female construction workers (n=380)	Female HK 2014 General Population (N=6,357) [16]	All construction workers (n=2,396)	General population[16] (n=12,022)
Physical functioning (PF)	90.4 (20.08)	91.6 (20.55)*	90.2 (18.37)	88.4 (24.54)*	90.3 (19.81)	89.9 (25.51)
Role physical (RP)	87.5 (18.69)	92.9 (16.45)*	91.9(16.68)#	91.0 (18.75)	88.2 (18.46)	91.9(19.59)*
Bodily pain (BP)	89.2 (17.90)	89.3 (18.14)	91.4(19.38)#	86.6 (20.73)*	89.5 (18.16)	87.9(21.68)*
General health (GH)	51.7 (26.10)	58.7 (28.72)*	52.0 (25.62)	54.7 (30.40)*	51.8 (26.02)	56.6(34.37)*
Vitality (VT)	64.9 (25.64)	77.7 (23.47)*	71.1(26.21)#	75.2 (24.90)*	65.9 (25.82)	76.4(28.02)*

Social function (SF)	86.9 (19.82)	92.1 (17.21)*	92.3(18.02)#	90.6 (18.87)*	87.7 (19.64)	91.3(20.34)*
Role emotional (RE)	88.0 (18.41)	94.2 (14.05)*	93.1(16.37)#	93.1 (15.87)	88.8 (18.20)	93.6(16.73)*
Mental health (MH)	76.9 (19.22)	83.3 (15.85)*	83.5(18.13)#	82.2 (16.47)	78.0 (19.20)	82.8(18.08)*

Note: # donates the significant difference between male and female construction workers;
* donates the significant difference between construction workers and the general population

4 Discussion and Conclusions

This is one of the first studies to compare the behavioural risk factors, biomedical risk factors, and self-rated health status between construction workers and the general population in Hong Kong. There has been a saying that construction workers commonly had poorer health conditions than other occupations or the general population [1-2]. The current findings, however, did not fully support the statement, particularly considering gender difference.

Male construction workers had heavier smoking than the male population, Although the proportion of male workers who drank alcohol 4 times per week or over was significantly larger than that of the male population, over half of workers did not drink alcoholic beverages. It implies that male workers have better drinking habit than the male population. Male construction workers consumed more fruit and vegetables than the general population, indicating a better dietary habit. However, they are recommended to consume more milk products that can provide a rich source of protein. Similar to male construction workers, female workers had worse smoking habit but better drinking habit than the female population. They also had better dietary habit but are recommended to consume more milk products. Male construction workers had less working hours per day than the general population but female workers had more working hours per day. Both male and female construction workers had less rest days per months than the male population. This is because their average working days per week are six days. It implies that the workload of construction workers could be heavier than that of the general population. The heavy workload of construction jobs may be one of the reasons resulting in a worse physical condition of construction workers in general. Despite this, it is observed that construction workers had some better lifestyle habits than the general population.

Male construction workers had higher BMI, SBP, and glucose than the general population. The lung function of construction workers was worse than the general population, regardless of gender. Further research should be conducted to explore the underlying reasons behind this. Self-rated health status indicated that male construction workers had worse physical and mental health than the male population. Female construction workers had worse physical health than the female population

but their self-rated mental health was better. It is recommended that gender-specific health promotion programmes are needed.

Last but not the least, similar to any research involving the use of self-reported food, alcohol, or tobacco consumption, the accuracy and validity of such an approach has been questioned [20]. Moreover, this study investigated the current alcohol drinking and tobacco smoking habits, while the patterns of quitted smoking or stopped drinking alcohol were unexplored. Better instruments should be designed in future studies to enhance the reliability and validity of healthcare surveys. Furthermore, the relationship among behavioural risk factors, biomedical factors, and self-rated status by gender and age should be investigated in future studies to offer a comprehensive health profile of construction workers.

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