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Cohort profile: The prospective study on Chinese elderly with multimorbidity in primary care in Hong Kong

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Cohort profile: The prospective study on Chinese elderly with multimorbidity in primary care in Hong Kong

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ABSTRACT

Purpose This is an ongoing prospective cohort aiming to examine the biopsychosocial health profiles and predictors of health outcomes of older patients with multimorbidity in primary care in Hong Kong.

Participants From April 2016 to October 2017, 1077 patients aged 60+ years with at least two chronic diseases were recruited in four public primary care clinics in the New Territories East Region of Hong Kong.

Findings to date After weighting, the patients had 4.1 (1.8) chronic conditions and 2.5 (1.9) medications on average; 37% forgot taking medication sometimes; 71% rated their health as fair or poor; 17% were frail; 73% reported one (21%) or two or more (52%) body pain areas; 62% were overweight/obese; 23% reported chewing difficulty, 18% reported incontinence; 36% had current stage 1/2 hypertension; 38% had handgrip strength below the cut-off; 10% screened positive in sarcopenia; 17% had mild or severer cognitive impairment; 17% had mild to severe depression; 16% had mild to severe anxiety; 50% had subthreshold to severe insomnia; 28% indicated being lonely; 12% needed help in at least one out of the five daily functions and the EuroQoL-5-Dimensions-5-Level index score was 0.81 (0.20) and its Visual Analogue Scale (VAS) score was 67.6 (14.6). In the past 12 months, 17% were hospitalised, 92% attended general outpatient clinics, 70% attended specialist outpatient clinics and 10% used elderly daycare centre services, the median out-of-pocket health cost was HK$1000 (US$150). Female and male patients showed significant differences in many biopsychosocial health aspects.

Future plans With assessments and clinical data, the cohort can be used for understanding longitudinal trajectories of biopsychosocial health profiles of Chinese older patients with multimorbidity in primary care. We are also initially planning cohort studies on factors associated with various health outcomes, as well as quality of life and healthcare use.

Cohort registration number ChiCTR-OIC-16008477

Strengths and limitations of this study

► This prospective cohort comprehensively examines biopsychosocial health problems encountered by Chinese older patients with multimorbidity in a primary care programme in Hong Kong. As far as we are aware of, very few prospective cohorts specifically cover this population in primary care, and no such prospective cohort exists among Chinese.

► The data could be linked with electronic health records to allow follow-up and examination of long-term outcomes associated with multimorbidity and predictors of those outcomes.

► The limitation was that older adult patients who were male, disabled, very ill, institutionalised or housebounded were less likely to have participated in this study; a few assessments were only conducted within subgroups or added at a later stage; the sample size may limit examinations of potential interactions and factors associated with multimorbidity in some subgroups.

► The baseline health results had been weighted according to the census data. The weighted rates might be an underestimation of the rates among the primary care patients and be close to the rates of the general population.

INTRODUCTION

Multimorbidity, defined as patients living with two or more chronic health conditions, is common in primary care. The prevalence is increasing over the last decades as a result of an ageing population and changes in lifestyles, for example, more sedentary lifestyle which have increased the risk of obesity, resulting in a higher risk of developing chronic conditions.[1 2] A recent systematic review suggests that the prevalence of multimorbidity is high among the elderly ranging from 12.9% to 95.1% in different studies.[3] Multimorbidity is associated with increased disability and depression, reduced quality of life and higher rates of adverse drug consequences.[4] Multimorbidity also leads to increased primary and secondary health service utilisation, especially unplanned healthcare, as well as reduced life expectancy.[5] The direct and indirect economic burden associated with multimorbidity is huge.[6] The annual healthcare costs were €4096.86 among patients with five or more chronic conditions, which was almost five times more than those who were healthy
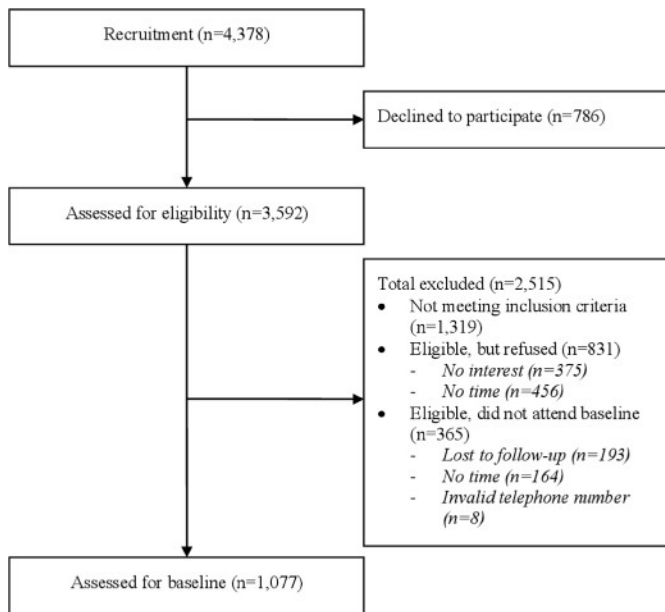
Figure 1 Flow chart of recruitment.

in a study in the West of Ireland.[7] It has been estimated that by 2030, 66% of the global disease burden will be due to chronic diseases, with most of the burden occurring in the most populous area—Asia.[8 9] The economic burden highlights an urgent need for holistic understanding of patients with multimorbidity when searching for cost-effective ways to manage these patients, given that treatment of diseases in isolation can be inefficient, leading to duplication of care and poorer health outcomes.[10]

Studies on multimorbidity have increased in recent years,[11–20] and a clinical guideline on clinical assessment and management of multimorbidity was developed by the National Institute for Health and Care Excellence in the UK in 2016.[21] However, studies are still needed for the epidemiology and profiles of patients with multimorbidity and their longitudinal outcomes to inform policy-making in different populations including Chinese primary care patients.[3 11] Most studies on primary care patients with multimorbidity are conducted in western countries such as UK, USA, Australia, Spain and Belgium,[14 15 22–28] and limited research has been conducted on psychological and social problems accompanying with multimorbidity.[3 11 21 29 30] Several longitudinal studies of multimorbidity have been conducted in Asian populations,[31–33] but none of these are of primary care patients. Important knowledge gaps still exist regarding the biopsychosocial health profiles of patients with multimorbidity in primary care among Asian Chinese.[34] Therefore, more studies among Chinese patients with multimorbidity in primary care are needed to advance our understanding for services.[14 35–39]

This study focuses on the elderly in Hong Kong, where the population is ageing rapidly. Hong Kong has a population of 7.34 million according to the 2016 census data, with 23.7% aged 60 years or above. The rate was higher than the proportions in 2006 (16.5%) and 2011

(19.5%).[40] In Hong Kong, although there is a large private primary care sector, around 85% of people with chronic conditions are managed in the public primary care setting. Given that the Hong Kong population has the longest life expectancy in the world: (81.7 for men and 87.7 for women in 2017),[41] the ageing population and multimorbidity have brought much burden and challenge to the local healthcare system. To inform healthcare providers and policy-makers in allocating suitable health services for people with multimorbidity in primary care, the present study aimed to study the longitudinal biopsychosocial health profiles and also predictors of health outcomes of Chinese patients with multimorbidity who present to public primary care in Hong Kong.

COHORT DESCRIPTION
Study setting and participants
This study contains primary care patients from four general outpatient clinics (GOPCs) out of the 10 general outpatient clinics (GOPCs) in the New Territory East Cluster (NTEC), Hong Kong, as permission to recruit from these four clinics was given by the local regulator (the Hospital Authority) during the study period. Each GOPC receives about 450 patients each day. The working hours are generally from 9:00 to 17:00 hours from Monday to Friday with some additional night and weekend sessions. In the most recent Hospital Authority Annual Report 2016–2017, the 10 GOPCs in NTEC provided 972 454 consultations in total in the year of 2015/2016, which consisted of one-third of total GOPC consultations in Hong Kong public health system.[42]

The inclusion criteria of participants were: (1) aged 60 years or above; (2) with two or more chronic diseases confirmed by the medical information in the public clinical management system and patients' self-report and (3) could speak and understand Chinese. No specific exclusion criteria were adopted. However, as participants needed to respond to questionnaire surveys and health checks, they should be able to access the clinic, sign informed consent by themselves, and understand and answer the research questions.

Patients were first consecutively screened for eligibility by trained research assistants in the waiting areas of the GOPCs. For those who were eligible, they were asked to provide a contact phone number and then were scheduled to visit the study nurse for further assessments. All patients provided informed consent before participation in the study. From April 2016 to October 2017, 1077 eligible patients were recruited and completed the baseline assessments. The baseline assessments were conducted through face-to-face interviews by nurses or a social worker at a university affiliated primary care clinic. The flow chart of recruitment is shown in figure 1. The sample size allows a margin of error at 3% with a 95% CI. It is also 100% powered to detect a mean difference of 0.5 (assuming SD is 1.0) and 90% powered to detect a

Table 1 Core topic areas in questionnaires and examinations of the study

Assessment	Description
Questionnaire	
Use of medication	No and duration (0–1 year/2–5 years/>5 years) for antihypertensive, cardiovascular and hypolipidaemic drugs, antidiabetics, antipsychotics and analgesics.
Compliance of medication use	'At times, do you forget to take your prescription medications?' (no/yes)
Depression	The 2-item Patient Health Questionnaire (PHQ-2) for depression; The 9-item PHQ (PHQ-9) for those with PHQ-2 ≥3.
Anxiety	The 2-item Genralised Anxiety Disorder (GAD-2); The 7-item GAD (GAD-7) for those with GAD-2 ≥3.
Loneliness*	The 6-item De Jong Gierveld Loneliness Scale; and one question asking 'Do you feel lonely? (yes/no)' (added at a later stage)
Insomnia	The 7-item Insomnia Severity Index for those answered yes to the screening question 'In the past 2 weeks, do you have insomnia? (yes/no)'
Pain	A screening question of 'In the past year, do you have musculoskeletal pain for at least 3 months', for those who answered 'yes, one pain area or 'yes, two or more pain areas', Brief Pain Inventory was measured.
Physical activity	For those were screened positive in pain, Physical Activity Scale for the Elderly was measured.
Self-rated health	'In general, how will you describe your health? (extremely good, very good or good/fair/poor)'
Community network	'When you need help, do you have someone who is willing to and able to meet your needs?' (always/sometimes/never)
Meaning of existence*	One item extracted from the validated reliable Chinese Purpose in Life test: "My personal existence is utterly meaningless and purposeless vs. very meaningful and purposeful", assessed by a 7-point Likert scale with 1 denoting the lowest level and 7 denoting the highest level of perceived meaning of existence.
Use of social media	A screening question of 'In the past 2 weeks, have you ever used the following social media', for those who answered yes to any of the social media, they were further assessed with importance and comfort of using internet.
Oral health*	'Do you have any difficulty when biting or chewing foods (even with the use of denture)' (yes/no)
Incontinence*	'Do you have incontinence?' (yes/occasionally/no)
Frailty*	The Edmonton Frail Scale.
Sarcopenia*	The 5-item Sarcopenia Assessment.
Cognition	Mainly assessed with Montreal Cognitive Assessment Hong Kong version but in an earlier stage, Abbreviated Memory Inventory for Chinese was used.
Quality of life	The EQ-5D-5L
Daily function	Instrumental Activities of Daily Living including ability to use telephone, mode of transportation, shopping, food preparation, ability to handle finances.
Use of health services	Visits to primary care doctors, specialist outpatient clinics, admission to hospital, use of services in elderly daycare centres and out-of-pocket healthcare cost both in private and public in the past year.
Alcohol use	The 3-item Alcohol Use Disorders Identification Test-consumption for those who drank alcohol in the past year.
Tobacco use	One question asking for current, ex-smoking and non-smoking behaviour.
Caregiving to somebody else	'Are you taking care of somebody?' (yes/no)
Social economic status	Age, gender, marriage, living status, employment, receiving of social welfare scheme.
Physical examination	
Blood pressure	Measured twice in 15 min after rest.
Body mass index	
Waist circumference	
Handgrip strength	Each hand was measured twice.

Continued

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Table 1	Continued
Assessment	**Description**
Electronic health record and self-report data	
Chronic diseases	43 common chronic conditions in 15 categories including: 1. Metabolic diseases (hypertension, lipid disorder, diabetes). 2. Cancer. 3. Disease of the cardiovascular system (coronary heart disease, stroke/cerebrovascular disease, peripheral vascular disease). 4. Disease of the respiratory system (COPD, bronchiectasis, asthma, chronic pharyngitis / laryngitis). 5. Disease of the liver, spleen and gallbladder (gallbladder/spleen disease, viral hepatitis, chronic liver disease). 6. Disease of the stomach and intestines (dyspepsia and gastritis, diverticular disease of intestine, chronic enteritis; irritable bowel syndrome; constipation). 7. Disease of the musculoskeletal and connective tissue (chronic pain needing medication control, skeletal and connective tissue inflammation (such as arthritis, gout)). 8. Disease of the genitourinary system (chronic kidney disease (nephritis), prostatitis, benign prostatic hyperplasia). 9. Disease of the ear, nose and throat (chronic rhinitis, deafness/tinnitus). 10. Disease of the visual system (glaucoma/cataracts, blindness/amblyopia, diabetic eyes, retinal detachment). 11. Disease of the skin (eczema, psoriasis). 12. Disease of the blood (anaemia). 13. Disease of the nervous system (multiple sclerosis, migraine, epilepsy, Parkinson's disease). 14. Mental disorders (schizophrenia/bipolar disorder, depression, anxiety and other stress-related disorders, dementia). 15. Others.
Use of medication	Medication use number and duration (0–1 year/2–5 years/>5 years) for antihypertensive drugs, cardiovascular drugs, cholesterol-lowering drugs, antidiabetics, antipsychotics and analgesics

*Measures were added at later stages: about 712–995 patients received these measures.
COPD, Chronic obstructive pulmonary disease; EQ-5D-5L, EuroQoL-5-Dimensions-5-Level.

difference of 8% of different rates, with a follow-up rate of 50% (α=0.05).[43 44]

Measures

The assessments covered a range of measures that are postulated to be potential physical, psychological and social factors associated with multimorbidity. Each complete assessment lasted for about 45–60 min. All the measures were validated and have been widely used or have been used in our previous studies. Information was collected through face-to-face interviews by trained nurses, social workers and research assistants, and additional information of the disease entities, medication use and health service utilisation was confirmed through the review of electronic medical records by nurses. The electronic medical records include patient information and diagnosis, health examinations, medication prescription and health visits to the public health system. The records cover all patients who seek medical services in public health system. It is a medical record system of routine clinical practices with quality ensured by all healthcare professionals including trained doctors, nurses and allied health professionals under Hospital Authority in Hong Kong.

The measures in the questionnaires included: (1) the number and type of chronic diseases in fifteen categories (a total of 43 chronic conditionals) adapted slightly by a group of family physicians and researchers based on chronic conditions employed in previous studies[45 46] and the International Statistical Classification of Diseases 11. Details can be seen in table 1; (2) depression (screened by the 2-item Patient Health Questionnaire (PHQ-2)).[47] Those with a score of 3 or more (which suggests depression) were further measured by the 9-item PHQ (PHQ-9)[48]; (3) anxiety (screened by the 2-item Generalised Anxiety Disorder (GAD-2)). Those with a score of 3 or more (which suggests anxiety) were further measured by the 7-item GAD (GAD-7)[49]; (4) loneliness (measured by the 6-item De Jong Gierveld Loneliness Scale),[50] as well as one loneliness question; (5) insomnia (measured by the 7-item Insomnia Severity Index)[51] among those who answered yes to a screening question); (6) pain (measured by the Brief Pain Inventory among those who were screened positive in pain); (7) physical activity (measured by Physical Activity Scale for the Elderly (PASE)[52] among those who were screened positive in pain); (8) frailty (measured by the Edmonton Frail Scale[53] which was translated and back-translated by experienced bilingual translators); (9)

meaning of existence (measured by one question extracted from the validated Chinese Purpose in Life test which was used in a previous study)[54]; (10) sarcopenia (measured by the 5-item Sarcopenia Assessment)[55 56]; (11) cognition (measured by the Hong Kong Montreal Cognitive Assessment (HK-MoCA) with a score of 22 or above being with normal cognition)[57]; (12) alcohol use (screened by one question and then measured by the 3-item Alcohol Use Disorders Identification Test-consumption for those who screened positive); (13) smoking (non-smoker, current smoker, ex-smoker); (14) medication use (number and duration (0–1 year/2–5 years/>5 years) of antihypertensive, cardiovascular and hypolipidaemic drugs, antidiabetics, antipsychotics and analgesics was checked in electronic medical system, and compliance of medication use was measured by 'At times, do you forget to take your prescription medications?' (no/yes)); (15) self-rated health; (16) community network; (17) use of social media (measured by a screening question, and for those who answered yes to any of the social media, they were further assessed on the importance and comfort of using the internet); (17) oral health; (18) incontinence; (19) caregiving to somebody; (20) quality of life (measured by the EuroQoL-5-Dimensions-5-Level (EQ-5D-5L))[58]; (21) daily function (ability to use the telephone, mode of transportation, shopping, food preparation, ability to handle finances were measured); (22) health service utilisation (visits to primary care doctors, specialist outpatient clinics (SOPC), admission to hospital, use of services in elderly daycare centres and out-of-pocket healthcare costs which were not covered by public health system or insurance both in private and public in the past year). In addition, physical examinations included blood pressure, body mass index (BMI), waist circumference and handgrip strength (kg). For blood pressure, two assessments were taken by the nurses. Patients sat for at least 5 min before the first assessment, and they were assessed again 15 min later. Handgrip strength was also assessed twice for each hand. Social economic status, such as age, gender, marriage, living status, employment, receiving of social welfare scheme, was also included. Due to the data collection plan amendments, a few measures were only collected in a subgroup of the patients at a later stage. Summaries of the baseline measures are described in table 1.

The questionnaire was set up in password protected EpiData files in a password-protected computer with quality control. For example, for scale questions with answers on a Likert scale of 1–5, a range of 1–5 and one digit was set up so no other results were allowed during data entry. Additionally, for most data variables, a 'must enter' was set up, so that the question could not be missed unless answered or an individual purposely moves to the next question. Checking for missing data was done regularly by experienced researchers and missing data was further collected by nurses through face-to-face interviews, telephone or by checking the electronic medical record system.

Patient and public involvement

The research questions and outcome measures were developed based on some most common problems that are widely recognised among elder patients. Patients or the public did not involve in the design of the study, recruitment or conduction of the study. The results of the study would be disseminated to patients once he or she requests so and aggregated data would be reported in project reports and research publications and conferences.

Findings to date

Baseline characteristics of the patients in the study are shown in table 2. The weighted data are shown in the bracket beside the unweighted data. The mean age of the study patients was 70 (SD=6.8) (70.5, SD=7.9) years, 70% (53%) were female, 67% (68%) were married, 14% (15%) lived alone, 92% (87%) were retired or housewives, 49% (52%) had 6 years of education or above, 10% (10%) were on the Comprehensive Social Security Assistance scheme which is open for those with a low income, about half used social media in the last 2 weeks, about 18% (15%) provided care to another (such as their spouse or children/grandchildren), 13% (17%) had drank alcohol in the past year and 3% (4%) were current smokers. More female patients lived alone, were retired/housewives, had lower education and more received social security support than male patients (p values <0.05).

After weighting, overall, the mean number of chronic diseases was 4.1 (SD=1.8) and about one in five patients had six or more chronic diseases. The top three chronic conditions were hypertension (75%), dyslipidaemia (46%), and skeletal and connective tissue inflammation (eg, arthritis) (36%). The unweighted and weighted prevalence of comorbidities of the 15 disease categories among the patients is shown in figures 2 and 3, respectively. The unweighted and weighted comorbidities of top 10 prevalent conditions out of the 43 conditions are shown in figures 4 and 5, respectively, with the combination of hypertension and dyslipidaemia being the most common (39%), followed by hypertension and diabetes mellitus (27%), hypertension and skeletal and connective tissue inflammation (eg, arthritis) (26%), dyslipidaemia and diabetes mellitus (21%), hypertension and chronic pain (20%). Information of the rest comorbidities is shown in the figures. Female patients had fewer number of chronic conditions, fewer number of medications in use but poorer self-rated health than male patients (p<0.05). On average, patients took 2.5 (SD=1.9) medications, with 30% taking five or more medications regularly, 36% reported forgot taking medication sometimes.

After weighting, the mean BMI was 24.3 (SD=3.4) with 62% being overweight or obese. Based on the Edmonton Frail Scale, 17% were frail. Ten per cent had sarcopenia, 23% reported chewing difficulty, 17% reported incontinence, 36% had stage one or two hypertension currently according to the physical examination, 38% had their handgrip strength (based on the best outcome

Table 2 Basic characteristics and biopsychosocial health profiles of the elderly with multimorbidity in primary care in Hong Kong

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
Female				69.9%				52.8%
Age (mean, SD)	69.6 (6.6)	71.1 (7.1)	<0.001	70.0 (6.8)	71.3 (8.4)	70.2 (7.9)	0.097	70.5 (7.9)
60–64	22.8%	19.8%	0.002	22.0%	28.8%	31.4%		30.2%
65–69	35.6%	26.5%		32.9%	22.9%	25.3%		24.0%
70–74	21.8%	24.4%		22.5%	12.5%	14.5%		13.4%
75–79	9.7%	16.4%		11.6%	12.1%	13.0%		12.5%
80 or above	10.1%	13.0%		11.0%	23.8%	15.7%		20.0%
Marriage			<0.001				<0.001	
Married	57.9%	89.2%		67.3%	54.7%	82.9%		68.1%
Single/divorced/separated	11.8%	4.3%		9.6%	10.9%	9.6%		10.3%
Widowed	30.2%	6.5%		23.1%	34.4%	7.5%		21.7%
No of children (mean, SD)	2.5 (1.6)	2.5 (1.2)	0.409	2.52 (1.47)	2.7 (1.9)	2.4 (1.3)	0.013	2.53 (1.6)
Living alone	16.5%	8.3%	<0.001	14.0%	18.4%	11.9%	0.004	14.6%
Employment								
Retired/housewife	96.0%	82.4%	<0.001	91.9%	95.8%	77.5%	0.000	86.9%
Employed	4.0%	17.6%		8.1%	4.2%	22.5%		13.1%
Education (year, mean, SD)	7.2 (4.7)	8.7 (4.1)	<0.001	7.7 (4.6)	6.5 (4.6)	8.9 (4.1)	<0.001	7.7 (4.5)
Year of education ≥6 years	46.8%	59.5%	0.001	49.3%	40.7%	63.2%	<0.001	51.8%
Social security recipient	58.1%	59.3%	0.726	58.6%	59.8%	50.5%	0.002	55.4%
Comprehensive Social Security Assistance Scheme	11.4%	7.1%	0.031	10.1%	12.3%	7.6%	0.011	10.1%
Fruit voucher	44.7%	50.3%	0.089	46.4%	45.5%	41.5%	0.190	43.6%
Disability allowance	3.7%	3.1%	0.604	3.5%	3.9%	3.0%	0.426	3.5%
Other	0.5%	0.3%	0.621	0.5%	0.4%	0.3%	0.803	0.3%
Caregiving to somebody	18.9%	14.5%	0.118	17.6%	16.8%	13.0%	0.126	15.0%
Alcohol use								
Yes, in last 12 months	5.4%	29.3%	<0.001	12.6%	5.2%	29.8%	<0.001	16.8%
AUDIT-C*								
AUDIT-C positive (≥3)	1.4%	11.1%	<0.001	4.4%	1.5%	11.2%	<0.001	6.1%
Smoke			<0.001				<0.001	
Never smoke	97.1%	60.5%		86.1%	96.9%	60.3%		79.6%
Smoke	0.8%	7.1%		2.7%	0.8%	7.2%		3.8%

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
Quit smoke	2.1%	32.4%		11.2%	2.4%	32.5%		16.6%
Self-rated health			<0.001				0.001	
Excellent/very good/good	26.0%	34.7%		28.5%	26.8%	32.7%		29.5%
Fair	59.5%	58.4%		59.2%	58.6%	60.1%		59.3%
Poor	14.6%	6.9%		12.3%	14.7%	7.2%		11.2%
No of chronic conditions (mean, SD)	4.0 (1.7)	4.3 (1.9)	0.004	4.1 (1.8)	4.0 (1.7)	4.3 (1.9)	0.026	4.1 (1.8)
2 diseases	21.4%	15.4%	0.003	19.6%	22.6%	16.0%	0.019	19.4%
3 diseases	25.5%	28.7%		26.5%	25.1%	29.8%		27.3%
4 diseases	21.0%	17.0%		19.8%	19.5%	16.1%		17.9%
5 disease	15.0%	13.0%		14.4%	14.8%	12.7%		13.8%
6+ disease	17.1%	25.9%		19.8%	18.1%	25.4%		21.5%
Chronic conditions by category								
Metabolic diseases	82.2%	86.7%	0.066	83.6%	83.8%	85.5%	0.449	84.6%
Cancer	7.3%	13.0%	0.003	9.0%	7.0%	11.6%	0.009	9.2%
Cardiovascular diseases	13.4%	24.7%	<0.001	16.9%	14.5%	24.1%	<0.001	19.0%
Respiratory disease	6.1%	9.6%	0.043	7.2%	6.4%	9.9%	0.039	8.1%
Liver disease	9.3%	10.2%	0.649	9.6%	9.3%	10.8%	0.439	10.0%
Gastrointestinal disorders	28.0%	23.8%	0.148	26.7%	27.7%	23.2%	0.093	25.5%
Musculoskeletal disorders	65.2%	48.8%	<0.001	60.3%	65.5%	49.8%	<0.001	58.1%
Thyroid disease	9.7%	1.9%	<0.001	7.3%	9.2%	1.9%	<0.001	5.7%
Renal disease	2.3%	33.3%	<0.000	11.6%	2.1%	31.7%	<0.001	16.1%
ENT	8.9%	9.3%	0.849	9.0%	8.8%	9.6%	0.645	9.2%
Eye	27.9%	22.5%	0.067	26.3%	29.1%	20.5%	0.001	25.0%
Skin	9.3%	9.9%	0.765	9.5%	9.0%	10.5%	0.401	9.7%
Anaemia	3.1%	2.8%	0.806	3.0%	3.0%	2.8%	0.867	2.9%
Neurological disease	0.7%	1.2%	0.346	0.8%	0.5%	1.3%	0.175	0.9%
Mental disorders	16.7%	10.2%	0.005	14.8%	16.4%	11.2%	0.015	14.0%
Use of medication								
Antihypertensive drugs (mean, SD)	1.0 (0.9)	1.2 (0.9)	0.082	1.1 (0.9)	1.1 (0.9)	1.1 (0.9)	0.431	1.1 (0.9)
Percentage of patients who use	69.1%	75.3%	0.038	70.9%	71.3%	74.0%	0.326	72.5%
Cardiovascular drugs (mean, SD)	0.2 (0.5)	0.3 (0.6)	<0.001	0.2 (0.5)	0.2 (0.5)	0.3 (0.7)	0.024	0.24 (0.6)

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
Percentage of patients who use	11.8%	22.8%	<0.001	15.1%	12.7%	21.8%	<0.001	17.0%
Antidiabetics (mean, SD)	0.4 (0.7)	0.5 (0.8)	0.0195	0.4 (0.8)	0.3 (0.7)	0.5 (0.8)	0.029	0.4 (0.7)
Percentage of patients who use	22.6%	31.8%	0.001	25.4%	22.1%	31.9%	<0.001	26.7%
Cholesterol-lowering drugs (mean, SD)	0.4 (0.5)	0.5 (0.5)	0.005	0.4 (0.5)	0.4 (0.5)	0.5 (0.5)	0.004	0.4 (0.5)
Percentage of patients who use	38.8%	48.2%	0.004	41.6%	37.5%	48.4%	<0.001	42.7%
Antipsychotics (mean, SD)	0.2 (0.8)	0.1 (0.5)	0.038	0.2 (0.7)	0.2 (0.8)	0.1 (0.5)	0.035	0.2 (0.7)
Percentage of patients who use	11.7%	7.4%	0.035	10.4%	11.1%	7.7%	0.055	9.5%
Analgesics (mean, SD)	0.1 (0.5)	0.1 (0.4)	0.875	0.1 (0.5)	0.1 (0.5)	0.1 (0.4)	0.929	0.1 (0.4)
Percentage of patients who use	10.5%	10.8%	0.879	10.6%	9.8%	10.2%	0.833	10.0%
Total nor of medication (mean, SD)	2.3 (1.9)	2.7 (1.9)	0.001	2.4 (1.9)	2.3 (1.9)	2.6 (1.9)	0.025	2.5 (1.9)
% forgetting taking medication (n=995)	38.4%	34.0%	0.196	37.1%	36.3%	34.8%	0.640	35.6%
Oral health problem (n=992)	25.3%	20.6%	0.119	23.9%	24.8%	20.5%	0.104	22.8%
Incontinence (n=992)			0.004				<0.001	
No	77.0%	86.3%		79.7%	76.9%	86.6%		81.5%
Occasionally	21.3%	12.7%		18.8%	20.3%	12.7%		16.7%
Yes	1.7%	1.0%		1.5%	2.8%	0.7%		1.8%
Pain								
Musculoskeletal pain for at least 3 months in the past year			0.000				<0.001	
No	19.1%	37.7%		24.9%	18.7%	37.4%		27.5%
Yes, one pain area	19.7%	23.8%		10.9%	18.7%	23.6%		21.0%
Yes, two or more pain areas	61.2%	38.6%		64.3%	62.7%	39.0%		51.5%
Brief Pain Inventory (BPI)†								
Interference (n=809)	4.6 (1.9)	4.1 (1.9)	<0.001	4.5 (1.9)	4.7 (2.0)	4.1 (1.9)	<0.001	4.4 (2.0)
Severity (n=810)	2.9 (2.2)	2.2 (1.8)	<0.001	2.7 (2.1)	2.9 (2.2)	2.2 (1.8)	<0.001	2.6 (2.1)
Physical Activity Scale for the Elderly (PASE) (n=809)‡								
Mean (SD)	77.4 (34.9)	89.1 (61.5)	<0.001	80.3 (43.4)	74.7 (36.1)	95.7 (67.3)	<0.001	83.3 (52.2)
Sarcopenia (mean, SD) (n=719)§	1.5 (1.6)	0.7 (1.3)	<0.001	1.2 (1.5)	1.7 (1.8)	0.7 (1.2)	<0.001	1.2 (1.6)
Positive (≥4)	11.0%	5.7%	0.019	9.3%	15.5%	5.1%	<0.001	10.4%
Negative (0–3)	89.0%	94.3%		90.7%	84.5%	94.9%		89.6%
Cognition¶								
AMIC (mean, SD) (n=337)	2.2 (1.7)	1.7 (1.6)	0.035	2.1 (1.7)	2.1 (1.7)	1.6 (1.6)	0.038	1.9 (1.7)

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
AMIC Positive % (≥3)	40.6%	27.3%	0.027	37.1%	39.3%	24.7%	0.007	33.3%
HK-MOCA (n=785)	24.7 (4.3)	25.4 (3.2)	0.026	24.9 (4.0)	24.0 (4.8)	25.5 (3.1)	<0.001	24.7 (4.1)
HK-MOCA Abnormal % (<22)	17.5%	12.6%	0.080	15.9%	23.0%	10.5%	<0.001	16.9%
Depression								
PHQ-2	1.3 (1.6)	0.8 (1.2)	<0.001	1.2 (1.5)	1.3 (1.6)	0.8 (1.3)	<0.001	1.1 (1.5)
Screen (-) (<3)	78.1%	88.3%	<0.001	81.2%	77.8%	87.6%	<0.001	82.4%
Screen (+) (≥3)	21.9%	11.7%		18.9%	22.2%	12.4%		17.6%
PHQ-9 (mean, SD)**	11.4 (4.3)	10.5 (4.5)	0.274	11.2 (4.4)	11.4 (4.2)	10.4 (4.3)	0.179	11.0 (4.3)
Mild (5–9)	8.8%	4.3%		7.4%	8.6%	4.8%		6.8%
Moderate (10–14)	7.3%	4.9%		6.6%	8.2%	5.4%		6.9%
Moderately severe (15–19)	4.2%	1.2%		3.3%	4.0%	1.2%		2.7%
Severe (20+)	1.3%	0.9%		1.2%	1.2%	0.8%		1.0%
Anxiety								
GAD-2 (≥3) (mean, SD)	1.4 (1.5)	0.8 (1.1)	<0.001	1.2 (1.5)	1.4 (1.6)	0.8 (1.1)	<0.001	1.1 (1.4)
Screen (-) (<3)	79.7%	91.1%	<0.001	83.0%	79.5%	90.9%	<0.001	84.9%
Screen (+) (≥3)	20.3%	9.0%		17.0%	20.5%	9.1%		15.1%
GAD-7 (mean, SD)††	10.8 (3.9)	9.8 (3.7)	0.182	10.7 (3.9)	10.9 (3.9)	10.1 (3.6)	0.294	10.7 (3.8)
Mild (5–9)	0.9%	0.3%		0.7%	0.7%	0.2%		0.5%
Moderate (10–14)	6.9%	4.6%		6.2%	8.5%	5.0%		6.8%
Moderately Severe (15–19)	9.6%	3.4%		7.7%	10.1%	4.4%		7.4%
Severe (20+)	2.9%	0.6%		2.2%	3.6%	0.6%		2.2%
Insomnia								
Insomnia in the past 2 weeks			0.030				0.086	
No	31.5%	28.3%		33.5%	32.2%	37.2%		34.6%
Yes	68.5%	61.7%		66.5%	67.8%	62.8%		65.4%
ISI (n=716) (mean, SD)†	12.0 (5.1)	10.2 (4.6)	<0.001	11.5 (5.0)	11.9 (5.1)	10.1 (4.5)	<0.001	11.1 (4.9)
No clinically significant insomnia (0–7)	13.7%	18.2%		15.0%	14.2%	18.8%		16.4%
Subthreshold insomnia (8–14)	31.1%	29.0%		30.5%	31.0%	29.7%		30.4%
Clinical insomnia, moderate severity (15–21)	22.2%	14.2%		19.8%	22.1%	15.0%		18.8%
Clinical insomnia, severe (22–28)	1.6%	0.3%		1.2%	1.5%	0.3%		0.9%
Meaning (0–7) (n=544)	4.8 (1.2)	5.0 (1.1)	0.098	4.8 (1.2)	4.7 (1.3)	5.0 (1.1)	0.022	4.9 (1.2)

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
Loneliness (n=741)								
One question (yes/no)			0.009				0.128	
No	68.0%	77.1%		72.5%	69.8%	74.6%		72.2%
Yes	32.1%	22.9%		27.5%	30.2%	25.4%		27.9%
De Jong Gierveld Loneliness Scale								
Total loneliness score (mean, SD)	1.8 (1.9)	1.6 (1.7)	0.121	0.7 (1.2)	1.8 (1.8)	1.6 (1.7)	0.309	1.7 (1.8)
Emotional loneliness score (mean, SD)	1.0 (1.1)	0.9 (1.0)	0.156	1.6 (1.8)	0.9 (1.0)	0.9 (1.0)	0.566	0.9 (1.0)
Social loneliness score (mean, SD)	0.8 (1.3)	0.7 (1.2)	0.121	0.9 (1.0)	0.8 (1.3)	0.7 (1.3)	0.350	0.8 (1.3)
Social support (can count on someone willing and able to meet your needs)			0.083				0.146	
Always	61.2%	66.3%		62.7%	61.6%	65.8%		63.5%
Sometimes	31.1%	30.0%		30.7 %	31.2%	28.6%		30.0%
Never	7.7%	4.1%		6.7%	7.3%	5.6%		6.5%
Use of social media in last 2 weeks								
Yes	52.5%	52.1%	0.849	52.6%	46.6%	55.8%	0.003	51.0%
Web	20.9%	33.6%	<0.001	24.7%	18.5%	36.5%	<0.001	27.0%
WhatsApp	51.4%	50.0%	0.675	51.0%	45.9%	52.6%	0.028	49/0%
Facebook	15.9%	20.4%	0.077	17.3%	14.5%	20.7%	0.006	17.4%
Blog	1.7%	3.4%	0.089	2.2%	1.3%	3.0%	0.065	2.1%
E-literacy (n=566)‡‡	25.0 (11.7)	24.9 (12.6)	0.931	25.0 (12.0)	25.5 (11.6)	25.4 (12.7)	0.953	25.4 (12.2)
Importance of social media (total score: 6–24)	11.3 (4.8)	10.8 (4.7)	0.218	11.1 (4.8)	11.5 (4.7)	10.8 (4.8)	0.171	11.1 (4.8)
Comfort of using social media (total score: 3–18)	8.2 (4.5)	8.2 (4.7)	0.975	8.2 (4.5)	8.3 (4.4)	8.3 (4.7)	0.878	8.3 (4.5)
Daily function (Percentage of patients needing help or being dependent)								
Total	8.4%	14.8%	0.001	10.3%	10.5%	14.3%	0.056	12.3%
Using telephone	0.7%	1.2%		0.8%	1%	1%		1%
Transportation	4.7%	5.6%		4.3%	5.9%	5.4%		5.7%
Shopping	5.7%	5.0%		5.5%	7.5%	4.8%		6.2%
Preparing meals	4.3%	12.7%		6.8%	5.5%	12.7%		8.9%
Financial management	2.9%	4.9%		3.5%	4.1%	0.9%		2.6%
Frailty								
Edmonton Frail Scale (mean, SD) (n=989)§	3.5 (2.3)	3.1 (2.0)	0.003	3.4 (2.2)	3.7 (2.4)	3.1 (2.0)	<0.001	3.4 (2.2)

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
No frailty (0–5)	80.3%	88.3%	0.012	82.6%	77.6%	88.7%	<0.001	82.8%
Apparently vulnerable (6–7)	13.7%	8.6%		12.2%	13.8%	8.7%		11.4%
Mild frailty (8–9)	4.7%	2.4%		4.0%	6.8%	2.0%		4.6%
Moderate frailty (10–11)	1.3%	0.3%		1.0%	1.8%	0.2%		1.1%
Severe frailty (12–18)	0%	0.33%		0.1%	0%	0.4%		0.2%
Quality of life (EQ-5D-5L)								
Index score (range: −0.864–1)	0.8 (0.2)	0.9 (0.2)	0.001	0.81 (0.20)	0.8 (0.2)	0.9 (0.2)	<0.001	0.81 (0.2)
Visual Analogue Scale (0–100)	66.0 (15.3)	69.6 (13.4)	<0.001	67.1 (14.8)	66.0 (15.4)	69.4 (13.3)	0.001	67.6 (14.6)
Healthcare utilisation in the past year								
Hospitalisation frequency			0.453				0.557	
0	83.8%	81.2%		83.0%	83.6%	82.0%		82.9%
1–2	14.4%	17.3%		15.2%	14.0%	16.7%		15.3%
2+	1.9%	1.5%		1.8%	2.4%	1.3%		1.9%
Hospitalisation Length (days, mean, SD) (n=1073)	1.1 (5.1)	1.5 (8.2)	0.424	1.2 (6.2)	1.1 (5.1)	1.4 (8.3)	0.535	1.2 (6.8)
Specialist outpatient clinics	69.0%	70.7%	0.587	69.5%	68.8%	70.2%	0.636	69.5%
General outpatient clinics	89.6%	94.1%	0.018	91.0%	89.8%	94.3%	0.007	92.0%
Elderly day care service	9.4%	9.9%	0.824	9.6%	10.2%	9.1%	0.554	9.6%
Cost (out of pocket) (HKD) median (IQR, IQR) (n=1063)	1000 (0–3000)	1000 (0–2000)	0.141	1000 (0–3000)	1000 (0–3000)	1000 (0–2000)	0.488	1000 (0–3000)
Physical examinations								
Blood pressure								
Systolic (mean, SD)	133.2 (15.6)	134.2 (15.9)	0.337	133.5 (15.7)	133.5 (16.3)	133.3 (15.2)	0.848	133.4 (15.8)
Diastolic (mean, SD)	74.9 (9.6)	78.4 (10.0)	<0.001	75.9 (9.9)	74.1 (10.0)	78.6 (9.9)	<0.001	76.2 (10.2)
Normal (SBP <120 and DBP <80)	19.2%	14.8%	0.272	17.9%	19.9%	15.8%	0.070	17.9%
Prehypertension (SBP: 120–139 or DBP: 80–89)	45.8%	48.2%		46.5%	44.6%	48.4%		46.4%
Stage I hypertension (SBP: 140–159 or DBP: 90–99)	30.2%	30.6%		30.3%	29.9%	29.8%		29.8%
Stage II hypertension (SBP ≥160 or DBP≥100)	4.8%	6.5%		5.3%	5.6%	6.0%		5.8%
Pulse (per minute)	71.5 (19.5)	75.2 (28.0)	0.016	72.7 (22.5)	71.7 (22.0)	74.9 (24.8)	0.041	73.2 (23.4)
Weight (kg, mean, SD)	57.5 (56.8)	66.5 (9.6)	<0.001	60.2 (10.4)	56.9 (9.3)	66.9 (9.7)	<0.001	61.6 (10.7)
Height (cm, mean, SD)	154.0 (6.2)	165.5 (6.7)	<0.001	157.4 (8.2)	153.4 (6.2)	165.6 (6.7)	<0.001	159.2 (8.8)
Waist circumference (cm, mean, SD)	88.8 (9.7)	93.2 (9.5)	<0.001	90.2 (9.9)	89.1 (9.9)	93.2 (9.2)	<0.001	91.1 (9.8)

Continued

Table 2 Continued

Characteristics	Unweighted rates and analyses			Crude total %	Weighted rates and analyses			Weighted total %
	Female (n=753)	Male (n=324)	P value		Female (n=568)	Male (n=508)	P value	
Body mass index (mean, SD)	24.2 (3.8)	24.2 (2.0)	0.963	24.2 (3.6)	24.2 (3.7)	24.4 (3.1)	0.398	24.3 (3.4)
Underweight (<18.5)	4.1%	2.8%	0.067	3.7%	3.6%	2.7%	0.013	3.1%
Normal (18.5–22.9)	37.6%	31.3%		35.7%	38.9%	31.5%		35.4%
Overweight (23–24.9)	20.4%	26.0%		22.1%	20.5%	23.6%		22.0%
Obese (≥25)	37.9%	39.9%		38.5%	37.0%	42.2%		39.5%
Handgrip strength (kg)§§								
<Cut-off score (<26 for male, <18 for female)	36.3%	36.1%	0.964	36.2%	40.2%	34.7%	0.061	37.6%
Left hand (mean, SD)	17.4 (4.2)	26.4 (7.0)		20.1 (6.6)	17.0 (4.2)	26.7 (7.0)		21.5 (7.5)
Right hand (mean, SD)	18.5 (4.3)	27.4 (7.5)		21.1 (6.8)	18.0 (4.3)	27.5 (7.7)		22.5 (7.7)
Both hand (mean, SD)	19.1 (4.1)	28.5 (7.1)		21.9 (6.7)	18.6 (4.0)	28.8 (7.2)		23.4 (7.6)

Statistical methods: X^2 tests were used for categorical data; paired t-tests were used for continuous data.

*n=136, those who did not drink alcohol the past 12 months were regarded as 0 in AUDIT-C.

†719 patients were assessed with ISI.

‡Only those who had one or more pain areas in the past 3 months were assessed with BPI or PASE-C.

§Measured by the 5-item Sarcopenia Assessment which were added at a later stage.

¶HK-MOCA replaced AMIC in a later stage.

**Mean (SD) was for 203 patients who did PHQ-9. The % was for all the 1077 patients with the rest 874 patients who screened negative in PHQ-2 regarded as having normal scores in PHQ-9.

††Mean (SD) was for 182 patients who did GAD-7. The % was for all the 1077 patients with the rest 895 patients who screened negative in GAD-2 regarded as having normal scores in GAD-7.

‡‡Only those who had social media use in the past 2 weeks were assessed.

§§Better result of two series for left or right hand, or best result of both hands.

AUDIT-C, the 3-item Alcohol Use Disorders Identification Test-consumption; DBP, diastolic blood pressure; ENT, ear, nose and throat; EQ-5D-5L, EuroQoL-5-Dimensions-5-Level; GAD-2, the two-item General Anxiety Disorder scale; HKD, Hong Kong Dollars; HK-MoCA, Montreal Cognitive Assessment Hong Kong version; ISI, 7-item Insomnia Severity Index; PHQ-2, the two item Patient Health Questionnaire for depression; SBP, systolic blood pressure.
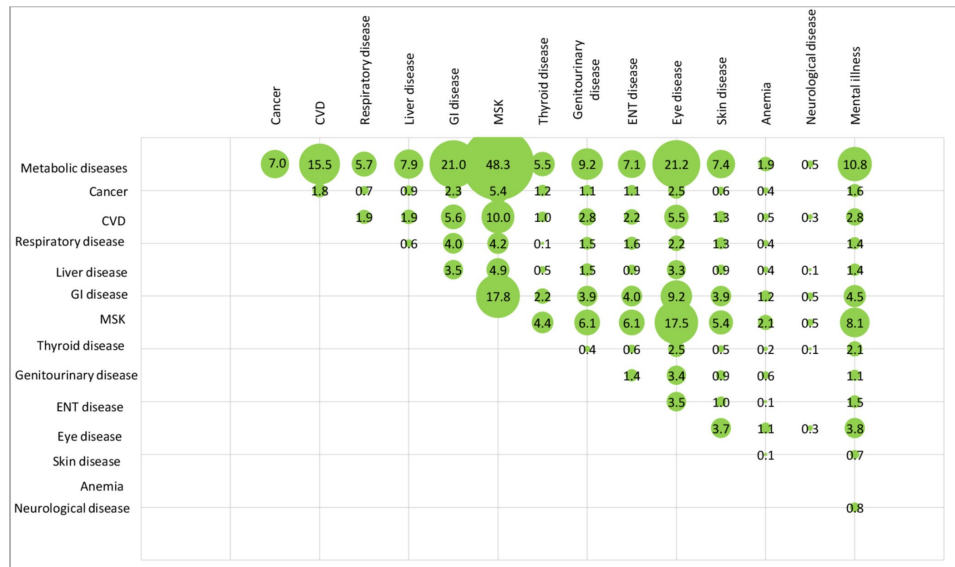
Figure 2 — Unweighted prevalence of comorbidities (%)

	Cancer	CVD	Respiratory disease	Liver disease	GI disease	MSK	Thyroid disease	Genitourinary disease	ENT disease	Eye disease	Skin disease	Anemia	Neurological disease	Mental illness
Metabolic diseases	7.0	15.5	5.7	7.9	21.0	48.3	5.5	9.2	7.1	21.2	7.4	1.9	0.5	10.8
Cancer		1.8	0.7	0.9	2.3	5.4	1.2	1.1		2.5	0.6	0.4		1.6
CVD			1.9	1.9	5.6	10.0	1.0	2.8	2.2	5.5	1.3	0.5	0.3	2.8
Respiratory disease				0.6	4.0	4.2	0.1	1.5	1.6	2.2	1.3	0.4		1.4
Liver disease					3.5	4.9	0.5	1.5	0.9	3.3	0.9	0.4	0.1	1.4
GI disease						17.8	2.2	3.9	4.0	9.2	3.9	1.2	0.5	4.5
MSK							4.4	6.1	6.1	17.5	5.4	2.1	0.5	8.1
Thyroid disease								0.4	0.6	2.5	0.5	0.2	0.1	2.1
Genitourinary disease									1.4	3.4	0.9	0.6		1.1
ENT disease										3.5	1.0	0.1		1.5
Eye disease											3.7	1.1	0.3	3.8
Skin disease												0.1		0.7
Anemia														
Neurological disease														0.8

Figure 2 Unweighted prevalence of comorbidities (by 15 disease categories) among the 1077 elderly with multimorbidity (figures are unweighted (%)). CVD, cardiovascular disease; ENT, ear, nose and throat; GI disease, gastrointestinal disease; MSK, musculoskeletal disorders.

of two trials of both hands) below the cut-off point, 12% needed help or were dependent in at least one out of the five daily functions (using telephone, transportation, shopping, preparing meals or financial management). Overall, 30%, 59% and 11% of patients rated their health being 'excellent/very good/good', 'fair' or 'poor', respectively. Seventy-three per cent reported the presence of one (21%) or two or more (52%) body pain areas, 17% scored the HK-MoCA <22 suggesting at least mild cognitive impairment; 18% had PHQ-2 ≥3, while 17% had PHQ-9 ≥5 suggesting mild depression or more severe; 15% had GAD-2 ≥3, while 16% had GAD-7 ≥5 suggesting mild anxiety or more severe; 50% had insomnia at subthreshold level or above, the mean score of the meaning of existence was 4.9 (SD=1.2) out of 7, 28% reported feeling lonely. More finding details can be seen in table 2. More female patients had incontinence, pain, sarcopenia and cognitive impairment than male patients. Female patients were more likely to be screened positive in depression and anxiety, reported severer level of insomnia and reported lower perceived existence of meaning than male patients. Female patients were more likely to be frail. More male patients used social media (p<0.05). The loneliness level and perceived social support were not significantly different between female and male patients.

Figure 3 — Weighted prevalence of comorbidities (%)

	Cancer	CVD	Respiratory disease	Liver disease	GI disease	MSK	Thyroid disease	Genitourinary disease	ENT disease	Eye disease	Skin disease	Anemia	Neurological disease	Mental illness
Metabolic diseases	7.8	17.8	6.1	8.3	20.2	47.8	4.3	12.0	7.2	20.2	7.9	1.8	0.5	9.9
Cancer		2.3	0.9	0.9	2.2	5.9	0.9	1.5	1.6	2.6	0.7	0.3		1.2
CVD			2.3	2.5	5.6	11.0	0.8	3.6	2.5	5.5	1.3	0.4	0.3	3.3
Respiratory disease				0.7	4.5	4.2	0.0	2.1	1.9	2.4	1.6	0.4		1.7
Liver disease					3.4	5.2	0.3	1.9	1.1	2.7	1.1	0.4	0.0	1.6
GI disease						17.2	1.5	5.3	3.8	7.9	3.7	1.2	0.4	3.8
MSK							3.6	8.4	6.3	16.1	5.0	2.1	0.7	7.4
Thyroid disease								0.3	0.5	2.0	0.5	0.1	0.0	1.7
Genitourinary disease									2.3	4.1	0.9	1.0		1.8
ENT disease										3.3	1.0	0.2		1.5
Eye disease											4.0	0.9	0.2	3.7
Skin disease												0.1		0.8
Anemia														0.9
Neurological disease														

Figure 3 Weighted prevalence of comorbidities (by 15 disease categories) among the 1077 elderly with multimorbidity (figures are weighted prevalence (%)). CVD: cardiovascular disease; ENT: ear, nose and throat; GI disease: gastrointestinal disease; MSK: musculoskeletal disorders.
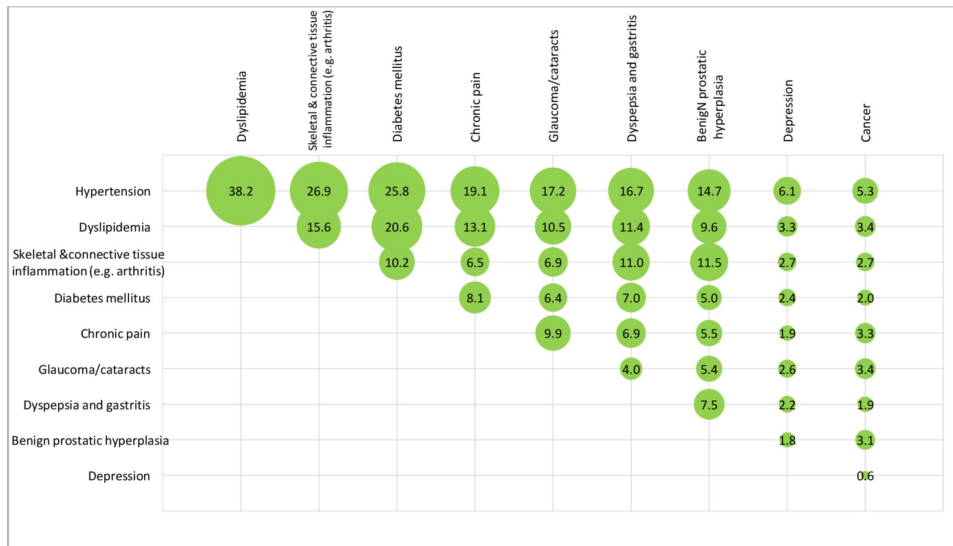
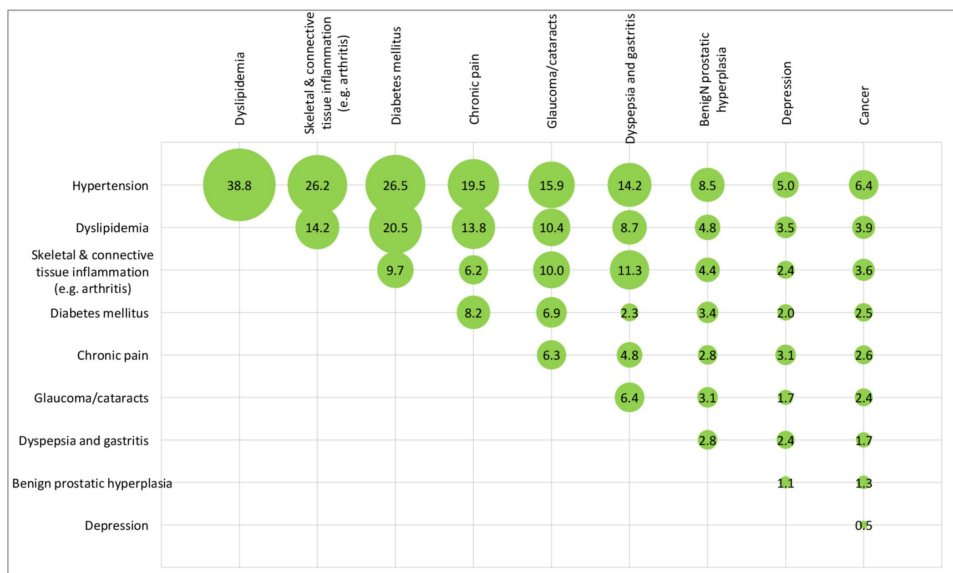**Figure 4** Unweighted prevalence of the comorbidities of top 10 chronic conditions (out of 43 specific chronic conditions) among the 1077 elderly with multimorbidity (figures are unweighted prevalence (%)).

In addition, after weighting, the EQ-5D-5L index score was 0.81 (0.20) and its Visual Analogue Scale score was 67.6 (14.6) out of 100. Female patients showed poorer quality of life. In the last year, 17% were admitted to hospital, 92% attended GOPC, 70% attended SOPC, 10% used elderly day care centre services and the median out-of-pocket health cost was HK$1000 (US$150) for any health expenditures not covered by the public health system or insurance. Male patients reported more GOPC visits than female patients in the past year (p=0.007).

Future plans

The patients will be followed up regularly (interval of ~2 years) to monitor changes in health status and outcomes through data collected from questionnaires, physical assessments and clinical records. Key biopsychosocial assessments such as depression, anxiety, loneliness, pain, frailty, as well as quality of life would be included in the follow-up assessments, but each follow-up might be added with some additional assessments with specific research interests. The first follow-up (ie, wave 2 assessment) had started in early 2018. Additional information on mobility by the 30s chair-stand test, visual acuity by Amsler Grid test and hearing by Weber's test and Rinne Test were added. Information on electronic medical records will also be updated to provide information on health service utilisation, changes in medication use and new onset of diseases and death.

The longitudinal trajectories of biopsychosocial health profiles of these primary care patients will be described. For example, changes and occurrence of different

Figure 5 Weighted prevalence of the comorbidities of top 10 chronic conditions (out of 43 specific chronic conditions) among the 1077 elderly with multimorbidity (figures are weighted prevalence (%)).

physical, mental and social problems among all the study participants as well as some subgroups (eg, different age, gender, comorbidities). We are also initially planning cohort studies on factors associated with various health outcomes as well as quality of life and healthcare use. In addition, more explorations will be made to answer many other research questions based on hypotheses.

Strengths and limitations

This study has several strengths. First, this is one of the few aetiological studies on older adults being conducted in Asian primary care settings to examine physical, psychological and social problems accompanying with multimorbidity. Second, it prospectively covers a range of biopsychosocial factors, which are not included in other previous large-scale studies since plenty of them are derived from extracted medical or insurance records. Our findings suggest that people with multimorbidity have significant complex healthcare needs in physical, mental and social aspects such as obesity, multiple body pain, polypharmacy, depression, anxiety, insomnia and loneliness. The results suggested that a holistic approach that addresses general physical and functional domain of health, at the same time assessing and managing psychological and social problems is therefore needed in the care of older adults with multimorbidity. Services which are designed to cater for the complex needs of elder patients with multimorbidity from biopsychosocial perspectives are urgently needed. These service models should also be adapted and tested in local circumstances to maximise its efficacy. Furthermore, given the significant differences found between male and female patients in biopsychosocial aspects, future interventions may also need to take gender differences into account. Third, the results were weighted according to the census data to make the sample more representative of the general population. In general, the weighted results were similar to the unweighted results, and in consistency with results reported in the western populations. Fourth, because it contains linked electronic medical records, it will allow us to follow them up for public medical service use and mortality.

There are also several limitations. First, self-selection bias might still exist which was consistent with other similar studies,[59] although we used weighting for adjustment, as not all variables were available for weighting such as education. Since only ambulatory adults who agreed to join were recruited and these usually are more likely to be female and those with higher educational level and higher self-motivation, and those who were housebound or institutionalised are less likely to have been included, we might have resulted in a relatively healthier and higher-functioning patients in primary care, and the real health status might be worse than what are reported in our study. Future studies may need to take measures to increase participation from male and vulnerable patients. Second, the sample size may limit examinations of potential interactions and factors

associated with multimorbidity in some subgroups such as older men and patients with lower educational levels, or uncommon health problems. Third, we used a two-step assessment for some health indicators. While false negative reported rates of pain, insomnia and alcohol use were unlikely, there might be false negative rates for depression and anxiety as the specificity and sensitivity of PHQ-2 and GAD-2 were not 100% (although results from meta-analytical reviews suggest they are reasonable to use in initial screening).[49 60] In addition, as PHQ-2 and GAD-2 are often used for screening with results in dichotomies (negative/positive), this might limit application of some statistical analysis such as using growth models in future longitudinal data. Fourth, for a few assessments, we only conducted them among a subgroup of participants, for example, PASE for physical activity among those patients with pain. Furthermore, some additional assessments such as meaning, sarcopenia, oral health were added at a later stage. So only subgroup data could be reported in this paper or analysed in the future when using these data.

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