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香港理工大學

The Health and Social Impact of the Green Deck Project on the Population Living in the Neighborhood

(First Interim Report)

By Prof. Frances Wong

Co-investigators: Dr David Ip & Dr Fiona Wong

Faculty of Health and Social Sciences

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Living in the Neighborhood

Prof. Frances Wong, Associate Dean and Professor, FHSS
Dr. David Ip, Associate Head, APSS
Dr. Fiona Wong, Research Fellow, FHSS
Dr. Lin Yang, Assistant Professor, SN

Executive Summary

The aim of this study is to examine the health and social impact of the Green Deck on the population living in the neighborhood. Residents living in the nine constituency areas involved in the proposed development of the Green Deck and pedestrian and bicycle network are sampled and assessed in the study. These nine constituency areas include: King's Park, Tsim Sha Tsui East, Whampoa East, Whampoa West, Hung Hom Bay, Hung Hom, Ka Wai, Oi Man, and Oi Chun.

We developed a survey questionnaire for PolyU's public exhibition on the Green Deck to solicit views from visitors about their satisfaction levels on various aspects on the environment and the accessibility of different leisure amenities and health and social care services in the Green Deck's immediate neighborhoods. During the exhibition period, a total of 1,010 people completed the survey, of whom 16.5% were residents of the constituency areas. Over 40% of all respondents indicated they were dissatisfied with the neighborhoods' air quality, noise level, and greenery. Over 30% found the recreational and sports facilities, and health education and promotions were not easy to reach. When comparing the responses of residents with those of respondents who lived in other districts, significantly more residents (28.5%) reported that they were dissatisfied with their health status than non-residents (21.9%).

A community diagnosis by conducting a more comprehensive questionnaire survey with residents was carried out in July and August last year. In addition to the views of Green Deck, open spaces and environment in the neighborhoods, residents' quality of life (QOL) was assessed by the validated WHOQOL-BREF (Hong Kong version) and a description of the health and social characteristics of the population was obtained according to the community diagnoses guidelines developed by WHO. Eligible residents living in the nine constituency areas were approached by the trained interviewers and invited to complete a 99-items questionnaire. Among the 317 residents who completed the questionnaire, 43.8% were male, 70.1% aged 25-64 years, 70% had been living in the neighborhoods for at least 5 years and 30.6% reported an individual monthly income more than the median of the monthly wages in Hong Kong in 2011 (HKD14,800). When they were asked the areas which needed to be "greener", the top three were Hung Hom Cross Harbour Tunnel Toll Plaza (49.2%), Hung Hom MTR Station and Hong Kong Coliseum (44.5%), and Whampoa & Hung Hom (43.8%). Most people indicated that forest and botanical gardens (49.8%), tame grassland

(38.5%) and sports and recreation facilities (38.5%) were the most needed in the neighborhoods.

The WHOQOL-BREF assesses QOL in four domains (Physical, Psychological, Social relationship and Environmental). The total score for each domain ranges from 0 – 100, with low scores indicating poor QOL. The mean domain scores of our respondents were in the range of 61.98 – 70.83. If 1 SD below the mean is used as the cut-off criteria for low QOL, we estimated that 18.9%, 14.5%, 10.4%, and 16.7% of the residents had a low physical, psychological, social relationship and environmental QOL, respectively. In order to identify factors which had significant correlations with the four QOL domains, multivariate analyses were performed. Presence of chronic illness, emotion, psychological and environmental QOL and general health were the predictors that contributed significantly to the physical health QOL. People who did not smoke, had better emotion, more satisfied with their relationships with other people, and better physical and environmental QOL, also had a significantly better psychological health. For social relationship QOL, those who were never married, married or widowed, more satisfied with their relationship with other people, with better psychological QOL and overall QOL, had significantly better social relationship QOL. In additional to their living districts, those who reported having a higher individual monthly income, who were more satisfied with the environment and open space, with better physical health, psychological and social relationship QOL and overall QOL, were found to have significantly better environmental QOL. For physical activity, most of the participants were identified as moderate physical activity level (55.8%), however, one quarter of the participants were identified as low activity level or no activity was reported (25.2%).

Environmental QOL was one of the significant determinants of the residents' physical health QOL and psychological QOL. Environmental QOL comprises physical conditions (pollution and temperature), safety and recreational facilities of the living environment. It is possible that enhancing the living environment by improving air quality and ventilation, and developing accessible recreational facilities can positively influence residents' QOL.

Introduction

Green space planning has wider public health benefits than previously recognized. The effects of green space in the living environment on health, well-being and social safety are always people's concerns. Increased physical activity, psychological restoration and stress reduction have been proposed as possible mechanisms for the health benefits of green space (Groenewegen et al 2006; Taylor et al 1998). Land-use mix which blends a combination of residential, commercial, cultural or institutional use has been found to have a strong association with physical activity and body weight. People living in areas with more commercial and other non-residential land use tended to walk more to accomplish their daily activities and therefore were less likely to be obese (Frank et al 2004; Yang wt al 2012; Yen wt al 2009). People tend to be more satisfied with their neighborhood if there are more green spaces around, more vegetation and better air quality (Honold et al 2012). Green space is also associated with more social contacts and cohesion, and neighborhood trust (Kweon et al 1998).

The creation of a healthy urban environment is a major policy priority (Dye 2008). However, policy makers tend to view green environment as a luxury good rather than a basic necessity, especially in a densely populated city like Hong Kong. The Green Deck proposed by The Hong Kong Polytechnic University would cover 43,000 square meters with connections from the surrounding areas (Excel@PolyU 2014). It is proposed to be developed over the existing Toll Plaza and the Tunnel Portal of Hung Hom Cross Harbour Tunnel in order to improve the environment in the areas.

Residents in the neighborhood, people working or studying in these areas and commuters are the main users of the Green Deck, their perspectives are important in the creation of a healthy and green environment. Nine constituency areas will be involved in the proposed development of the Green Deck and pedestrian and bicycle network. According to the district council, these areas include Whampoa East (G16), Whampoa West (G17), Hung Hom Bay (G18), Hung Hom (G19), Ka Wai (G20), Oi Man (G21), Oi Chun(G22), King's Park (E16), and Tsim Sha Tsui East (E17) (Appendices 1a and 1b). Community leaders and Government officials are also our target populations in this project.

There are four phases in this study: (1) Reviewing and analyzing relevant government and NGO data; (2) Community diagnosis; (3) Needs gap assessment; and (4) Estimating the potential impact of the Green Deck. We have completed (1) part of the data and information retrieval, (2) a questionnaire survey conducted at the 10-day Fest Green Deck Exhibition, and (3) a community diagnosis using a questionnaire survey approach.

Aim

To study the health and social impact of a green environment on the population living in the neighborhood.

Objectives

To conduct a community diagnosis to identify the characteristics of the population, and the factors which influence their physical and mental health.

To conduct a needs gap assessment to identify the health, social and environmental needs of the population.

To prioritize the potential impact of the Green Deck on the population's physical and mental health and social life.

1. **Reviewing government and relevant information on the socio-demographics, health and social services, recreational and cultural facilities in the nine constituency areas**

The 2011 Population Census data were studied. Data were collected from 30 June to 2 August 2011 by the Census and Statistics Department of the HKSAR Government. A total of 41 data topics were drawn up and they could be categorized into demographic and social characteristics, educational characteristics, internal migration characteristics, economic characteristics, housing characteristics and household characteristics. These data help understanding the background of the area studied and the characteristics of the population. Availabilities of hospitals and clinics and the health services provided, information of the environment and infrastructures like the types of recreational, leisure and cultural facilities currently existing in the area were obtained.

This process is ongoing. Other data such as healthcare and social services utilizations, reports on health behaviors and social and environmental issues will be obtained from the Hospital Authority, Department of Health, Social and Welfare Department, District Councils and /or non-government organizations. Comparisons between the existing services and facilities and the needs of the population will be performed in order to assist the planning and development of a green and healthy environment.

2. **A questionnaire survey conducted at the 10-day Fest Green Deck Exhibition**

Methods

An exhibition on green deck was held in the university during Oct 2014 – Feb 2015. A self-administered questionnaire written in Chinese and English was distributed to visitors of the exhibition. Besides students and staff from the university, students from secondary schools, visitors from other universities, group tours and general public also visited the exhibition. Answering the questionnaire was voluntary. The questionnaire was anonymous and visitors were asked to put the completed questionnaire in a box before they left the exhibition. People who were unable to read Chinese or English, or had difficulties in writing were excluded.

The questionnaire was designed based on the guidelines of healthy cities developed by the WHO. It was a structured questionnaire with 9 items to measure (1) satisfactory level on air quality, noise level, light pollution, environmental hygiene and greening in the studied districts, (2) accessibility of parks, gardens and open space, recreation and sports facilities, pedestrianisation, healthcare services, child care services, elderly services, and health education and promotion in the studied districts, (3)self-perceived quality of life and health status, and exercise level and (4) socio-demographic information (sex, age, living district and education). Visitors living in other districts also rated their satisfactory level of the environment, and accessibility of amenities and services in the studied districts, however, analyses of these questions were excluded.

Data analysis was performed using SPSS version 21. Descriptive statistics were reported by mean ± standard deviation or percentage, as appropriate. Differences in perceived QOL and health status and exercise level between people living in different living districts were analysed using univariate analysis. For people living in the neighborhood, associations of perceived QOL, health status and

exercise level with their views on environment, amenities and services were evaluated using multivariate analysis.

Results

A total of 1010 people completed the questionnaire. 16.5% were living in the studied districts, including Hung Hom, Oi Man, Whampoa, Tsim Sha Tsui and King's Park. 48.6% were male, 43.7% were 18 years old or below, and 56.1% had attained a university level (Table 1).

Table 1 Socio-demographic and self-reported health information of the 1010 visitors.

	N=1010
Living district	
Areas surrounding the University	165 (16.5%)
Other districts	837 (83.5%)
Missing	8
Sex	
Male	491 (48.7%)
Female	517 (51.3%)
Missing	2
Age (yrs)	
18 or below	440 (43.7%)
19 – 25	383 (38.0%)
26 – 30	84 (8.3%)
31 – 40	63 (6.3%)
41 or above	37 (3.7%)
Missing	3
Education	
Primary school or below	11 (1.1%)
Secondary school	354 (35.3%)
Diploma / Certificate	75 (7.5%)
University degree	562 (56.1%)
Missing	8
Quality of life	
Very poor / Poor	108 (10.8%)
Fair	553 (55.2%)
Good / Very good	340 (34.0%)
Missing	9
Health status	
Very dissatisfied/dissatisfied	230 (23.0%)
Fair	542 (54.15)
Satisfied / Very satisfied	229 (22.9%)
Missing	9
Exercise	
No exercise	275 (27.5%)
≥30 mins for <3days/wk	546 (54.5%)
≥30 mins for ≥3days/wk	180 (18.0%)
Missing	9

Among those 165 people who lived in the studied districts, about half were dissatisfied with the greening (52.8%), noise level (48.5%) and air quality (48.2%) in their neighborhood (Figure 1). Over 30% stated that recreation and sports facilities (33.7%) and parks, garden and open space (32.3%) were not easy to reach in their neighbourhood. For health and social services, they found that elderly services (43.2%) were the most difficult to reach, followed by childcare services (36.4%), health education and promotion (35.4%) and healthcare services (32.1%) (Figure 2).

Figure 1 Satisfactory level of the living environment of people living in the studied areas
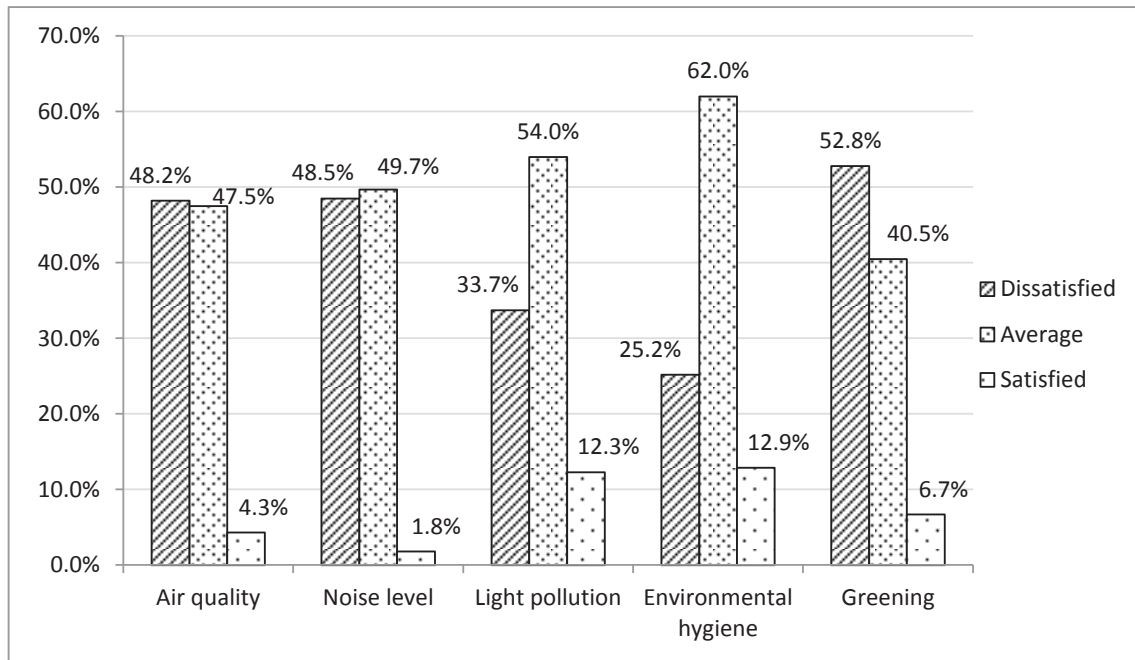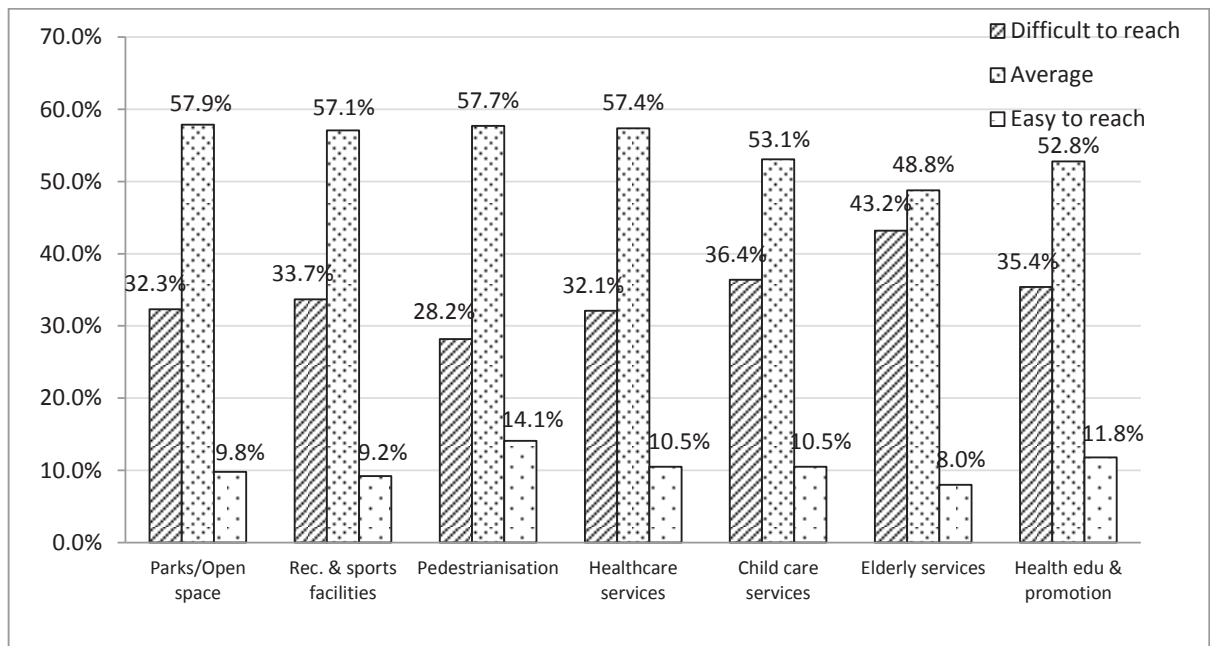

Figure 2 Accessibility of amenities and services of people living in the studied areas

When we compared views of people living the neighborhood and those living in other districts using Chi-square tests, people living in the neighborhood were significantly more dissatisfied with the noise level (48.5% vs 32.8%; P=0.016) and greening (52.8% vs 43.5%; P = 0.029) of the neighborhood. They also found that parks, gardens, open space (32.3% vs 29.3%; P = 0.005), and recreation and sports facilities were significantly more difficult to reach (33.7% vs 30.7%; P = 0.037). People living in the neighborhood were also significantly more dissatisfied with their health status (28.5% vs 21.9%; P = 0.019). There was no significant difference on their self-reported quality of life and exercise level (Table 2).

Table 2 Comparing views of people living in the neighborhood and other districts

	Living in Hung Hom, Oi Man, Whampoa, TST or King's Park	Living in other districts	Chi-square (χ^2)	P
Noise Level				
Dissatisfied	79 (48.5%)	357 (42.8%)	8.275	0.016
Average	81 (49.7%)	412 (49.3%)		
Satisfied	3 (1.8%)	66 (7.9%)		
Greening				
Dissatisfied	86 (52.8%)	363 (43.5%)	7.050	0.029
Average	66 (40.5%)	365 (43.8%)		
Satisfied	11 (6.7%)	106 (12.7%)		
Parks/Gardens/Open Space				
Not easy to reach	53 (32.3%)	244 (29.3%)	10.452	0.005
Average	95 (57.9%)	419 (50.2%)		
Easy to reach	16 (9.8%)	171 (20.5%)		
Recreation & Sports Facilities				
Not easy to reach	55 (33.7%)	256 (30.7%)	6.614	0.037
Average	93 (57.1%)	434 (52.0%)		
Easy to reach	15 (9.2%)	144 (17.3%)		
Self-reported Health Status				
Dissatisfied	47 (28.5%)	183 (21.9%)	7.942	0.019
Fair	93 (56.4%)	449 (53.7%)		
Satisfied	25 (15.2%)	204 (24.4%)		

When comparing between people living in the neighborhood and those living in other districts, people living in the neighborhood were significantly more dissatisfied with their self-perceived health status (χ^2 = 7.94, P= 0.019). No significant difference was found in self-perceived QOL (χ^2 = 2.17, P= 0.339) and exercise level (χ^2 = 3.91, P= 0.141).

3. A community diagnosis using a questionnaire survey approach

Methods

To understand the needs and gaps of the community, WHO has suggested guidelines for conducting a community diagnosis. Health and social indicators like health status, lifestyles, living environment, public health services and family and community relationship are suggested to be included in the assessment. Our questionnaire was developed based on the WHO guidelines and aimed at assessing resident's quality of life, satisfactory level on environment, open space, transportation and social services, views on features and facilities needed to improve greening, and health and socio-demographic profiles. To assess quality of life, the validated WHOQOL-BREF (Hong Kong version) was used. It consists of 24 items to assess the perception of quality of life in four domains, including physical health, psychological, social relationships and environment (38, 39); two items on overall QOL and general health and two national items. All items are rated in a five-point Likert scale. For facets incorporated within the four domains, please refer to Table 3.

Table 3 Facets in the four QOL domains.

Domain	Facets incorporated within domains
1. Physical health	Activities of daily living Dependence on medicinal substances and medical aids Energy and fatigue Mobility Pain and discomfort Sleep and rest Work Capacity
2. Psychological	Bodily image and appearance Negative feelings Positive feelings Self-esteem Spirituality / Religion / Personal beliefs Thinking, learning, memory and concentration
3. Social relationships	Personal relationships Social support Sexual activity
4. Environment	Financial resources Freedom, physical safety and security Health and social care: accessibility and quality Home environment Opportunities for acquiring new information and skills Participation in and opportunities for recreation / leisure activities Physical environment (pollution / noise / traffic / climate) Transport

Reliability of the whole questionnaire was evaluated using a test-retest method. Depending on the characteristics of the question items, Cohen's weighted kappa were used for nominal variables and intra-class correlations were used for ordinal and continuous variables. Results showed that all nominal variables had a moderate to perfect reliability with kappa statistics ranged from 0.50 – 1.00, and ordinal and continuous variables showed a fair to excellent reliability with ICC values ranged from 0.41 – 1.00, except that one item showed an ICC value of 0.35. According to literature, a kappa from 0.41 to 1.00 indicates moderate to perfect agreement, and an ICC value from 0.40 to 1.00 indicates fair to excellent agreement, therefore, the reliability of the questionnaire was acceptable (Hallgren 2012).

All residents living in the nine constituency areas for at least 90 days were the target population of the community diagnosis. Trained interviewers were sent to the nine areas and approached eligible subjects using a convenience sampling method. The purpose and procedures of the questionnaire survey were explained. An informed consent was signed if they agreed to answer the questionnaire. Subjects who were cognitively impaired or unable to communicate effectively in Cantonese, Mandarin or English were excluded.

Results

Socio-demographics

A total of 317 residents were successfully interviewed. Data analysis was performed using SPSS version 21. The number of residents from each of the nine constituency areas varied from 12-53. The majority were Chinese (99.1%), 43.8% were male, 60.3% were married and the mean age was 45.12 years. 46.4% had been living in the studied areas for more than 10 years and 45.9% were living in a self-owned private permanent housing. 33.4% had attained a university level and 69.4% reported an individual monthly income of ≤ HK$14800, the median in 2011 (Table 4).

Views on greening in the neighborhood

Over 40% of the residents interviewed believed that the tunnel and toll plaza (49.2%), Hung Hom MTR station & Hong Kong Coliseum (44.5%) and Whampoa and Hung Hom areas (43.8%) needed to be greener (Figure 3). When they were asked about the facilities and amenities needed in those areas, approximately half of them suggested botanical gardens (50.2%), followed by grassland (38.5%) and sports and recreation facilities (38.5%) (Figure 4).

Table 4 Socio-demographic characteristics of the participants (N=317)

	n (%)	Mean ± SD
Sex		
Male	139 (43.8%)	
Female	178 (56.2%)	
Age (years)		
18-24	48 (15.1%)	45.12 ± 17.28
25-44	107 (33.8%)	
45-64	115 (36.3%)	
65 or above	47 (14.8%)	
Ethnic group		
Chinese	313 (99.1%)	
Indonesian	1 (0.3%)	
Filipino	1 (0.3%)	
Japanese	1 (0.3%)	
Missing	*1*	
Living district		
TST East	12 (3.8%)	
King's Park	28 (8.8%)	
Whampoa East	48 (15.1%)	
Whampoa West	40 (12.6%)	
Hunghom Bay	40 (12.6%)	
Hunghom	49 (15.5%)	
Ka Wai	17 (5.4%)	
Oi Man	53 (16.7%)	
Oi Chun	30 (9.5%)	
Number of years living in the district		
5 years or less	95 (30.0%)	14.94 ± 13.09
6-10	75 (23.7%)	
11-20	64 (20.2%)	
21 years or more	83 (26.2%)	
Type of housing		
Self-owned_Private premanant housing	145 (45.9%)	
Self-owned_Subsidized home ownership housing	23 (7.3%)	
Self-owned_Others	3 (0.9%)	
Rental_Private permanant housing	34 (10.8%)	
Rental_Public rental housing	87 (27.5%)	
Rental_Room	19 (6.0%)	
Rental_Bed	1 (0.3%)	
Rental_Others	2 (0.6%)	
Provided by employer/Rent free_Private permanant housing	1 (0.3%)	
Provided by employer/Rent free_Room	1 (0.3%)	
Missing	*1*	
Education		
Primary school or below	61 (19.2%)	
Secondary/Sixth form	117 (36.9%)	
Diploma/Cert	33 (10.4%)	

University degree	106 (33.4%)
Occupation	
Managers and administrators	26 (8.2%)
Professionals	44 (13.9%)
Associate professionals	9 (2.8%)
Clerical support workers	31 (9.8%)
Service and sales workers	29 (9.1%)
Craft and related workers	3 (0.9%)
Plant and machine operators and assemblers	3 (0.9%)
Elementary occupations	16 (5.0%)
Unemployed	5 (1.6%)
Homemakers	38 (12.0%)
Students	38 (12.0%)
Retired	67 (21.1%)
Others	8 (2.5%)
Individual monthly income	
$0	78 (24.6%)
$10500 or below	83 (26.2%)
$10501 - 14800	59 (18.6%)
$14801 - 23000	45 (14.2%)
$23001 or above	52 16.4%)
Marital status	
Never married	110 (34.7%)
Married	191 (60.3%)
Widowed	11 (3.5%)
Divorced	3 (0.9%)
Separated	2 (0.6%)
Living with	
Alone	21 (6.6%)
Families	276 (87.1%)
Friends	19 (6.0%)
Others	1 (0.3%)
Household size	
1	21 (6.6%)
2	72 (22.8%)
3	91 (28.8%)
4	93 (29.4%)
5	27 (8.5%)
6	7 (2.2%)
7	3 (0.9%)
8	2 (0.6%)
Missing	*1*

Figure 3 Views on districts/areas needed to be "greener" (N=317)

	Tunnel & toll plaza	PolyU & Tsim Sha Tsui	Whampoa & Hunghom	Oi Man & Oi Chun	Tsim Sha Tsui East	Hung Hom MTR station & HK Coliseum	Others
	49.2%	39.7%	43.8%	28.1%	31.5%	44.5%	0.6%
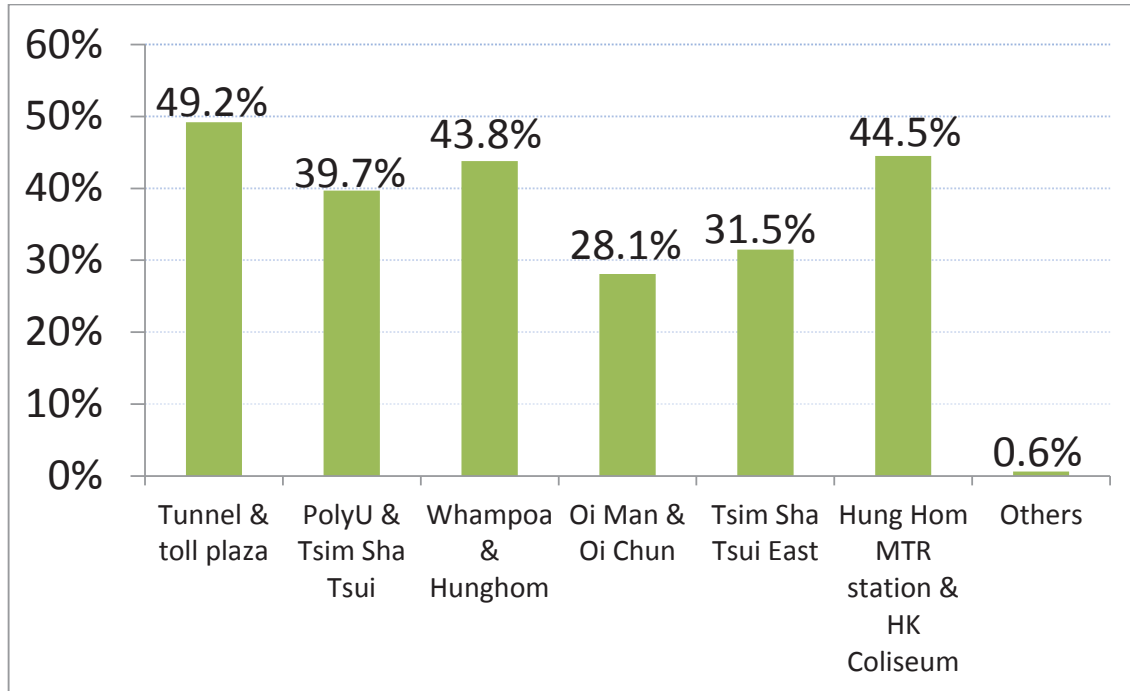
*Respondents were allowed to choose more than one answer.

Figure 4 Views on facilities needed in the areas (N=317)

	Pedestrianization	Bicycle path	Sports and recreations	Cultural and art zone	Botanical gardens	Grassland	Outdoor plaza	Others
	36.0%	35.3%	38.5%	24.9%	50.2%	38.5%	32.8%	0.9%

*Respondents were allowed to choose more than one answer.

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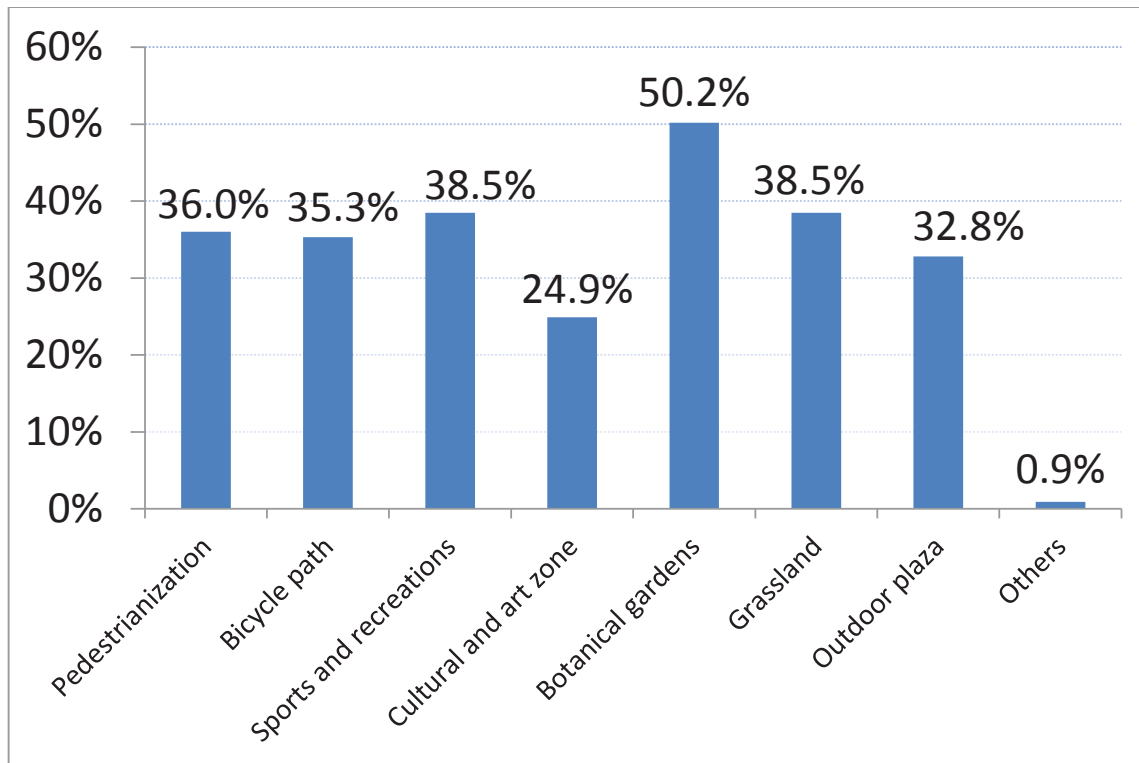
Quality of life (QOL)

Quality of life (QOL) was assessed using WHOQOL-BREF (Hong Kong version). Items in the WHOQOL-BREF are structured into four domains, namely physical, psychological, social relationship and environmental QOL. The domain scores were transformed into a linear scale between 0 and 100. A high score indicates a better QOL. Table 5 shows the scores of the four domains. If one SD below the mean is used as the cut-off standards for low QOL (Xia et al 2012), 18.9% of the subjects were considered to have a poor physical QOL, followed by environmental QOL (16.7%), psychological QOL (14.5%) and social relationship QOL (10.4%). Among the four QOL domains, the residents interviewed had the lowest mean score in environmental QOL. Significant moderate correlations were also found between the four domains, overall QOL and general health (P<0.01). It is important to note that environmental QOL was more correlated with psychological QOL (γ = 0.49), compared with physical health QOL (γ = 0.44) and social relationship QOL (γ = 0.33).

Table 5 Scores of the 4 QOL domains, overall QOL and general health (N=317)

	Mean	SD	Number of participants with poor scores, n (%) (score < 1SD)
Domain 1 Physical QOL	70.83	12.69	60 (18.9%)
Domain 2 Psychological QOL	65.43	12.61	46 (14.5%)
Domain 3 Social Relationship QOL	63.96	14.61	33 (10.4%)
Domain 4 Environmental QOL	61.98	13.76	53 (16.7%)
General QOL	62.07	15.98	14 (4.4%)
General health	60.41	18.50	31 (9.8%)

Self-reported health behaviors

From the self-reported health behavior data, 10.5% of the subjects were smokers while 18.3% stated that they consumed alcohol at least 2 – 4 times /month (Table 6). The majority did not meet the recommended fruit and vegetable intake guidelines. Only 13.2% met the recommended intake of fruit of 2 or more servings per day and 7.6% met the recommended intake of vegetable of 3 or more servings per day. For regular exercise, 31.2% exercised for at least 30 minutes, 3 – 4 times a week. More than 1/3 (37.2%) never exercised or exercised < 30 minutes/week.

Table 6 Self-reported health behaviors (N=317)

	n(%)		
Current smoking status			
Never smoke	284 (89.6%)		
Occasionally	10 (3.2%)		
Every day/Almost everyday	23 (7.3%)		
Previous smoking status (for people who answered never smoke and occasionally only)			
Never smoke	249 (85.6%)		
Occasionally	28 (9.6%)		
Everyday	14 (4.8%)		
Missing	*3*		
Alcohol drinking			
Never	165 (52.1%)		
1 or <1/mth	94 (29.75)		
2-4/mth	40 (12.6%)		
2-3/wk	10 (3.2%)		
4 or more/wk	8 (2.5%)		
Alcohol drinking unit per day			
0-2	100 (65.8%)		
3-4	34 (22.4%)		
5-6	11 (7.2%)		
7-9	6 (3.9%)		
10 or more	1 (0.7%)		
Frequency of drinking 5 peg			
Never	93 (61.2%)		
<1/mth	40 (26.3%)		
1/mth	16 (10.5%)		
1/wk	3 (2.0%)		
Amount of fruit intake			
Never	13 (4.1%)		
1-3/wk	104 (32.8%)		
4-6/wk	69 (21.8%)		
1/day	89 (28.1%)		
2 or more servings /day	42 (13.2%)		
Amount of vegetable intake			
Never	5 (1.6%)		
1-3/wk	51 (16.1%)		
4-6/wk	76 (24.0%)		
1/day	92 (29.0%)		
2/day	69 (21.8%)		
3 or more servings /day	24 (7.6%)		
Following dietary guidelines			
	Low fat	**Low salt**	**Low sugar**
Never	48 (15.1%)	51 (16.1%)	46 (14.5%)
Seldom	55 (17.4%)	60 (18.9%)	66 (20.8%)
Sometimes	122 (38.55)	114 (36.0%)	104 (32.8%)
Always	92 (29.0%)	92 (29.0%)	101 (31.9%)
Regular body exam			
No	182 (57.4%)		
Yes	135 (42.6%)		
Regular exercise			
Never/ <30mins a week	118 (37.2%)		
1-2 30 mins exercise a week	100 (31.5%)		
3-6 30 mins exercise a week	46 (14.5%)		
At least 30 mins / day	53 (16.7%)		

Emotion and satisfactory level on relationship and social services

More than 60% stated that they seldom or never had their emotion being affected by work, daily life or social life in the past three months (Table 7). For relationship, more than 90% reported that they were fair to very satisfied with their relationship with general people, families and neighbors.

For social services, participants were allowed not to respond to these items if they had no experience in receiving these services or not familiar with these services in their constituency areas. Generally, more than 77% of the participants were satisfied with the social services provided in the neighborhood. More than 20% were dissatisfied with rehabilitation services (20.7%), disabled services (21.4%), family welfare & critical incident management (22.5%) and health education and promotion (22.6%).

For ease of reaching public transportation, 32.5% reported that it was difficult or very difficult to reach MTR. Bus and minibus services were comparatively more convenient with less than 7% of the participants revealed that it was difficult or very difficult to reach.

Table 7 Satisfactory levels on emotion, relationship, Gov/Private/NGO social services and public transport

	Always n (%)	Sometimes n (%)	Seldom n (%)	Never n (%)	
Emotion affected by					
Work	19 (6.0%)	93 (29.3%)	90 (28.4%)	115 (36.3%)	
Daily life	4 (1.3%)	73 (23.0%)	147 (46.4%)	93 (29.3%)	
Social life	4 (1.3%)	56 (17.7%)	142 (44.9%)	114 (36.1%)	
	Very dissatisfied n (%)	**Dissatisfied** n (%)	**Fair** n (%)	**Satisfied** n (%)	**Very Satisfied** n (%)
Relationship					
General	1 (0.3%)	5 (1.6%)	100 (31.5%)	190 (59.9%)	21 (6.6%)
Families	1 (0.3%)	3 (0.9%)	80 (25.2%)	197 (62.1%)	36 (11.4%)
Neighbors	4 (1.3%)	24 (7.6%)	142 (44.8%)	130 (41.0%)	17 (5.4%)
Gov/Private/NGO services					
Cultural & Recreational services (N=245)	1 (0.4%)	20 (0.8%)	118 (48.2%)	92 (37.6%)	14 (5.7%)
Child care (N=166)	2 (1.2%)	13 (7.8%)	94 (56.6%)	55 (33.1%)	2 (1.2%)
Teenager services(N=172)	1 (0.6%)	18 (10.5%)	98 (57.0%)	52 (30.2%)	3 (1.7%)
Elderly services (N=192)	4 (2.1%)	32 (16.7%)	78 (40.6%)	64 (33.3%)	14 (7.3%)
Rehab services (N=145)	3 (2.1%)	27 (18.6%)	71 (49.0%)	38 (26.2%)	6 (4.1%)
Disabled services (N=131)	4 (3.1%)	24 (18.3%)	70 (53.4%)	31 (23.7%)	2 (1.5%)
Family welfare & critical incident management (N=142)	1 (0.7%)	31 (21.8%)	71 (0.5%)	36 (25.4%)	3 (2.1%)
Health edu & promotion (N=187)	2 (1.7%)	39 (20.9%)	85 (45.5%)	50 (26.7%)	11 (5.9%)
	Very difficult n (%)	**Difficult** n (%)	**Fair** n (%)	**Easy** n (%)	**Very easy** n (%)
Public Transport					
Bus	2 (0.6%)	17 (5.4%)	71 (22.4%)	172 (54.3%)	55 (17.4%)
Minibus	1 (0.3%)	21 (6.6%)	83 (26.2%)	164 (51.7%)	48 (15.1%)
MTR	38 (12.0%)	65 (20.5%)	75 (23.7%)	105 (33.1%)	34 (10.7%)
Taxi	0 (0%)	32 (10.1%)	78 (24.6%)	159 (50.2%)	48 (15.1%)

Satisfactory levels of environment and open space

Participants were also asked whether they were satisfied with the environment in the constituency area they belonged to. Air quality (29.6%), ventilation (27.1%) and noise level (25.9%) were the top three environmental issues they were most dissatisfied (Figure 5). For public space, they were most dissatisfied with the pedestrianization (25.2%), followed by promenade (22.7%) and greening (22.1%) in the neighborhood (Figure 6).
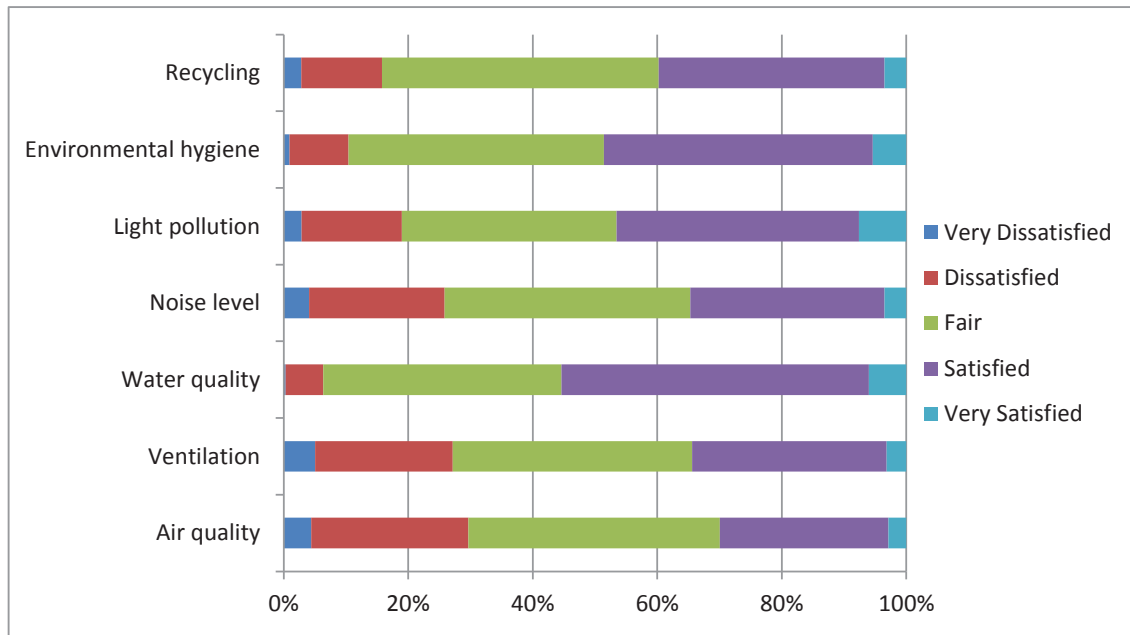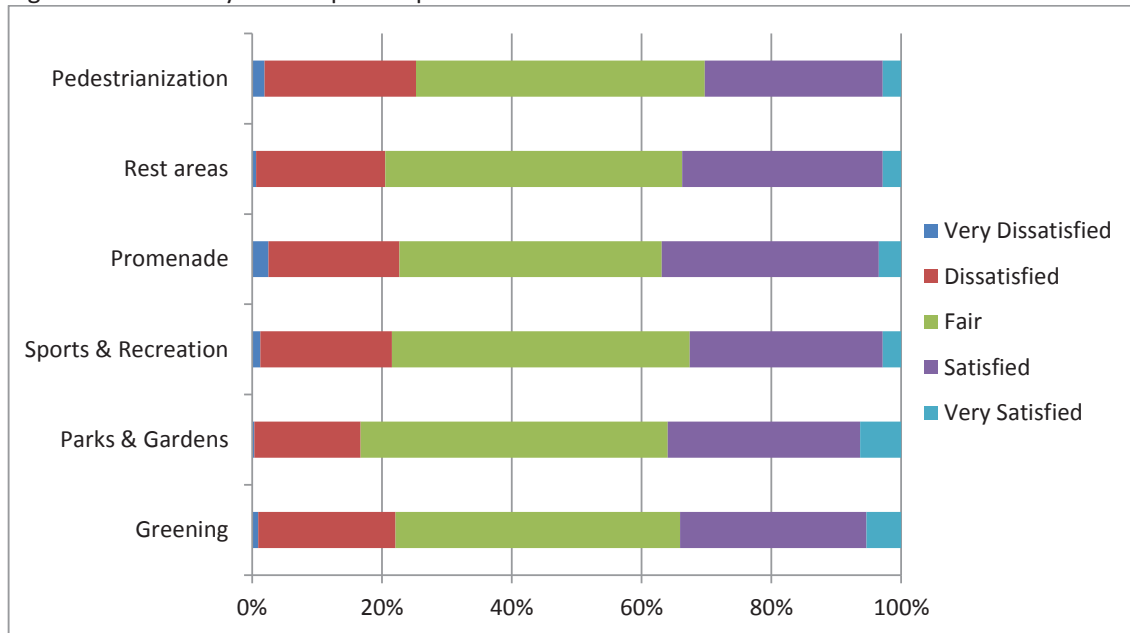
Figure 5 Satisfactory level of environment

Figure 6 Satisfactory level of public space

Health Status and Healthcare practices

Approximately 23% reported that they had at least one chronic illness diagnosed by western medical doctors (Table 8). The top three chronic illnesses reported were hypertension (68.1%), diabetes (16.7%) and arthritis (12.5%). Around one third (36.3%) had no private health insurance coverage or were not eligible for any medical fee waivers provided by the government. For other self-reported healthcare practices, please refer to Table 8.

Table 8 Self-reported health status and healthcare practices (N=317)

	n (%)
Chronic illness	
No	245 (77.3%)
Yes	72 (22.7%)
Types of chronic illness	
(N=72, can choose multiple options)	
Hypertension	49 (68.1%)
Diabetes	12 (16.7%)
Arthritis	9 (12.5%)
Heart disease	8 (11.1%)
Asthma	3 (4.2%)
Cancer	1 (1.4%)
Others	11 (15.3%)
Health insurance/Medical fee waivers	
(can choose multiple options)	
Health benefits provided by employers	95 (30.0%)
Individual private insurance	113 (35.6%)
Eligible for health services waivers	31 (9.8%)
Health Care vouchers (for age ≥70 years)	28 (8.8%)
None	115 (36.3%)
Hospitalization (in the past 3 months)	
No	305 (96.2%)
Yes	12 (3.8%) (Private hospital (n) = 8 (57.1%); Gov hospital (n) = 6 (42.9%))
Length of stay in hospitals (days)	
Private	1-7 days
Government	1-30 days
Purchasing medication (in the past 3 months)	
No	192 (60.6%)
Yes	125 (39.4%) (Western med. (n) = 103 (82.4%); Chinese med. (n) = 37 (29.6%))
Seeing doctors/TCM practitioners	
(in the past 3 months)	
No	180 (56.8%)
Yes	137 (43.2%)
Sick leave (in the past 3 months)	
No	198 (81.8%)
Yes	44 (18.2%)
Not applicable	75
Number of days of sick leave in the past 3 mths	Mean = 2.97 ± 8.87

Self-reported physical activity

Physical activities were assessed by the International Physical Activity Questionnaire (IPAQ) short form. It has been validated for use in adults. Activities including walking, moderate-intensity activities and vigorous-intensity activities were assessed. The total MET-minutes / week of each participant were calculated. Metabolic Equivalent of Task (MET) is the energy cost of physical activities. Physical activity levels were categorized as low, moderate and high, based on the total MET-min/week and some other criteria. Please refer to the Guidelines for Data Processing and Analysis of the IPAQ for more details (2005).

Table 9 shows that approximately 97% of the participants walked at least 10 minutes continuously in the past seven days while only 41.8% and 28.7% had moderate and vigorous intensity activities, respectively, for at least 10 minutes at a time in the past seven days. 48.9% performed both moderate and vigorous activities for at least 10 mins. Based on their time spent on physical activities, most of the participants were identified as moderate physical activity level (55.8%). It is important to note that ¼ were identified as low activity level or no activity was reported (25.2%).

Table 9 Exercise level measured by IPAQ

	No n (%)	Yes n (%)	min/day Mean ± SD	MET-min/week* Mean ± SD
Walking at least 10 mins continuously in the past 7 days	10 (3.4%)	283 (96.6%)	79.75 ± 98.18 (N=255)	1118.82 ± 1104.17
Moderate intensity activities for at least 10 mins at a time in the past 7 days	166 (58,2%)	119 (41.8%)	83.41 ± 87.03 (N=116)	323.15 ± 726.42
Vigorous intensity activities for at least 10 mins at a time in the past 7 days	211 (71.3%)	85 (28.7%)	76.84 ± 64.31 (N=80)	329.69 ± 715.93
			Total MET-min/week†	1771.67 ± 1667.45

	n (%)
IPAQ Category (N=317)	
Low	80 (25.2%)
Moderate	177 (55.8%)
High	60 (18.9%)

*MET-min per week = MET level x min of activity/day x days per week
 (MET level of Walking: 3.3 METs; Moderate: 4.0 METs; Vigorous: 8.0 METs)

†Total MET-min/week = Walk MET-min/week + Moderate MET-min/week + Vigorous MET-min/week

Potential determinants of the 4 QOL domains, overall QOL, general health and physical activity level

Statistical analyses were performed to identify factors which determine the participants' 4 domains QOL, overall QOL, general health and physical activity level. The emphasis were to find out how environmental (e.g. air quality, ventilation, noise level, etc.) and open space factors (e.g. greening, parks, recreational facilities, etc) affect participants' QOL, health and physical activity. First, univariate analyses including Chi-square, one-way ANOVA, and correlation were performed.

Variables which had significant correlations were put into the models for multivariate logistic regression and ANCOVA in order to identify potential determinants.

Potential Determinants of Physical Health Quality of life (QOL)

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' physical health QOL. Participants who had no chronic illness, with better emotion, better psychological and environmental QOL and better general health were found to have significantly better physical health QOL (P<0.05) (Table 10).

Table 10 Analysis of potential factors of physical health QOL using ANCOVA

	Physical Health QOL Score Mean (SD)	β (95% CI)	P
Sex			
Male	70.37 (11.39)		0.941
Female	70.56 (13.18)		
Age		-0.04 (-0.13 – 0.06)	0.436
Type of Housing			
Owner-occupier	70.39 (12.41)		0.963
Rental/Employer provided/ Rent free	70.44 (12.31)		
Education			
Primary school or below	69.00 (13.27)		0.396
Secondary / Sixth form	69.97 (11.58)		
Diploma / Cert	72.88 (10.67)		
University degree	69.82 (12.81)		
Individual monthly income			
$0	70.35 (10.90)		0.484
$10,500 or below	68.87 (11.29)		
$10,501 - $14,800	71.11 (10.74)		
$14,801 - $23,000	69.62 (10.82)		
$23,001 or above	72.14 (12.39)		
Chronic illness			
No	72.24 (11.69)		0.032
Yes	68.59 (12.22)		
Seeing doctors / TCM practitioners in the last 3 months			
No	71.48 (13.57)		0.076
Yes	69.35 (11.21)		
Satisfactory of Environment		0.16 (-0.13 – 0.45)	0.283
Score of Emotion (Higher score, poor emotion)		-0.79 (-1.37 – -0.21)	0.008
Satisfactory of Relationship		-0.12 (-0.89 – 0.65)	0.757
Physical Activity (Total MET-min / week)		0.00 (-0.00 – 0)	0.285
Domain 2 Psychological QOL		0.30 (0.18 – 0.42)	<0.001
Domain 3 Social Relationship QOL		0.03 (-0.07 – 0.12)	0.557
Domain 4 Environmental QOL		0.17 (0.06 – 0.28)	0.002
Overall QOL		0.02 (-0.06 – 0.10)	0.700
General Health		0.10 (0.03 – 0.17)	0.005

Potential Determinants of Psychological Quality of Life (QOL)

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' psychological QOL. Those who were non-smokers, with better emotion, more satisfied with their relationship with other people, better compliance with the low salt, low fat and low sugar dietary guidelines, and better physical health, social relationship and environmental QOL, had significantly better psychological QOL (P<0.05) (Table 11).

Table 11 Analysis of potential factors of psychological QOL using ANCOVA

	Psychological QOL Score Mean (SD)	β (95% CI)	P
Sex			
Male	64.53 (15.37)		0.069
Female	62.59 (19.21)		
Age		0.03 (-0.04 – 0.10)	0.459
Smoking status			
Non-smoker	64.03 (12.68)		0.013
Occasionally	61.92 (9.22)		
Every day/Almost every day	61.74 (9.36)		
Type of Housing			
Owner-occupier	64.33 (16.98)		0.167
Rental/Employer provided/ Rent free	62.79 (17.65)		
Individual monthly income			
$0	63.94 (11.43)		0.981
$10,500 or below	63.11 (13.36)		
$10,501 - $14,800	63.83 (12.88)		
$14,801 - $23,000	63.40 (11.31)		
$23,001 or above	63.51 (12.65)		
Regular Body Exam			
No	63.38 (18.60)		0.760
Yes	63.74 (16.54)		
Fruit intake			
Never	66.15 (6.40)		0.482
1-3/wk	62.42 (13.69)		
4-6/wk	63.14 (12.74)		
1/day	61.83 (14.55)		
≥2/day	63.96 (11.59)		
Score of Emotion (Higher score, poor emotion)		-0.55 (-1.08 – -0.02)	0.042
Satisfactory of Relationship		1.34 (0.67 – 2.01)	<0.001
Physical Activity Category			
Low	62.43 (13.23)		0.224
Moderate	63.19 (18.26)		
High	65.07 (12.75)		
Compliance to dietary guidelines		0.31 (0.23 – 0.98)	0.002
Domain 1 Physical health QOL		0.26 (0.16 – 0.35)	<0.001
Domain 3 Social Relationship QOL		0.19 (0.12 – 0.27)	<0.001
Domain 4 Environmental QOL		0.17 (0.08 – 0.25)	<0.001
Overall QOL		0.001(-0.07 – 0.07)	0.981
General Health		0.05(-0.01 – 0.12)	0.099

Potential Determinants of Social Relationship Quality of Life (QOL)

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' social relationship QOL. Participants who were never married, married or widowed, more satisfied with their relationship with other people, with better psychological QOL and overall QOL, had significantly better social relationship QOL (P<0.05) (Table 12).

Table 12 Analysis of potential factors of social relationship QOL using ANCOVA

	Social Relationship QOL Score Mean (SD)	β (95% CI)	P
Sex			
Male	55.58 (30.01)		0.119
Female	57.73 (32.17)		
Age		-0.18 (-0.29 – -0.07)	0.001
Marital Status			
Never married	61.96 (14.87)		<0.001
Married	65.41 (14.14)		
Widowed	72.87 (13.01)		
Divorced	47.72 (12.01)		
Separated	35.30 (12.07)		
Score of Emotion (Higher score, poor emotion)		-0.49 (-1.20 – 0.22)	0.176
Satisfactory of Relationship		1.08 (0.15 – 2.01)	0.023
Physical Activity Category			
Low	57.08 (23.98)		0.650
Moderate	55.79 (31.35)		
High	57.09 (21.65)		
Domain 1 Physical health QOL		0.07 (-0.06 – 0.21)	0.297
Domain 2 Psychological QOL		0.39 (0.25 – 0.54)	<0.001
Domain 4 Environmental QOL		0.08 (-0.04 – 0.20)	0.197
Overall QOL		0.10 (0.01 – 0.20)	0.034
General Health		-0.01 (-0.09 – 0.08)	0.881

Potential Determinants of Environmental Quality of Life (QOL)

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' environmental QOL. Living district was one of the factors affecting participants' environmental QOL. Those who lived in Tsim Sha Tsui East, Whampoa East, or Ka Wai had significantly better environmental QOL while those who lived in Hunghom had significantly lower environmental QOL (P<0.001) (Table 13). In addition, participants who had a higher individual monthly income, who were more satisfied with the environment and open space, with better physical health, psychological and social relationship QOL and overall QOL, were found to have significantly better environmental QOL (P<0.05).

Table 13 Analysis of potential factors of environmental QOL using ANCOVA

	Environmental QOL Score Mean (SD)	β(95% CI)	P
Sex			
Male	62.88 (11.12)		0.165
Female	64.46 (12.31)		
Age		0.03 (-0.05 – 0.12)	0.455
Living District			
Tsim Sha Tsui East	68.47 (9.94)		<0.001
King's Park	65.76 (10.07)		
Whampoa East	66.00 (10.36)		
Whampoa West	63.17 (10.34)		
Hunghom Bay	61.64 (10.26)		
Hunghom	56.53 (10.27)		
Ka Wai	70.05 (10.13)		
Oi Man	60.68 (10.29)		
Oi Chun	61.05 (10.22)		
Type of Housing			
Owner-occupier	62.55 (12.28)		0.093
Rental/Employer provided/ Rent free	64.79 (12.65)		
Education			
Primary school or below	61.99 (13.63)		0.562
Secondary / Sixth form	62.94 (11.29)		
Diploma / Cert	65.31 (10.00)		
University degree	64.44 (12.24)		
Individual monthly income			
$0	62.11 (10.95)		0.018
$10,500 or below	61.17 (10.62)		
$10,501 - $14,800	62.53 (10.49)		
$14,801 - $23,000	67.24 (10.53)		
$23,001 or above	65.30 (11.96)		
Satisfactory of Environment		0.95 (0.64 – 1.26)	<0.001
Satisfactory of Open Space		0.46 (0.13 – 0.79)	0.007
Score of Emotion (Higher score, poor emotion)		-0.01 (-0.58 – 0.58)	0.984
Satisfactory of Relationship		0.08 (-0.67 – 0.83)	0.83
Physical Activity Category			
Low	62.14 (10.93)		0.220
Moderate	64.38 (11.15)		
High	64.50 (10.25)		
Domain 1 Physical health QOL		0.16 (0.05 – 0.27)	0.005
Domain 2 Psychological QOL		0.27 (0.15 – 0.39)	<0.001
Domain 3 Social relationship QOL		0.10(0.01 – 0.19)	0.027
Overall QOL		0.13 (0.05 – 0.20)	0.002
General Health		-0.03 (-0.10 – 0.04)	0.361

Potential Determinants of Overall Quality of Life (QOL)

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' overall QOL. Living district was one of the factors affecting participants' environmental QOL. Those who lived in King's Park, Whampoa East, Hunghom Bay, Hunghom, and Oi Chuni had significantly better overall QOL (P=0.004) (Table 14). In addition, participants who lived in a self-owned housing, with emotion less affected by social life, better environmental QOL and general health, were found to have significantly better overall QOL (P<0.05).

Table 14 Analysis of potential factors of overall QOL using ANCOVA

	Overall QOL Score Mean (SD)	β (95% CI)	P
Sex			
Male	66.98 (60.10)		0.435
Female	68.31 (68.63)		
Age		-0.04 (-0.14 – 0.06)	0.427
Living District			
Tsim Sha Tsui East	62.38 (22.37)		0.004
King's Park	66.54 (29.29)		
Whampoa East	70.27 (38.14)		
Whampoa West	63.61 (34.79)		
Hunghom Bay	68.33 (33.77)		
Hunghom	74.19 (37.14)		
Ka Wai	63.52 (25.83)		
Oi Man	66.00 (39.90)		
Oi Chun	73.98 (30.91)		
Type of Housing			
Self-owned	71.01 (66.55)		<0.001
Rental/Employer provided/ Rent free	64.28 (62.46)		
Individual monthly income			
$0	69.10 (46.84)		0.420
$10,500 or below	66.62 (44.76)		
$10,501 - $14,800	68.09 (40.19)		
$14,801 - $23,000	64.83 (37.27)		
$23,001 or above	69.59 (40.37)		
Emotion Affected by Daily Life			
Never	66.86 (49.85)		0.896
Seldom	66.36 (59.80)		
Sometimes	65.50 (40.35)		
Always	71.87 (20.53)		
Emotion Affected by Social Life			
Never	75.19 (73.26)		0.022
Seldom	77.82 (81.02)		
Sometimes	74.84 (50.69)		
Always	42.74 (16.89)		

Satisfactory of General Relationship			
Very dissatisfied	76.90 (14.72)		0.178
Dissatisfied	75.33 (17.13)		
Fair	60.57 (45.52)		
Satisfied	63.84 (64.79)		
Very satisfied	61.59 (25.54)		
Satisfactory of Relationship with Families			
Very dissatisfied	85.37 (18.18)		0.281
Dissatisfied	71.82 (15.99)		
Fair	58.10 (36.93)		
Satisfied	59.44 (57.26)		
Very satisfied	63.50 (27.82)		
Satisfactory of Relationship with Neighbours			
Very dissatisfied	71.37 (17.36)		0.330
Dissatisfied	70.38 (27.09)		
Fair	65.16 (62.55)		
Satisfied	67.77 (60.45)		
Very satisfied	63.54 (26.91)		
Physical Activity			
(Total MET-min/week)		0.001 (0 – 0.002)	0.156
Satisfactory of Environment		-0.02 (-0.51 – 0.47)	0.934
Satisfactory of Open Space		0.17 (-0.32 – 0.67)	0.485
Satisfactory of Transportation		-0.05 (-0.77 – 0.67)	0.885
Domain 1 Physical health QOL		-0.02 (-0.18 – 0.14)	0.826
Domain 2 Psychological QOL		0.03 (-0.15 – 0.20)	0.786
Domain 3 Social relationship QOL		0.12 (-0.01 – 0.25)	0.080
Domain 4 Environmental QOL		0.29 (0.12 – 0.47)	0.001
General Health		0.13 (0.03 – 0.23)	0.014

Potential Determinants of General Health

ANCOVA analysis controlling for sex and age was performed to identify factors which affect the participants' general health. Participants who were more satisfied with the environment, had no chronic illness, covered by health insurance or eligible for medical fee waivers, had not seeing doctors or TCM practitioners in the past three months, and with better physical health QOL and overall QOL, were found to have significantly better general health ($P<0.05$) (Table 15).

Table 15 Analysis of potential factors of general health using ANCOVA

	General Health Score Mean (SD)	β (95% CI)	P
Sex			
Male	58.80 (19.51)		0.631
Female	59.70 (22.42)		
Age		0.02 (-0.13 – 0.17)	0.781
Education			
Primary school or below	57.03 (22.17)		0.687
Secondary / Sixth form	59.28 (19.82)		
Diploma / Cert	59.27 (17.17)		
University degree	61.41 (21.25)		
Individual monthly income			
$0	60.56 (18.39)		0.121
$10,500 or below	55.26 (18.36)		
$10,501 - $14,800	57.73 (17.72)		
$14,801 - $23,000	62.49 (18.36)		
$23,001 or above	60.21 (20.99)		
Chronic Illness			
No	62.14 (20.76)		0.035
Yes	56.36 (20.34)		
Health Insurance/Medical fee waivers			
No	56.93 (21.09)		0.024
Yes	61.56 (20.61)		
Purchasing Medication in the past 3 months			
No	60.47 (22.91)		0.211
Yes	58.03 (19.28)		
Seeing doctors/TCM practitioners in the past 3 months			
No	61.22 (23.72)		0.049
Yes	57.28 (19.07)		
Physical Activity Category			
Low	59.76 (19.34)		0.867
Moderate	58.63 (20.12)		
High	59.36 (17.27)		
Score of Emotion (Higher score, poor emotion)		-0.14 (-1.10 – 0.82)	0.770
Satisfactory of Relationship		0.16 (-1.07 – 1.39)	0.798
Satisfactory of Environment		0.60 (0.07 – 1.13)	0.027
Satisfactory of Open Space		-0.18 (-0.72 – 0.37)	0.527
Domain 1 Physical health QOL		0.24 (0.06 -0.42)	0.009
Domain 2 Psychological QOL		0.19 (-0.01 – 0.39)	0.065
Domain 3 Social relationship QOL		0.07 (-0.08 – 0.22)	0.339
Domain 4 Environmental QOL		0.03 (-0.15 – 0.22)	0.737
Overall QOL		0.19 (0.06 – 0.31)	0.003

Potential Determinants of Physical Activity Level

Multinominal regression was used to assess factors which determine physical activity levels categorized by IPAQ. The analysis was performed with the control for sex and age. Compared to participants who reported "low" physical activity level, those who lived in King's Park (OR=0.14), or Hunghom (OR=0.23), and those who claimed that it was not easy (fair (OR=0.24); difficult/very difficult (OR=0.36)) to reach MTR, were significantly less likely to have a "moderate" physical activity level (P<0.05) (Table 16).   No potential factor which significantly determined a "high" physical activity level was found.

Table 16 Analysis of potential factors of physical activity level using multinomial logistic regression (Note. Reference group: Low IPAQ)

	Moderate IPAQ OR (95%CI)	P	High IPAQ OR (95%CI)	P
Sex				
Male	1.50 (0.80-2.80)	0.203	2.11 (0.96 – 4.62)	0.063
Female	1.00			
Age	1.03 (1.01 – 1.05)	0.006	1.01 (0.98 – 1.03)	0.527
Living district				
TST East	1.78 (0.13 – 24.11)	0.660	1.61 (0.08 -33.12)	0.758
King's Park	0.14 (0.03 – 0.67)	0.014	0.49 (0.08 – 3.20)	0.159
Whampoa East	0.43 (0.12 – 1.56)	0.201	0.26 (0.04 – 1.56)	0.141
Whampoa West	0.99 (0.20 – 1.94)	0.993	2.11 (0.30 – 14.65)	0.451
Hunghom Bay	0.27 (0.06 – 1.24)	0.092	0.30 (0.04 – 1.09)	0.223
Hunghom	0.23 (0.06 – 0.82)	0.024	0.29 (0.05 – 1.62)	0.159
Ka Wai	1.69 (0.24 – 11.92)	0.599	0.54 (0.03 – 10.15)	0.678
Oi Man	0.61 (0.16 – 2.24)	0.451	1.59 (0.31 – 8.10)	0.580
Oi Chun	1.00		1.00	
Air Quality				
Very dissatisfied / Dissatisfied	3.42 (0.78 – 14.95)	0.103	1.81 (0.28 – 11.50)	0.531
Fair	2.24 (0.67 – 7.48)	0.190	1.14 (0.26 – 5.01)	0.861
Satisfied / Very Satisfied	1.00		1.00	
Ventilation				
Very dissatisfied / Dissatisfied	0.94 (0.20 – 4.35)	0.934	1.54 (0.22 – 10.63)	0.659
Fair	1.20 (0.35 – 4.19)	0.773	0.85 (0.18 – 4.15)	0.845
Satisfied / Very Satisfied	1.00		1.00	
Environmental Hygiene				
Very dissatisfied / Dissatisfied	0.69 (0.18 – 2.66)	0.593	1.89 (0.34 – 10.59)	0.471
Fair	0.54 (0.23 – 1.26)	0.156	0.74 (0.25 – 2.21)	0.583
Satisfied / Very Satisfied	1.00		1.00	
Recycling				
Very dissatisfied / Dissatisfied	0.58 (0.19 – 1.84)	0.358	0.29 (0.06 – 1.34)	0.113
Fair	0.93 (0.40 – 2.15)	0.864	0.52 (0.18 – 1.52)	0.235
Satisfied / Very Satisfied	1.00		1.00	
Promenade				
Very dissatisfied / Dissatisfied	0.90 (0.35 – 2.34)	0.834	0.44 (0.13 – 1.480	0.183
Fair	0.80 (0.36 – 1.78)	0.582	0.55 (0.21 – 1.44)	0.224
Satisfied / Very Satisfied	1.00		1.00	
MTR				
Very difficult / Difficult	0.36 (0.14 – 0.94)	0.037	0.46 (0.13 – 2.59)	0.219
Fair	0.24 (0.10 – 0.59)	0.002	0.77 (0.25 – 2.30)	0.632
Easy / Very Easy	1.00		1.00	
Domain 2 Psychological QOL	1.01 (0.98 – 1.04)	0.457	1.03 (0.99 – 1.07)	0.107
Domain 4 Environmental QOL	1.01 (0.98 – 1.05)	0.376	1.01 (0.97 – 1.06)	0.492
Overall QOL	1.02 (0.80 – 2.80)	0.068	1.03 (1.00 – 1.06)	0.064

Discussions

It is obvious that the Cross Harbour Tunnel toll plaza and the nearby areas are the most polluted areas among the nine constituency areas. Air quality is largely associated with vehicle exhaust emissions as there are long queues every day at the entrances to the Tunnel (Planned Dept 2008; SCMP 27 Jan 2013). It is reasonable that the residents in our survey stated that the Tunnel toll plaza, the Hunghom MTR station and the Hong Kong Coliseum were the top areas needed to be improved and greener. In a densely populated city like Hong Kong, a green environment is often viewed as a luxury good. Botanical gardens and grassland were the two amenities which our residents most wanted to have in the neighborhood. According to the information from the GeoInfo Map of Lands Department , there is a lack of botanical gardens and grassland, not only in Hunghom and Tsim Sha Tsui East, but also in Hong Kong. Parks also cannot be found in the areas studied. The closest parks are the Kowloon Walled City Park and Kowloon Tsai Park in Kowloon City, and the Kowloon Park in Tsim Sha Tsui.

The WHOQOL-BREF (Hong Kong version) assesses QOL in four domains including physical health, psychological, social relationships and environmental. Comparing the mean scores of the four domains of our residents with the mean scores of another healthy sample in Hong Kong (Leung et al, 2005), we found that our residents had a lower physical QOL (score difference: - 0.48) but better psychological QOL (score difference: +6.49), social relationships QOL (score difference: +2.52) and environmental QOL (score difference: +1.92). On the other hand, comparing with a sample in Guangzhou (Xia et al 2012), a higher percentage of our residents was identified as having poor physical health QOL (18.9% vs 11.8%) and environmental QOL (16.7% vs 13.6%).

There are a total of seven questions assessing physical QOL and eight questions assessing environmental QOL. Two questions, "enough energy for everyday life" and "sleeping quality" from physical QOL and five questions, "environmental safety and security", "pollution, noise, traffic and climate of the physical environment", "opportunities for recreation and leisure activities", "conditions of living place", and "satisfactory of transport" from environmental QOL, are directly or indirectly related to the greening of the living environment. Studies have found that green space can help people to achieve a healthier duration of sleep because sleep can be affected by temperature, light and noise exposure. People living in greener neighborhoods were at a lower risk of short sleep (less than 6 hours a night) (Astell-Burt 2013). Adverse effects on mood and cognitive performance can be found on the next day if sleeping quality is affected (Ohrstrom 1991). Short sleep duration has also been shown to be correlated with obesity, chronic disease and mortality (Cappuccio et al 2008; Gallicchio & Kalesan 2009; Knutson et al 2006).   On the other hand, people tend to be more satisfied with their living environment or better environmental QOL if there are more green spaces around, more vegetation and better air quality (Honold et al 2012; Kweon et al 1998). Green space is associated with more social contacts and cohesion, and neighborhood trust (Kweon et al 1998) which in turn people will feel safer. If people feel safe in the neighborhood, they are likely to engage in outdoor activities more often (Ball et al 2010; Ferrao et al 2013). The pollution issue in the studied areas could be one of the reasons to explain the relatively large proportion of residents having poor environmental QOL. The vulnerable population, such as young children, elderly and patients, are highly affected by air and noise pollution, and thermal stress compared to other population groups. To reduce pollution, the presence of vegetation and parks has been found to have a significant effect in improving indoor and outdoor thermal comfort and air quality (Feyisa et

al 2014). Exercise has long been supported for maintaining cardiovascular health and healthy body weight, however, the environment and the amenities can be the inhibitors. Participation in recreation and leisure activities could be affected by both the environment and the accessibility and availability of recreation and sports facilities. Poor air quality and ventilation were the top two environmental issues identified in the survey, and more than 35% claimed that more sports and recreation facilities and bicycle path were needed in the neighborhood. These could be the obstacles to exercise. For transportation, most of our participants were satisfied with the public transport except that around 1/3 stated that MTR was difficult to reach.

In order to identify factors which had significant correlations with the four QOL domains and physical activity level, multivariate analyses were performed. Presence of chronic illness, emotion, psychological and environmental QOL and general health were the predictors that contributed significantly to the physical health QOL. It is our expectation that people without chronic illness should have a better physical health QOL. For emotion and psychological health, a number of reviews have summarized the impact of emotions and cognitions on health outcomes and mortality (Gallo & Matthews 2003). People with positive emotions evidenced better physical health outcomes, such as fewer physical complaints, more exercise, longer sleeping hours and better sleep quality (Tugade et al 2004). On the other hand, statistical analysis also showed that people who did not smoke, had better emotion, more satisfied with their relationships with other people, and better physical and environmental QOL, also had a significantly better psychological health. Instead of helping people to relax, smoking actually increases anxiety and tension. Evidence has shown that anxiety is strongly associated with smoking (Mykletun 2008). It is also obvious that emotion and relationship are key components of psychological health (Hopp 2011). Literature has already shown that psychological benefits of a healthy environment. Green space around the home significantly decreased stressful events, anxiety disorder and depression (Mass et al 2009; van den Berg et al 2010). Similar correlations were also found between environmental QOL and overall QOL.   As discussed previously, environmental QOL comprises participation in leisure and recreation activities, and air quality and pollution in the living environment. There is no doubt about putting more effort into greening work to improve the physical conditions of the living environment in order to bring better physical health and psychological QOL to our people.

Resident's satisfactory of the environment and open space were two key determinants of environmental QOL while satisfactory of environment was also one of the key determinants of the residents' general health. If the conditions of and facilities in the environment can be further improved, more people will have a better environmental QOL, which will also bring a positive impact on their physical health and psychological QOL, and general health. From the analysis, we also found that people living in Tsim Sha Tsui East, Whampoa East and Ka Wai had a significantly better environmental QOL. More in-depth studies are needed to study the reasons behind.

A growing literature suggesting that physical exercise has beneficial effects across physical and psychological-health outcomes. People who engage in physical activity tend to have more desirable health including better general health and health-related quality of life (Penedo 2005). However in the analysis of determinants of physical activity levels using multinomial logistic regression, physical and psychological QOL, and general QOL were not significantly contributed to the variance in physical activity levels. It is interested to find that people living in King's Park and Hunghom and those who had difficulty in reach MTR were less likely to have a moderate physical activity level.

People with low physical activity level might think that their homes were too far from the MTR stations and were unwilling to walk to the stations. The ease of access to recreational facilities, parks and pedestrianization in these areas could also have an impact on exercise. More in depth interviews and information on sports and recreational facilities need to be obtained to understand the reasons why people in King's Park and Hunghom had a significantly lower physical activity level.

Conclusion

The development of the Green Deck or improving the environment with more green space is expected to have a beneficial effect on people's QOL. More importantly, environmental QOL was one of the significant determinants of the residents' physical health QOL and psychological QOL, as well as general QOL. Environmental QOL comprises physical conditions (pollution and temperature), safety and recreational facilities of the living environment. It is possible that enhancing the living environment by improving air quality and ventilation, and developing accessible recreational facilities can have a positive influence on people's physical and psychological health, and QOL. Studies have supported that a clean and green environment can lower the risk of chronic illness including cardiovascular and respiratory diseases, obesity, depression and anxiety. In the long term, healthcare expenditure can be lowered as people may visit clinics and hospitals less often and length of stay in hospitals can also be shortened.   A green environment with nicely built walking and bicycle paths, not only enhance the connection of different areas, but also facilitate people to walk and exercise regularly.

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Appendix 1a The nine constituency areas covered in this study
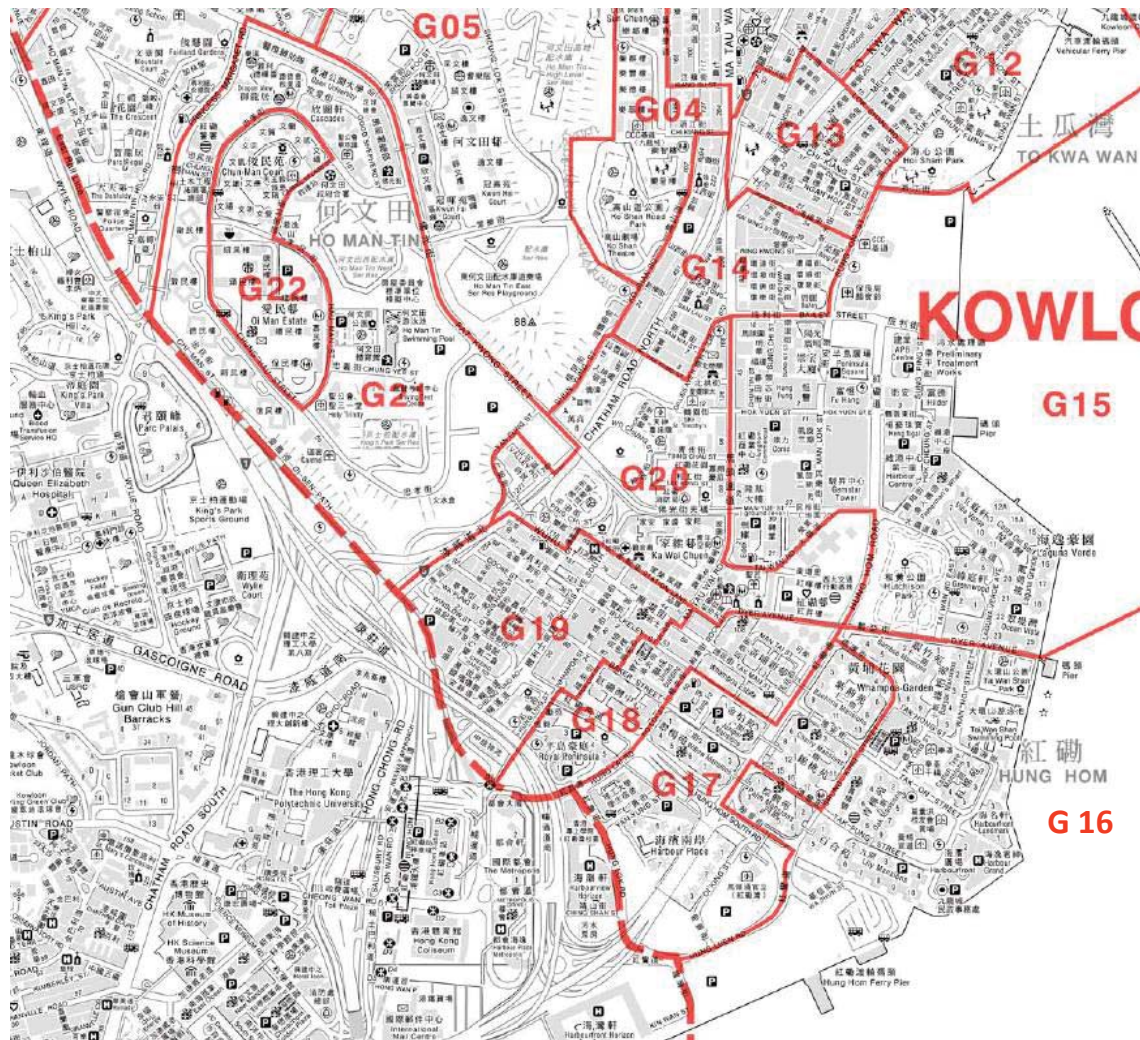
Whampoa East (G16), Whampoa West (G17), Hung Hom Bay (G18), Hung Hom (G19), Ka Wai (G20), Oi Man (G21) and Oi Chun(G22)

Appendix 1b The nine constituency areas covered in this study
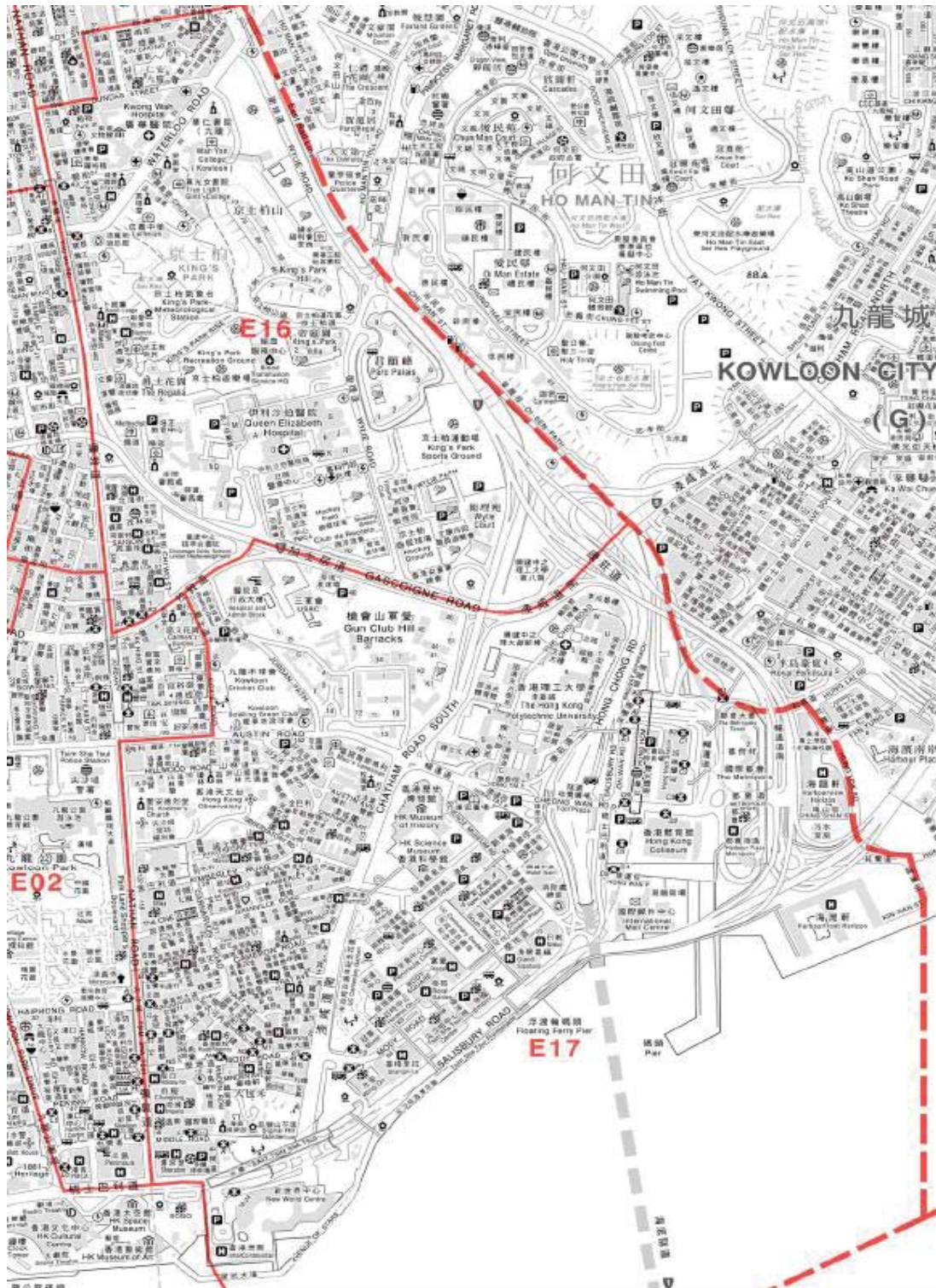
King's Park (E16), Tsim Sha Tsui East (E17)