CONSTRUCTION INDUSTRY COUNCIL
建造業議會

HEALTH PROFILING OF CONSTRUCTION WORKERS IN HONG KONG - A SECOND PHASE STUDY

RESEARCH SUMMARY

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DISCLAIMER

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FOREWORD

The pilot medical examination scheme provided an overview of the demographic characteristics, health problems, and lifestyle behaviours of the construction workers in Hong Kong. A more comprehensive health profiling and in-depth health assessment were required to establish a longitudinal health profiling of construction workers. Therefore, the CIC continued to engage Ir Prof. Albert CHAN to lead a research team formed by experts from The Hong Kong Polytechnic University and The Education University of Hong Kong to carry out a second phase study.

The research work presented in this report was funded by the CIC Research Fund, which was set up in September 2012 to provide financial support to research institutes/construction industry organizations to undertake research projects which can benefit the Hong Kong construction industry through practical application of the research outcomes. CIC believes that research and innovation are of great importance to the sustainable development of the Hong Kong construction industry. Hence, CIC is committed to working closely with industry stakeholders to drive innovation and initiate practical research projects.

The project cannot succeed without the dedicated effort of the research team. I would like to thank to all who took part in this valuable work.

Ir Albert CHENG
Executive Director
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PREFACE

The Hong Kong construction industry faces issues of acute ageing and labour shortage. To tackle these problems, it is important to retain the existing workforce and at the same time to recruit more new blood. However, work-related health problems may lead to loss of ability to work and early retirement, particularly in some physically demanding tasks. Therefore, it is of utmost importance to detect health problems of construction workers and develop corresponding preventive measures.

During the years 2017-2019, a multi-disciplinary research team led by Ir Prof. Albert CHAN with inputs from the Hong Kong Polytechnic University and the Hong Kong Education University was commissioned to conduct the second phase study on health profiling of construction workers at a larger scale, industry-wide level. The study identified a number of health risks of socio-demography and lifestyle habits that affected physical and mental health of construction workers. Health promotion programmes targeting at dietary and post-work exercise were formulated to help workers improve their healthy lifestyle behaviours. The current study offers a better understanding on physical and mental health of construction workers.

The two health profiling studies (2014-2016 and 2017-2019) establish a longitudinal health pattern of construction workers in Hong Kong, which enable policy makers and employers to develop better health guidelines for improving the well being of labourers in the construction industry.

Ir Prof. Albert P.C. CHAN
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RESEARCH HIGHLIGHTS

Scope and Objectives

The first phase of the study conducted between 2014 and 2016 initially established a database of health profile of construction workers. The key findings of the pilot study revealed that some lifestyle behaviours (e.g., alcohol intake, smoking, inadequate intake of fruit and vegetables) may affect the cardiovascular health, while physical activities may prevent and relieve the musculoskeletal pain symptoms. Towards a more in-depth health assessment at a larger scale, industry-wide level, the current study aims to examine physical and mental health of construction workers and formulate health promotion programmes for improving their quality of life.

Methods

Face-to-face questionnaire surveys and medical examinations were conducted at 126 construction sites between 11:00 am and 1:00 pm from December 2017 to May 2019. The measurements included:

- Bio-measurement: body height, weight, peak expiratory flow rate (PEFR), resting heart rate, and blood pressure;

- Blood chemistry: fasting blood glucose (FPG) or random blood glucose (RPG), total cholesterol, liver function (ALT/AST), uric acid, and renal function (urea);

- Socio-demography: age, gender, work experience in construction, ethnic groups, educational attainment, work hours/days, overtime (OT), number of depending family members, payroll method;

- Lifestyle: sleeping hours, dietary habits, alcohol drinking habit, current smoking status, stretch before/after work, physical activity;

- History of work-related illnesses/accidents: heat-related symptoms, construction accidents;

- Pain: pain spots, pain relief methods, pain effects;

- Health literacy;

- Self-rated health status (SF-12v2).

Findings

The key findings of the research are summarised below:

Health risk of work trades:
- Ethnic minorities and plant operators had higher BMI.

- "Other" trade group (except general labour, building services workers, plant operators, and the three major trades) tended to have higher cholesterol.

- General labour had lower PEFR after controlling age, BMI and gender.

- The prevalence of pain was the highest in the three major work trades (bar fixing and bending, formwork, concrete), followed by building services and general labour.

- Back and knees were the worst pain spots reported by the construction workers.

- For carpenters and rebar workers, the worst and the top most common pain spots were the extremities. Waist pain problems of rebar workers were remarkable.

- The prevalence of the worse physical health status of rebar and formwork workers was among the highest. However, for mental health the reverse was observed.

Health risk of male construction workers:
- Male workers had a higher likelihood of prehypertension and hypertension.

- The prevalence of hyperuricaemia was higher in male workers.

- Male workers had worse mental health than female workers.

- Male workers had worse role physical, vitality, social function, role emotional, and mental health than the general male population.

Health risk of female construction workers:
- The prevalence and the likelihood of reduced PEFR were significantly higher in female workers.

- The prevalence of impaired liver function was higher in female workers.

Health risk of higher educational attainment:
- Workers with post-secondary education had a higher likelihood of worse mental health than those with lower educational attainment.

Health risk of age:
- The prevalence of younger (25 yrs old below) and older workers (54 yrs old above) with worse physical health but better mental health was higher than the middle age groups (25-54 age groups).

Health risk of BMI:

● Increasing BMI was associated with the likelihood of prehypertension and hypertension.

● The prevalence of obesity (overweight and obese) of construction workers was higher than that of the general population.

Health risk of work experience in construction:

● Longer work experience was associated with pain and prehypertension.

Health risk of alcohol drinking and smoking habits:

● The prevalence of daily smoking and daily alcohol drinking of construction workers was higher than that of the general population.

● Weekly alcohol drinking quantity was associated with a high likelihood of hypertension.

● Heavy alcohol drinkers (i.e., ≥3 standard drinks per day) had a higher likelihood of high cholesterol than moderate drinker (i.e., ≤2 standard drinks per day).

● Heavy alcohol drinkers (i.e., ≥3 standard drinks per day) had a higher likelihood of worse mental health than non-alcohol drinkers.

Health risk of insufficient leisure-time physical activity:

● Workers who did leisure-time physical activity less than once per week had a higher likelihood of reduced PEFR.

● Insufficient leisure-time physical activity was associated with a higher likelihood of worse physical and mental health.

Health risk of pain:

● Pain was significantly associated with a higher likelihood of worse physical and mental health.

Health risk of inadequate health literacy:

● Inadequate health literacy was associated with lower mental component summary scores.

Health benefits:

- Longer sleep duration could reduce the likelihood of pain.

- Longer sleep duration could increase the likelihood of better physical and mental health. It implies that longer recovery duration between working days could improve workers' physical health.

Longitudinal comparison between the two health profile (2014 and 2019) studies:

- Some lifestyle behaviours and health conditions were slightly improved in the second study: warm up or stretching before work, cool down or stretching after work, doing physical activity, non-smoking, non-hypertension, and no pain,

- Some lifestyle behaviours and health conditions were deteriorated in the second study: inadequate fruit, vegetable, and dairy consumption, excessive alcohol consumption, and high cholesterol.

- No remarkable change between the two health profile studies was shown: over 60% of workers were overweight or obese.

- In the future health profile studies, it is expected that nutrition programme launched would improve dietary habits, and post-work stretching exercise programme would increase the proportion of workers undertaking cooling down or stretching after work and reduce the prevalence of pain.

Recommendation and Way Forward

Based upon the research findings, two health promotion programmes have been developed. The nutrition programme aims to improve healthy diet knowledge/skill/attitude levels of construction workers. The post-work stretching exercise programme aims to improve workers' exercise habits and thus relieve and prevent musculoskeletal pain. The web-based programme (**https://mhealth.eduhk.hk/exercise/**) consists of a whole-body based exercise and pain-spot based exercises. All exercises and the corresponding exercise durations in the web App are demonstrated and showcased by video clips. In addition, regular health promotion workshops are recommended to be held at construction sites. The key topics include: body weight control, alcohol withdrawal, longer sleep hours, active in physical exercise in leisure time (i.e., at least four times per week), and improvement of health literacy.

The current study offers a better understanding on physical and mental health of construction workers. The study has detected some health problems of construction workers and formulated specific health promotion programmes. The two health profile (2014-2016 and 2017-2019) studies provide initial longitudinal information about workers' health status. It is expected to develop a CIC Health Index (Physical-Mental Health Index) in the third health profile project which will be submitted to CIC for consideration upon completion of the current project. The benefits of the provision of an integrated health index are: (1) to establish a database to quantify the health status of construction workers, (2) to offer a benchmark to the whole industry, and (3) to assess workers' health patterns longitudinally.

CONTENTS

1 INTRODUCTION

1.1 Background

The construction workforce in Hong Kong is ageing and in severe shortage. To tackle this problem, it is crucial to retain the existing workforce and at the same time to recruit more new blood by improving our industry's image. However, work-related health problems can cause loss of ability of work and early retirement, which impair the well being of the current workforce and make young people reluctant to join the industry. Therefore, it is of utmost importance to detect health problems of construction workers and develop corresponding preventive measures. The first phase of the study conducted between 2014 and 2016 initially established a database of health profile of construction workers. Based on the first phase of the research conducted by the research team, unhealthy lifestyle could be one of factors inducing cardiovascular problems (Chung *et al.*, 2018). In addition, one quarter of workers suffered musculoskeletal pain, where the most frequent painful parts occurred in the lower back, shoulder, knees, leg, and neck (Yi and Chan, 2016). The key findings of the pilot study revealed that some lifestyle behaviours (e.g., alcohol intake, smoking, inadequate intake of fruit and vegetables) may affect the cardiovascular health, while physical activities may prevent and relieve the musculoskeletal pain symptoms. Towards a more in-depth health assessment at a larger scale, industry-wide level, the current study aims to examine physical and mental health of construction workers and formulate health promotion programmes for improving their quality of life.

1.2 Aims and Objectives

The project aims to establish health profiling for construction workers in Hong Kong with the following objectives:

1) To expand the study from general physical health to a more comprehensive health profiling, covering blood chemistry, lifestyle behaviours, psychological health and health literacy;

2) To establish a database of the general health conditions of construction workers, both physically and psychologically;

3) To evaluate how the demographic variables (e.g. age, gender, education level, work trades, year of work experience, ethnic groups, … etc.) affect the health profiling of construction workers;

4) To identify and recommend intervention measures for improving the physical and psychological health of construction workers;

5) To monitor and evaluate how these intervention measures improve the health conditions of construction workers longitudinally.

1.3 Scope

The scope of the project is to develop a health profiling specific for construction workers for the period 2017-2019 and to improve the well being of construction workers.

2 RESEARCH METHODOLOGY

2.1 Samples and Procedures

The representative sample size was determined as 2389, in which the numbers of rebar workers, concretors, and carpenters were 148, 146, and 149, respectively. This cross-sectional study consists of face-to-face questionnaire survey and medical examinations, which was mainly conducted at construction sites between 11:00 am and 1:00 pm from December 2017 to May 2019. Medical examination was conducted by the Hong Kong Federation of Trade Unions Worker's Medical Clinics (HKFTU) to measure workers' blood pressure and resting heart rate and collect their blood samples for glucose, cholesterol, liver function, uric acid and renal function. The bio-measurement and questionnaire survey were conducted by the Hong Kong Polytechnic University (PolyU) research team. The body weight and height were measured by a weight scale (Tanita HD-662) and a wall-mounted scale, respectively. The peak expiratory flow rate (PEFR) in litres per minute (L/min) was measured by a portable peak flow meter (Mini-WrightTM, Clement Clarke International Ltd.). The questionnaire surveys were administered to assess workers' socio-demographic characteristics, pain experience, lifestyle behaviours, physical and mental health status, and health literacy.

2.2 Statistical Analysis

Descriptive data were presented to describe the distribution of socio-demographic characteristics, lifestyle behaviours, physical health, mental health, and health literacy. They were compared with those collected in the first phase of the study (2014-2016) and the general Hong Kong population when available. Then statistical analyses, including the ANCOVA or logistic regression analysis, were applied, where appropriate, to assess the effects of socio-demographic characteristics, lifestyle behaviours and health literacy on physical health and mental health.

3 RESEARCH FINDINGS AND DISCUSSION

3.1 Socio-demography

Data sets collected as of 30 May is 2566. The numbers of rebar workers, carpenters, and concretors were 129, 121, and 29, respectively. 71.8% of the participants aged 40 years or above. The majorities of them were male workers and were the Hong Kong permanent residents. Over 60% the participants received secondary education. Their mean experiences in construction, current company, and current trade were 13.6 (11.4) yrs, 5.5 (7.5) yrs, and 11.4 (10.8) yrs, respectively.

Their average working hours per day were 9 (1) hrs, and the average working days per week were 6 (0.5) days. Approximately 41% of the participants had over-time (OT) work, with an average of 7 (11) hrs per week. The average number of depending family members supported by the participants was 2 (2). 38.8% of the participants received weekly-paid salary, while the rest got daily-paid salary.

3.2 History of Heat-related Illnesses and Accidents

Nearly 25.3 % of the participants (n=2561) had suffered from heat-related symptoms. The most frequently reported symptom was fatigue (13.3%), followed by profuse sweating (13.0%), dizziness (11.1%), and headache (7.3%). A total of 212 workers reported that they had suffered from construction accidents and injuries (i.e., about 8.3 %, n=2551) in the past year. Nearly 15.5% of the participants (n=746) had suffered from near-miss incidents.

3.3 Bio-measurement

The prevalence of obesity among construction workers was 63.0% (overweight 23.4%, obese 39.6%), while only one quarter of the participants had normal body weight (32.9%). More than one third of the participants had hypertension, while more than one quarter had prehypertension. Only 17.1% of workers had normal blood pressure.

The mean PEFR of male and female workers were 498 (102) and 317 (79), respectively. Most of workers had normal PEFR, while nearly one quarter of workers had reduced PEFR (i.e., less than 80% of normal value of the Hong Kong Chinese population; Ip and Chan-Yeung, 2010). In particular, the prevalence of reduced PEFR was remarkably high among female workers.

3.4 Blood Chemistry

The prevalence of hypertension, diabetes, and high cholesterol were 32.2%, 2.6%, and 9.5%, respectively. Nearly one third of workers had borderline high or high cholesterol. About 10% of workers had borderline high or high blood glucose. The prevalence of impaired renal function was 13.3%. The prevalence of hyperuricaemia was 26.9%. Its prevalence was higher in male workers (31.1%) than in females (12.2%). In terms of liver function, the prevalence of high AST and ALT were 14.1% and 27.5%, respectively. The prevalence of impaired liver function was higher in female workers. To be specific, 31.5% and 21.6% of female workers had high ALT and AST, respectively.

3.5 Lifestyle Behaviours

The prevalence of smoking and exceeding recommended alcohol consumption were 36.2% and 19.3%, respectively. The proportions of daily smokers and daily alcohol drinkers were 33.1% and 8.2%, respectively. 46% of workers did not stretch before work, while 75% did not cool down after work. Over half of workers did not undertake sufficient leisure-time physical activity (i.e., never or less than 1 day per week). Over 90% of workers did not meet the daily fruit and vegetable (i.e., less than 5 servings per day) and daily dairy (i.e., less than 2 servings per day) consumption recommendation.

3.6 Pain

Around 10% of workers reported pain experience. Pain was the most prevalent among the three work trades, followed by building services and general labour. The top ten common pain spots and the top ten worst pain spots are shown in Figure 1.
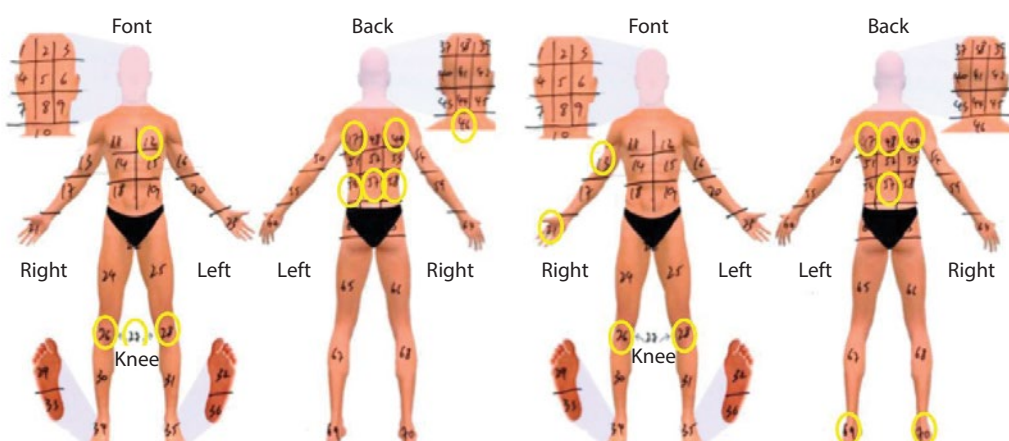

Figure 1 Common (left) and worst (right) pain spots

3.7 Health Literacy

The mean health literacy (HL) score was 35.5 (7.7). The distribution of HL categories was shown in Figure 2. More than one third of the workers had inadequate or problematic health literacy.
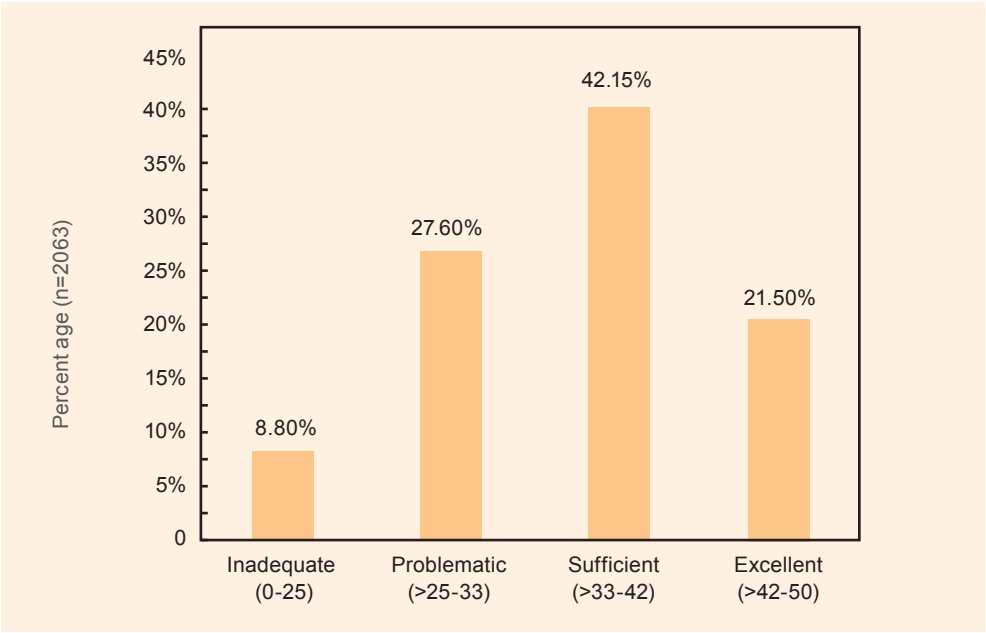

Figure 2 Distribution of HL categories

3.8 Self-rated Physical and Mental Health

Generally, physical component summary (PCS) of construction workers decreased with age, whereas mental component summary (MCS) increased with age (Figure 3). MCS of female workers was significantly higher than that of male workers. The prevalence of male workers with worse MCS was higher than that of female workers (Figure 4). The prevalence of workers with worse PCS was higher in the younger and older age groups, whilst the prevalence of workers with worse MCS was higher in the middle-age groups (Figure 5).
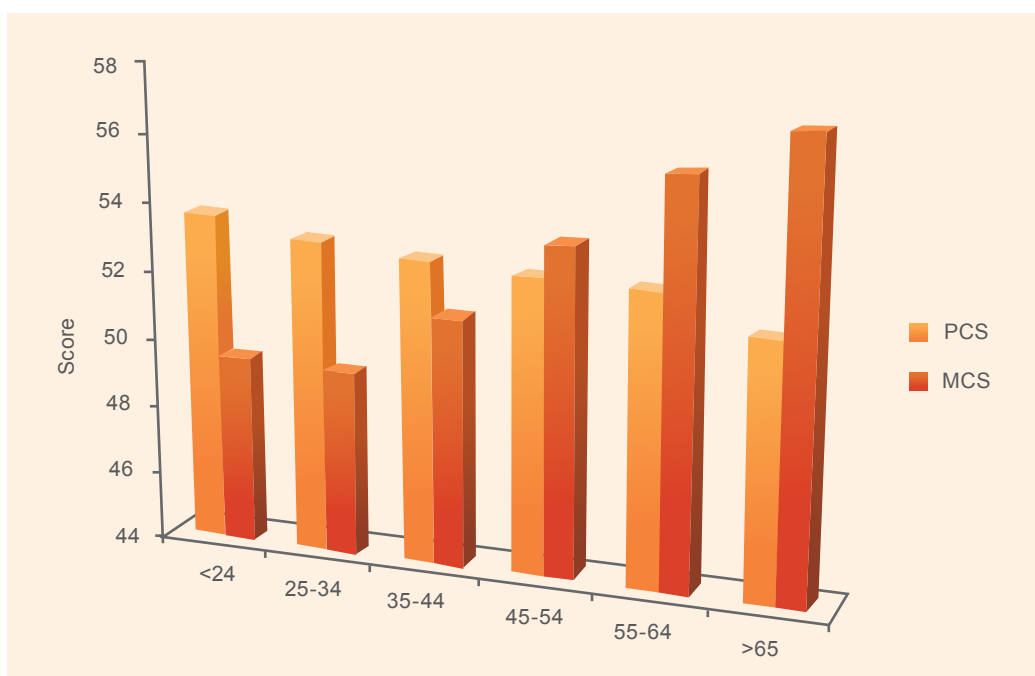
Figure 3 Physical summary score and mental summary score by age groups
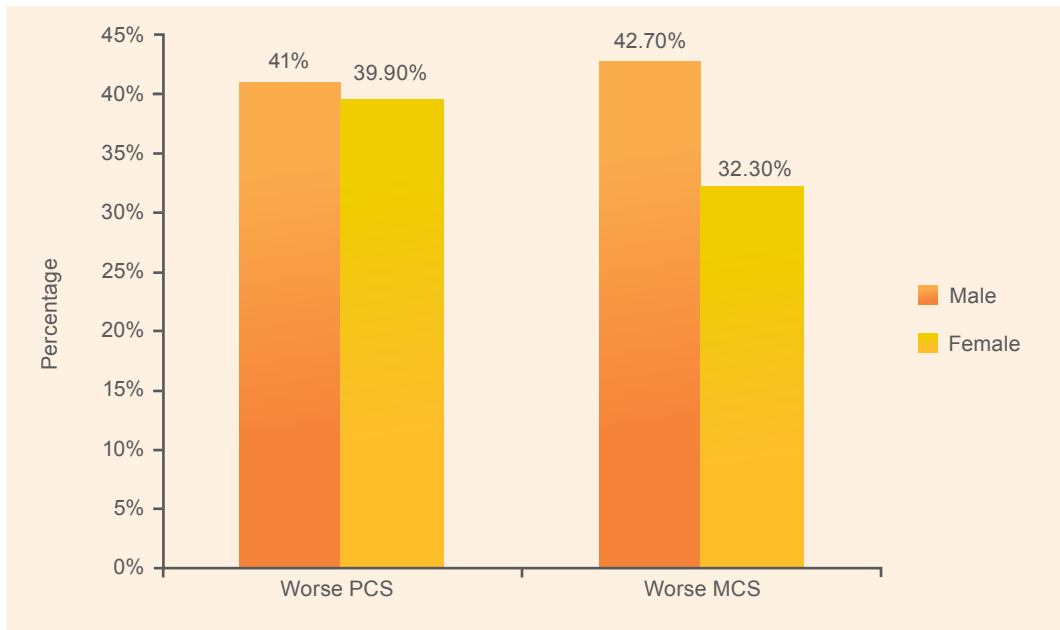
Figure 4 Prevalence of workers with worse health status by gender
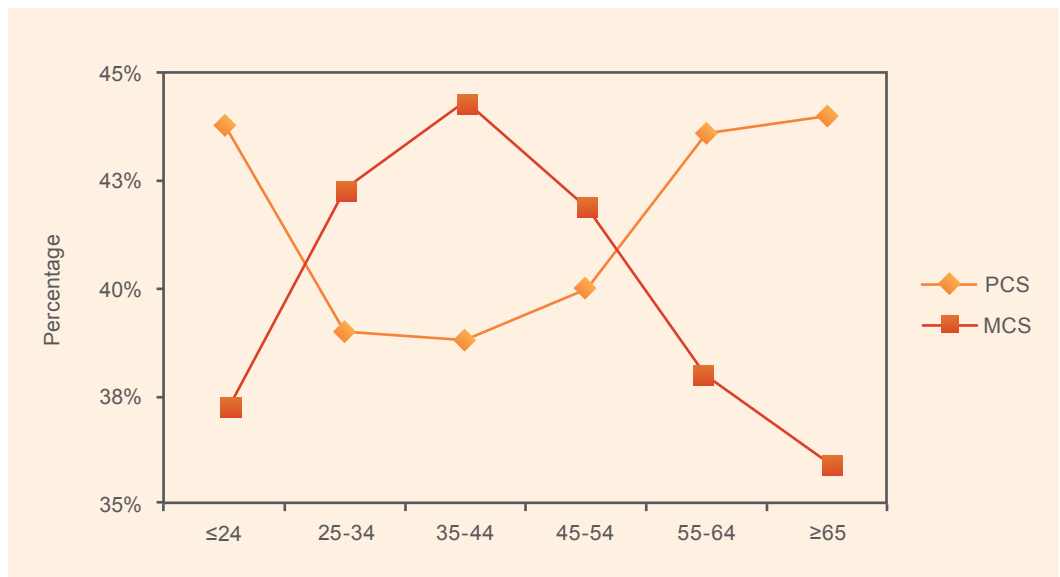
Figure 5 Prevalence of workers with worse health status by age groups

3.9 Trade-specific Analyses

Around half of rebar workers and carpenters were smokers, which was more prevalent than all construction workers. The prevalence of worse PCS in rebar workers (47.8%) and carpenters (42.7%) was higher than that of construction workers in general. Despite this, the prevalence of better MCS in rebar workers (27.5%) and carpenters (37.6%) was higher.

The prevalence of pain among rebar workers and carpenters was higher than that in all construction workers. Figure 6 illustrates the distribution of the top ten worst and common pain spots. Back and knees were the worst pain spots reported by all workers, including carpenters and rebar workers. Notably, carpenters and rebar workers had the worst pain spots on the extremities. Back, knees, and palm of the right hand were the *most common pain spots* reported by all workers, including carpenters and rebar workers. Lower back pain problems of rebar workers were more remarkable. Extremities were also the top common pain spots of carpenters and rebar workers.
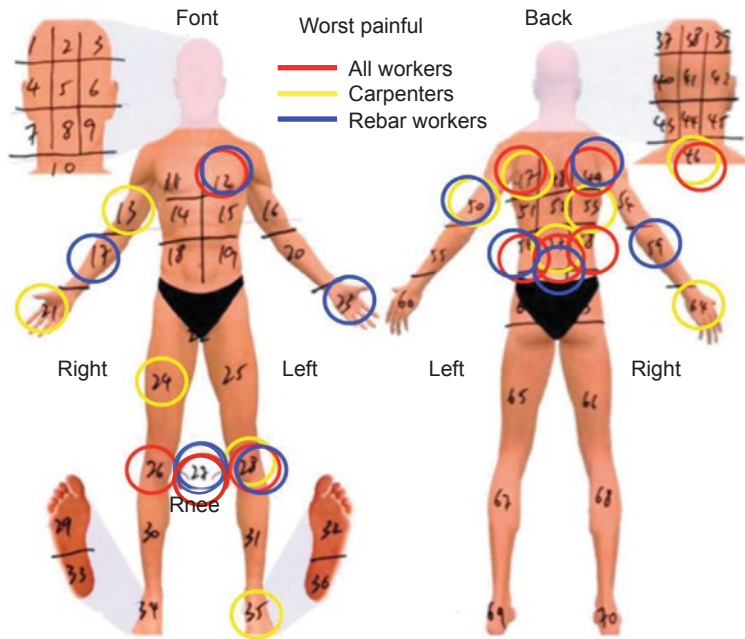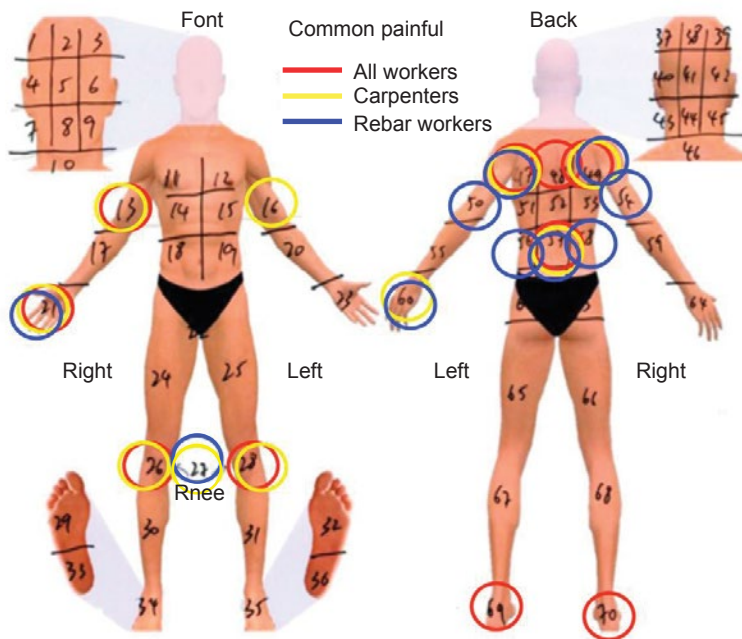
Figure 6(a) Top ten worst pain spots


Figure 6(b) Top ten common pain spots

3.10 Longitudinal Tendency

Figure 7 shows the longitudinal tendencies for lifestyle and health of construction workers. The solid lines in the figure indicate the change in lifestyle and health profile of construction workers from the first phase of the study to the second phase. The dotted lines show the potential trends in the future.

Longitudinal comparison between the two health profile (2014 and 2019) studies,

- Some lifestyle behaviours and health conditions were slightly improved in the second study: warm up or stretching before work, cool down or stretching after work, doing physical activity, non-smoking, non-hypertension, and no pain,

- Some lifestyle behaviours and health conditions were deteriorated in the second study: inadequate fruit, vegetable, and dairy consumption, excessive alcohol consumption, and high cholesterol.

- No remarkable change between the two health profile studies was shown: over 60% of workers were overweight or obese.

It is expected that nutrition programmes launched would improve dietary habits and body weight control, and post-work programmes would increase the proportion of workers undertaking cooling down or stretching after work. Tendency for changes in health literacy, physical and mental health could be plotted in the next phase of the study.
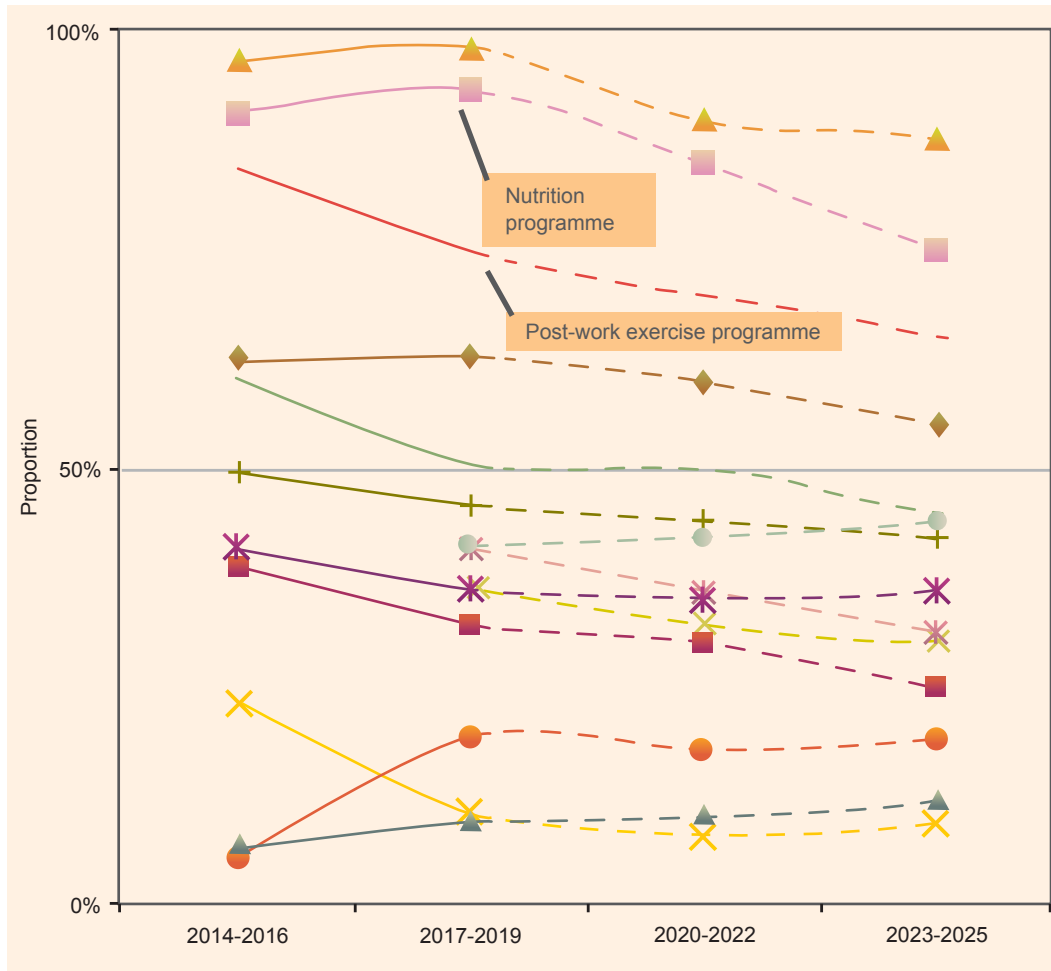
Figure 7 Potential tendencies for health profile of construction workers in Hong Kong

3.11 Comparison with the General Population

Figure 8 shows that the prevalence of obesity among construction workers was higher than the general population. Figure 9 shows that the prevalence of daily smoking among construction workers was higher than the general population. Figure 10 illustrates that the prevalence of non-alcohol drinking among construction workers was higher than the general population, but daily alcohol drinking habit was more prevalent.
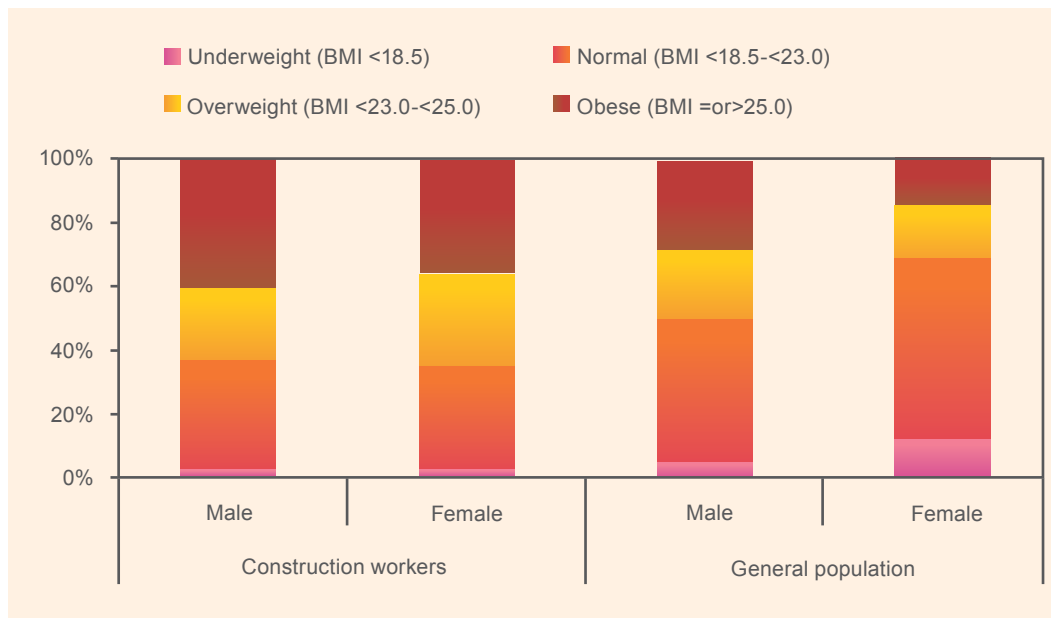
Figure 8 BMI distribution among construction workers and the general population
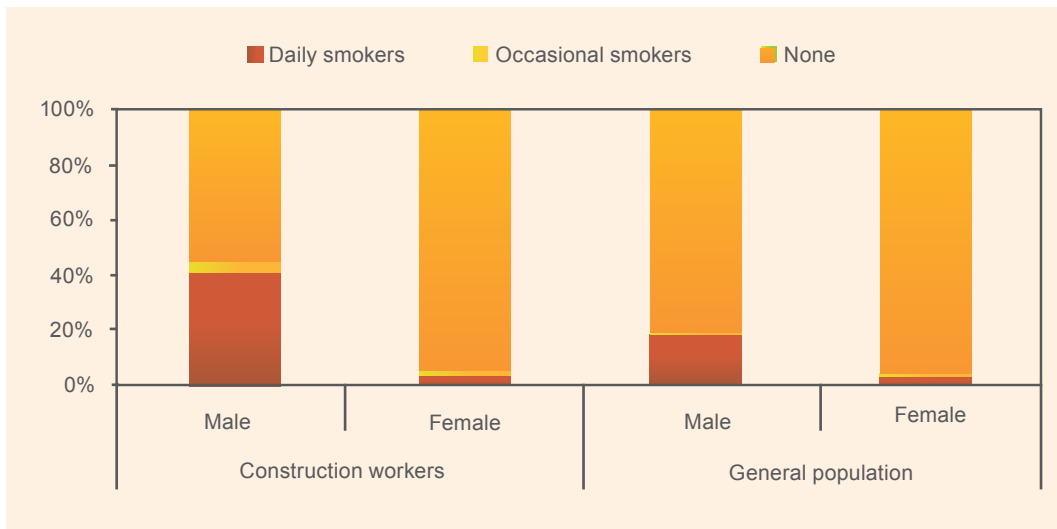
Figure 9 Smoking habits of construction workers and the general population
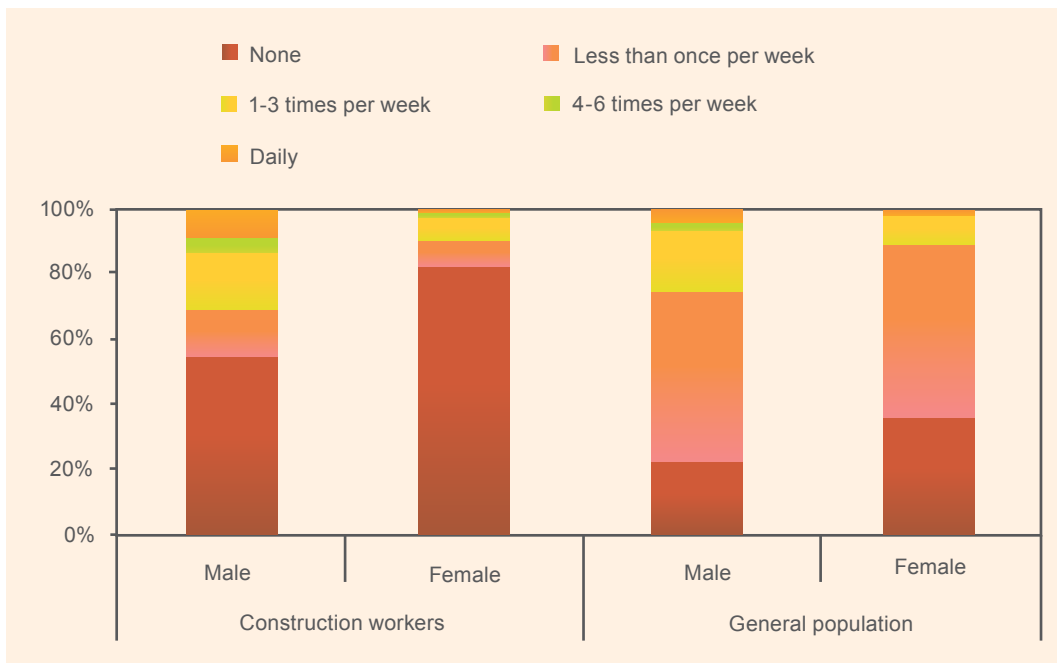
Figure 10 Alcohol drinking habits of among construction workers and the general population

Compared with the general population, male workers had worse health conditions except general health (GH), while female workers were better except vitality (VT) (Figure 11).

Figure 11 Comparison of health components between construction workers and general population

Physical and mental health generally decreased with the increase of age of the general population (Figure 12). However, it increased with age of construction workers except physical functioning (PF). This implies that occupational physical activity may provide some health benefits to construction workers.
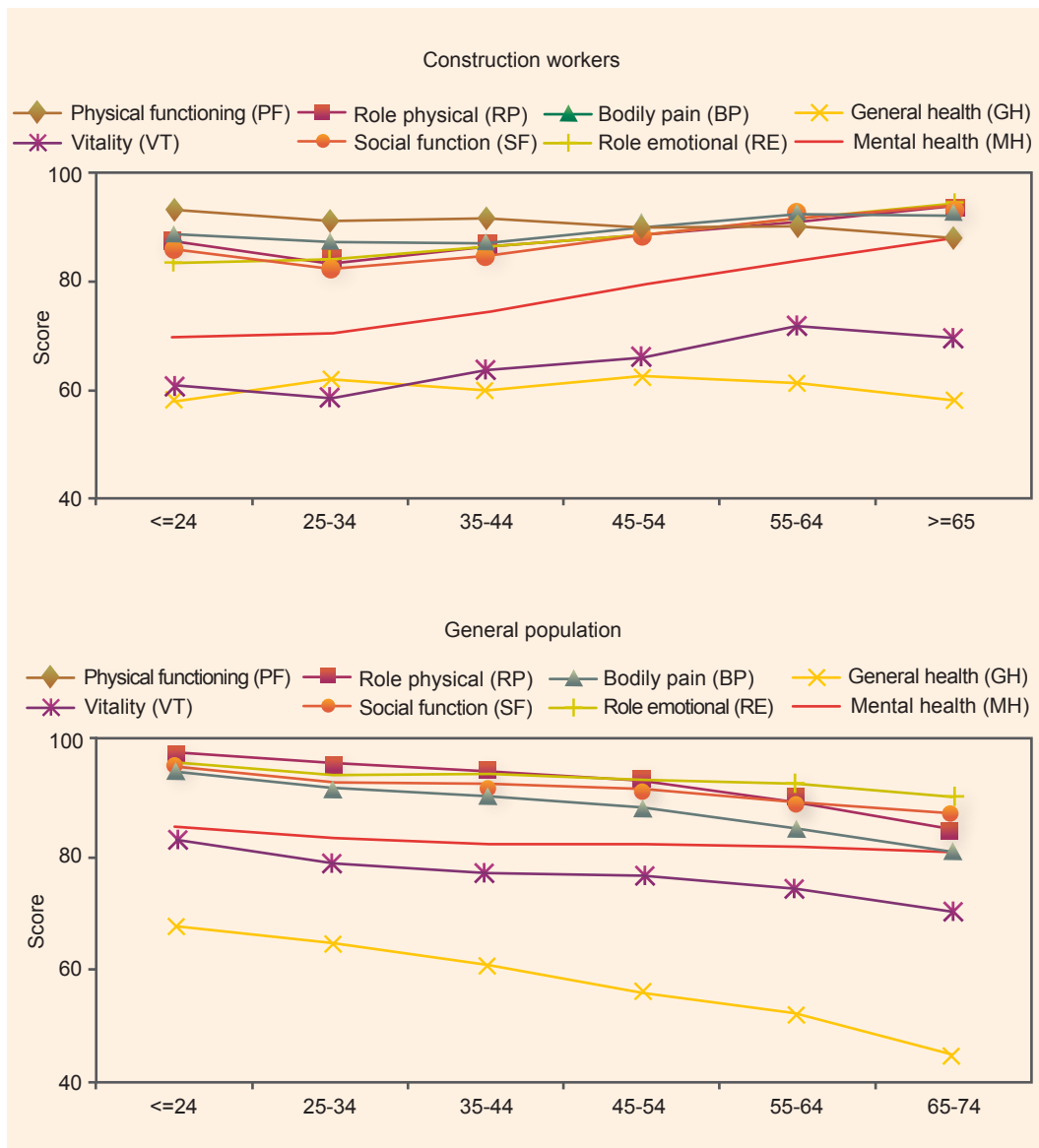

Figure 12 Physical and mental health of construction workers and the general population distributed by age groups

3.12 Factors Affecting Physical and Mental Health

Obesity has long been a risky factor affecting cardiovascular health. The ANCOVA was conducted to evaluate the demographic characteristics, lifestyle habits, and health literacy on workers' BMI (n=1909). After adjusting for age, gender, working experience in construction, sleep hours, it was found that ethnic minorities had significantly larger BMI than the Chinese. Workers engaged in plant/equipment operation had larger BMI than the others, probably because they were used to maintain a sitting posture. Daily smokers had smaller BMI, which was echoed to previous research (Yeh *et al.*, 2010). It should be noted that smoking cessation for heavy smokers might result in weight gain with a higher risk of diabetes (Yeh *et al.*, 2010).

Binary logistic regression analysis was conducted to assess the demographic characteristics and lifestyle habits affecting pain (n=2376). The likelihood of pain increased with working experience in construction but decreased with longer sleep hours.

Multinomial logistic regression analysis was conducted to examine the risky factors affecting blood pressure (n=2233). The likelihood of pre-hypertension increased with BMI, working experience in construction and increased for male constructing workers. The likelihood of hypertension increased with age, BMI, weekly alcohol drinking quantity and significantly increased for male construction workers, but decreased for workers who had normal cholesterol.

Multinomial logistic regression analysis was also performed to identify the risky factors affecting total cholesterol level (n=2296). After controlling for age, BMI and gender, the likelihood of high cholesterol decreased for general labour and building service workers compared with "other" group. It also decreased for moderate drinker (i.e., ≤2 standard drinks per day) compared with heavy drinker (i.e., ≥3 standard drinks per day).

Among the Chinese construction workers (n=2172), the likelihood of reduced PEFR decreased with BMI but increased for females and general labour. It also increased for workers with insufficient leisure-time physical activity (i.e., less than once per week).

The ANCOVA was performed to analyse the relationship between demographic characteristics/lifestyle habits/health literacy and PCS/MCS. After controlling for age, gender, and work experience in construction, workers with pain had significantly lower PCS (n=1829). Lower MCS was significantly associated with inadequate health literacy, higher level of educational attainment (i.e., postsecondary), pain, and insufficient leisure-time physical activity (n=1829).

The results of the binary logistic regression analysis (n=2172) revealed that reduced PEFR, increased BMI and insufficient leisure-time physical activity were significantly associated with a higher likelihood of worse physical health status of the Chinese construction workers (i.e., PCS score was less than the cutoff points), while longer sleep hours and no pain were associated with a significantly higher likelihood of better health status.

The results of the binary logistic regression analysis (n=2153) indicated that gender, educational attainment, sleep duration, pain, alcohol drinking quantity, smoking habits, and frequency of leisure-time physical activity were significantly associated with the odds ratio of worse mental health of the Chinese construction workers (i.e., MCS score was less than the cutoff points). To be specific, the following worker groups had a higher likelihood of worse mental health: male workers, workers with post-secondary educational attainment, workers with pain symptoms, shorter sleep duration, occasional smoking habit (compared with daily smoking), heavy alcohol drinkers (i.e., 3-4 drinks per day) (compared with non-alcohol drinking), and insufficient leisure-time physical activity.

4 RECOMMENDATIONS

4.1 Nutrition Programme

A nutrition workshop was held in April 2018 at the CIC training centre. The objective of the workshop was to enable construction workers to distinguish proper junk food with healthy snack. The programme included snack workshop, role-play, games matching and myth breaking. Two-round of questionnaire surveys were conducted before and after the programme. 36 trainees attended the workshop. 86.1% were male workers. The percentage of workers in age groups 19 yrs old or below, 20-40 yrs old, and 41-59 yrs old were 11.1%, 52.8%, and 36.1%, respectively. To evaluate the effectiveness of the nutrition programme, pre-test and post-test on the following three aspects were carried out in the workshop.

The objectives of the programme are:

- To introduce the components of balanced diet (knowledge level)

- To educate the healthy food choices and the nutrients (knowledge level)

- To promote the natural seasoning and healthy cooking method (knowledge level)

- To choose relatively healthier food items in the menu (skill level)

- To achieve 2 (fruit) + 3 (vegetables) daily (attitudes level)

Upon the completion of the workshop, the nutrition programme could be effective in improving workers' healthy eating knowledge/skill/attitude levels.

Workers' Healthy Eating Knowledge Level

Healthy eating knowledge was improved after the nutrition education:

● More workers (31.4%) were able to identify balanced diet (3 carbohydrates + 2 vegetables + 1 meat);

● More workers were able to identify junk food (60.0%) and healthy snack (45.7%).

Workers' Healthy Eating Skill Level

After the nutrition programme, more workers (94.4%) were able to choose less fat and sodium meal in the menu.

Workers' Healthy Eating Attitude Level

After the nutrition education, more workers were willingness to

● Eat 3 servings of vegetables every day;

● Eat 2 servings of fruit every day.

4.2 Exercise Programme

The results showed that workers commonly had ignored their pain (34.4%) or intake pain killers (24.2%). Few workers chose pain management methods that require a higher cost, such as physical therapy (5.1%) and acupuncture (5.1%). The post-work stretching exercise programme was developed on the website (**https://mhealth.eduhk.hk/exercise/**). It provides a cost-effective and convenient platform for workers to improve their exercise habits and thus relieve and prevent musculoskeletal pain.

The web app contains 2 parts. The first part consists of whole-body stretching exercises which takes 5 minutes in total. Although cool-down exercises are helpful to relax their tensed muscles after a whole day work, most of the workers (75.0%) did not have such a habit. The web-based exercise programme is easy, timesaving, and convenient to access by construction workers. All workers are recommended to use it to cool down anywhere and anytime after work. The second part consists of a series of stretching exercises based on pain spots. Workers can click the pain spot that they are exactly suffering from and the corresponding exercise video will be presented. All exercises and the corresponding exercise durations in the web app are demonstrated and showcased by video clips. The web App is ready to use. Evaluation on the effectiveness of the exercise programme in reducing the prevalence of pain will be conducted after trial.

4.3 Other Health Promotion Programmes

Last but not the least, it is recommended to launch health education programmes by holding regular workshops at construction sites. Health promotion programmes should focus on the following aspects.

- Body weight control
- Alcohol withdrawal
- Longer sleep hours
- Active in physical exercise in leisure time (i.e., at least four times per week)
- Improvement of health literacy

4.4 Directions for Future Research

The two phases of health profiling studies have developed a database for the Hong Kong construction workers, which can improve their well being progressively and thus facilitate a sustainable construction industry. Future research is recommended to improve some measurement methods, including but not limited to the historical smoking habits, alcohol consumption assessed by using the Alcohol Use Disorders Identification Test (AUDIT). To have an in-depth understanding of workers' lung function, the exposure time to dusts (e.g., PM 2.5), exposure frequency, the type of dusts, and the concentration and size of airborne dust in the breathing zone should be assessed further.

Health measurements can assist in the assessment of need of health care provision and the evaluation of its effectiveness and efficiency (Hunt and McEwen, 1980). Morbidity rates (e.g., absence from work, disability, diseases) are the most widely used health indicators, while personal habits such as smoking, diet and exercise play a role in changing health patterns (Hunt and McEwen, 1980). To integrate these health indicators, it is anticipated to develop a CIC Health Index (Physical-Mental health index) in the third health profile project which will be submitted to CIC for consideration upon completion of the current project (Figure 13). The benefits of the provision of an integrated health index are: (1) to establish a database to quantify the health status of construction workers, (2) to offer a benchmark to the whole industry, and (3) to assess workers' health patterns longitudinally.
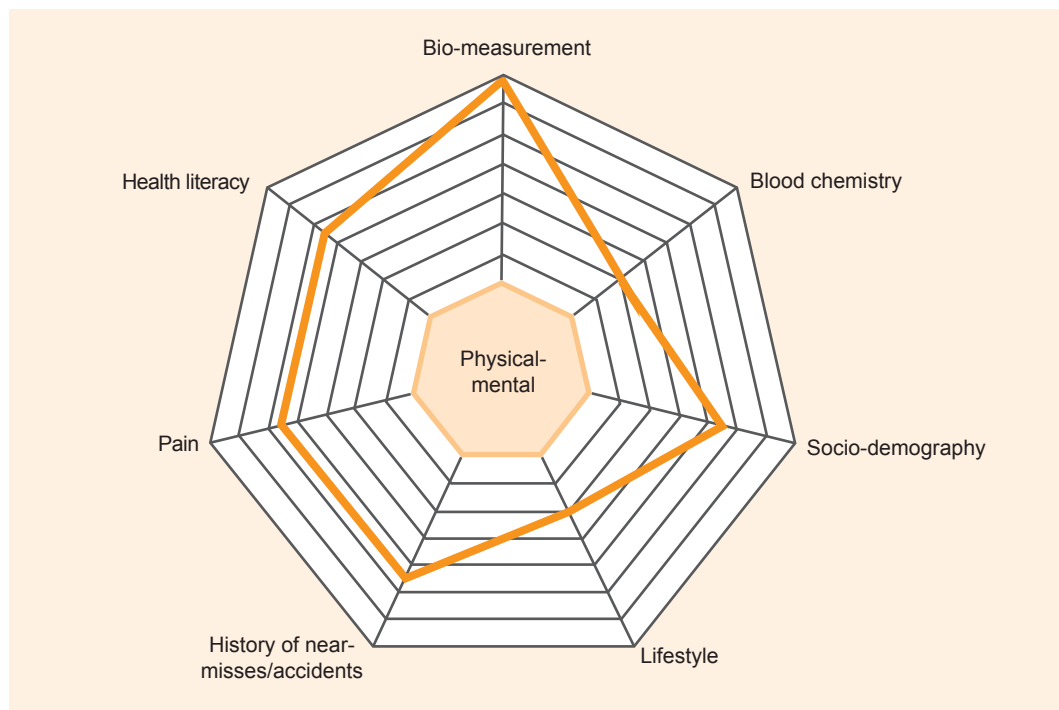

Figure 13 Paradigm of the proposed CIC Health Index

5 REFERENCES

Chung, J., Wong, B., Yan, V., Chung, L., So, H. and Chan, A. (2018). Cardiovascular health of construction workers in Hong Kong: A cross-sectional study. International Journal of Environmental Research and Public Health, **15**(6), 1251.

Department of Health (Hong Kong Special Administrative Region of China. Statistics on behavioural risk factors. Centre for Health Protection, Retrieved from: https://www.chp.gov.hk/en/static/24016.html. (accessed 12 Mar 2019)

Department of Health (Hong Kong Special Administrative Region of China. (2017). Report of Population Health Survey 2014/2015. Surveillance and Epidemiology Branch, Centre for Health Protection.

Hunt, S. M. and McEwen, J. (1980). The development of a subjective health indicator. Sociology of Health & Illness, **2**(3), 231-246.

Ip, M.S.M., Chan-Yeung, M. M. W. (2010). Lung function reference values in Chinese in Hong Kong. Hong Kong Lung foundation Ltd., Retrieved from: http://www.hklf.org/uploads/files/2015/Lung_Function_Reference_Value.pdf

Yeh, H. C., Duncan, B. B., Schmidt, M. I., Wang, N. Y. and Brancati, F. L. (2010). Smoking, smoking cessation, and the risk for type 2 diabetes mellitus: a cohort study. Annals of Internal Medicine, **152**(1), 10.

Yi, W. and Chan, A. (2016) Health profile of construction workers in Hong Kong. International Journal of Environmental Research and Public Health, **13**(12), 1232.

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