

# BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email [info.bmjopen@bmj.com](mailto:info.bmjopen@bmj.com)

# BMJ Open

## Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging Related Disorder Cohort in China

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-034317
Article Type:	Cohort profile
Date Submitted by the Author:	14-Sep-2019
Complete List of Authors:	<p>Liu, Li; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Wei; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Nie, Lulin; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Guo, Zhiwei; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Luo, Yi; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Chen, Weihong; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Liu, Weimin; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Wang, Lu; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhang, Jiafei; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Wang, Xian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Li, Tian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Gao, Erwei ; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhou, Li; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>He, Kaiwu; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Huang, Yidan; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School</p>

	<p>of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Yuan, Chunjie; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Zhu, Qingqing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Ye, Fang; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Yu, Xingchen; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Yuan, Jing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology  Liu, Jianjun; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>
Keywords:	Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3  
4 Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging  
5 Related Disorder Cohort in China  
6  
7  
8

9 Li Liu<sup>1†</sup>, Wei Liu<sup>2†</sup>, Lulin Nie<sup>2</sup>, Zhiwei Guo<sup>3</sup>, Yi Luo<sup>3</sup>, Weihong Chen<sup>4</sup>, Weimin Liu<sup>4</sup>,  
10 Lu Wang<sup>5</sup>, Jiafei Zhang<sup>5</sup>, Xian Wang<sup>5</sup>, Tian Li<sup>5</sup>, Erwei Gao<sup>5</sup>, Li Zhou<sup>2</sup>, Kaiwu He<sup>2</sup>,  
11 Yidan Huang<sup>5</sup>, Chunjie Yuan<sup>5</sup>, Qingqing Zhu<sup>5</sup>, Fang Ye<sup>5</sup>, Xingchen Yu<sup>1</sup>, Jing Yuan<sup>5\*</sup>,  
12 Jianjun Liu<sup>2\*</sup>  
13  
14  
15  
16  
17  
18

19 <sup>1</sup> Department of Epidemiology and Biostatistics and State Key Laboratory of  
20 Environmental Health for Incubating, School of Public Health, Tongji Medical  
21 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
22  
23  
24

25 <sup>2</sup> Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology,  
26 Shenzhen Center for Disease Control and Prevention, Shenzhen, Guangdong, PR.  
27 China  
28  
29

30 <sup>3</sup> Shenzhen Luohu Hospital for Traditional Chinese Medicine, Shenzhen, Guangdong,  
31 PR. China  
32  
33

34 <sup>4</sup> Shenzhen Luohu Center for Disease Control and Prevention, Shenzhen, Guangdong,  
35 PR. China  
36  
37

38 <sup>5</sup> Department of Occupational and Environmental Health and State Key Laboratory of  
39 Environmental Health for Incubating, School of Public Health, Tongji Medical  
40 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
41  
42  
43  
44  
45

46 <sup>†</sup> Li Liu and Wei Liu contributed equally.  
47  
48  
49

50 **Corresponding to:**

51 Jianjun Liu

52 Key Laboratory of Modern Toxicology of Shenzhen

53 Institute of Toxicology

54 Shenzhen Center for Disease Control and Prevention, Shenzhen, 518055, Guangdong,  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 PR China

5  
6 Tel: +86 755 25508584

7  
8 E-mail: JLIUSZCDC@163.com  
9

10  
11  
12 Jing Yuan

13  
14 Department of Occupational and Environmental Health

15  
16 State Key Laboratory of Environmental Health for Incubating

17  
18 School of Public Health, Tongji Medical College, Huazhong University of Science  
19  
20 and Technology, No. 13 Hangkong Road, Wuhan 430030, China

21  
22 Tel: +86 27 83693209

23  
24 E-mail: [jyuan@tjh.tjmu.edu.cn](mailto:jyuan@tjh.tjmu.edu.cn)  
25  
26

27  
28 Word count: 3474  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## ABSTRACT

**Purpose:** The Shenzhen Aging Related Disorder Cohort is designed to detect the associations of lifestyle, environmental exposures and genetic factors with major aging related disorders, especially neurological and mental disorders.

**Participants:** The cohort is a community-dwelling prospective study of 9411 elderly individuals aged 60 to 92 years from 51 community recover centers in Luohu district of Shenzhen city, Guangdong province, China. The baseline data were collected between 2017 and 2018, including demographics and socioeconomics, lifestyles, medical history, family history of major non-communicable chronic disease, environmental exposure measurements, clinical analysis of blood and urine and clinical imaging measurements, anthropometric measures and neurological function and mental health assessments. Blood and urinary samples were collected at baseline. All participants will be followed for physiological and psychological changes, incidence of aging related disorders, and updated lifestyle and environmental exposures every 5 years.

**Findings to date:** The mean age of the participants was 67.73 years at baseline. Among all participants, 42.74 % were males. The prevalence of overweight/obesity, hypertension, diabetes mellitus, dyslipidemia, chronic bronchitis, myocardial infarction, coronary heart disease, stroke, cancer, arthritis, Alzheimer's disease, Parkinson's disease, brain injury, cognitive impairment and depression status was 54.38%, 58.24%, 22.30%, 75.49%, 1.45%, 0.55%, 5.69%, 1.10%, 2.18%, 5.04%, 0.18%, 0.23%, 5.75%, 5.39%, and 3.28%, respectively. The mean scores for the

1  
2  
3  
4 Lawton-Brody Activities of Daily Living Scale and the Social Support Rate Scale  
5  
6 were 14.15 and 39.54, respectively.  
7  
8

9 **Future plans:** The data provide for the purpose of identification of the causality of  
10 various aging related disorders, especially neurological and mental disorders through  
11 integrating environmental, genetic and lifestyle factors. The datasets generated and/or  
12 analysed during the current study are not publicly available at this stage, but are  
13 available from the corresponding author on reasonable request.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24

25 **Keywords:** Cohort study, Aging related disorders, Lifestyle, Environmental exposure,  
26 Genetic susceptibility, Neurological disease, Mental health  
27  
28  
29  
30  
31

### 32 **Strengths and limitations of this study**

- 33  
34 1. The Shenzhen Aging Related Disorder Cohort is a community-dwelling aging  
35 related disorder cohort with comprehensive epidemiological data, clinical  
36 examination, environmental exposures, body components and biological samples in  
37 Chinese population, which will facilitate the identification of the causality of various  
38 aging related disorders, especially neurological and mental disorders through  
39 integrating environmental, genetic and lifestyle factors.  
40  
41 2. The ways to identify the disease morbidity and mortality through questionnaire  
42 investigation, and searching National Electronic Disease Surveillance System and  
43 National Mortality Surveillance System guarantee the integrity and validity of  
44 outcomes of interest in our cohort.  
45  
46 3. There are limitations of our cohort. First, all participants are adults aged 60 years or  
47 older. Second, the medical histories of the participants in our cohort were  
48 self-reported. Third, parts of the participants took part in the body components  
49 analysis at baseline.  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017,<sup>1</sup> and it is forecasted that the life expectancy will keep increasing until 2040.<sup>2</sup> Consequently, population aging has become one of the major challenges facing most countries worldwide. The proportion of people with ageing related disorders, especially non-communicable chronic diseases has been growing.<sup>3</sup> For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,<sup>4</sup> the cancer incidence increased by 28% from 2006 and 2016,<sup>5</sup> and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.<sup>6,7</sup> In 2017, aging related diseases accounted for 51.3% of the global burden of diseases among adults.<sup>8</sup>

Compared with developed countries, developing countries are suffering from more serious burden of ageing related diseases caused by increasing morbidities of these diseases and limited health resources for disease diagnosis and treatment.<sup>9,10</sup> As the biggest developing country in the world, China has stepped into an aging society. The growing incidence of aging related disorders have threatened public health and economy.<sup>11</sup> Besides cardiovascular diseases, cancer and diabetes,<sup>12-15</sup> neurological and mental disorders have attracted growing attention due to their dramatically increased contribution to disease burden, the relative lack of resources for intervention of various mental diseases, and the need for more research to find the best ways to provide mental health services.<sup>16,17</sup> Data from the Chinese Longitudinal Healthy Longevity Study revealed an annual increase of 0.7%-2.2% of cognitive impairment rate and an annual decrease of 0.4%-3.8% of objective physical performance capacity

1  
2  
3  
4 among the oldest old Chinese between 1998 and 2008.<sup>18</sup> The prevalence of  
5  
6 Parkinson's disease increased by 116% in China from 1990 to 2016,<sup>19</sup> and that of  
7  
8 Alzheimer's disease was estimated to have quadrupled from 6 to 28 million between  
9  
10 2011 and 2015.<sup>20</sup> However, to date, there are no known effective treatments for most  
11  
12 aging related disorders, especially for neurological diseases, it is therefore urgent to  
13  
14 identify the risk factors, particularly those modifiable ones to facilitate the early  
15  
16 intervention and prevention of the onset of aging related disorders.  
17  
18  
19  
20  
21

22 Shenzhen, a major city in Guangdong province, China, situates immediately north  
23  
24 of Hongkong. As the first special economic zone and the birthplace of economic  
25  
26 miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd  
27  
28 most competitive financial center in the world in 2017. Along with the highest-speed  
29  
30 urbanization, Shenzhen has attracted large internal migration across the country, and  
31  
32 experienced dramatic socioeconomic changes and accelerated aging process during  
33  
34 the past decades. Given the population diversity, rapid urbanization, high-speed aging  
35  
36 process as well as adequate medical and health resources in Shenzhen city, a dynamic,  
37  
38 prospective cohort study, the Shenzhen Aging Related Disorder Cohort, has been  
39  
40 designed to provide evidence for addressing opportunities regarding aging related  
41  
42 disorders as an aging-oriented research model for areas with most rapid urbanization  
43  
44 and socioeconomic structure changes in developing countries.  
45  
46  
47  
48  
49  
50  
51

52  
53 The purposes of the Shenzhen Aging Related Disorder Cohort were to:

54  
55 1) determine the prevalence of aging related disorders, including neurological  
56  
57 disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases,  
58  
59  
60

1  
2  
3  
4 diabetes mellitus, neoplasms, injuries and other non-communicable diseases in  
5  
6 Shenzhen;

7  
8  
9 2) estimate the disease burden of aging related disorders, especially from  
10  
11 neurological and mental disorders in Shenzhen;

12  
13 3) describe the temporal dynamics of aging related disorders in Shenzhen;

14  
15 4) assess the effects of environmental factors, lifestyle, and genetic factors on the  
16  
17 initiation and progression of aging related disorders, especially for neurological and  
18  
19 mental disorders;  
20  
21  
22

23  
24 5) develop risk prediction tools for multiple aging related disorders;

25  
26 6) generate health intervention and management strategies for aging related  
27  
28 disorders, especially for neurological and mental disorders.  
29  
30  
31

## 32 33 34 35 **COHORT DESCRIPTION**

### 36 37 **The participants of the cohort**

38  
39  
40 The Shenzhen Aging Related Disorder Cohort was established between 2017 and  
41  
42 2018 in 51 community recover centers in Luohu district of Shenzhen city, Guangdong  
43  
44 province, China (Figure 1). A multistage cluster sampling was applied to recruit the  
45  
46 participants older than 60 years. People with severe physical disabilities or mental  
47  
48 disorders were not included. In the first stage, a district (Luohu district) in Shenzhen  
49  
50 city was randomly sampled. In the second stage, 51 community recover centers in the  
51  
52 selected district were randomly sampled. In the final stage, all permanent residents  
53  
54 older than 60 years and without severe physical or mental disorders (16843) in the  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 selected community recover centers were invited to participate in the study.  
5  
6 Approximately 56% (n=9411) agreed and provided signed informed consent. All  
7  
8 participants were asked to bring their unique national identity cards for questionnaire  
9  
10 investigation and physical examination in local health centers or hospitals.  
11  
12 Considering the annual increase of 4000 adults aged 60 years or older in above  
13  
14 mentioned community recover centers from 2016 to 2018, the cohort will be  
15  
16 expanded by recruiting 2000 new entrants every year until 2028. The study has been  
17  
18 approved by the Review Board of Shenzhen Center for Disease Control and  
19  
20 Prevention.  
21  
22  
23  
24  
25

### 26 27 **Epidemiological investigation** 28

29  
30 The epidemiological data were collected through face-to-face interviews by health  
31  
32 professionals. A semi-structured questionnaire was designed to collect demographic  
33  
34 information (name, identity card, gender, birthday, education level, marital status,  
35  
36 native place, occupation, housing condition, annual family income, etc.), commuting  
37  
38 tools, lifestyle (food intake, active and passive smoking status, alcohol consumption,  
39  
40 physical activity, cooking and sleep habits, etc.), histories of chronic diseases  
41  
42 (hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancer,  
43  
44 neurological and mental disorders, etc.), medication history, family histories of  
45  
46 aforementioned chronic diseases, and reproductive history (women only). After the  
47  
48 investigation, trained investigators checked the integrity and logical errors of each  
49  
50 questionnaire. The missing information was fulfilled and logical errors were corrected  
51  
52 by further telephone investigation. Data from each questionnaire were entered into  
53  
54  
55  
56  
57  
58  
59  
60

computer by two integrators independently using Epidata software (version 3.1). All information was double-checked for the validity. Data items of the questionnaire query are summarized as Table 1.

**Table 1 Summary of studied items at baseline in the Shenzhen Aging Related Disorder Cohort**

Categories	Measurements
Demographics and socioeconomics	Birthday, gender, residential address, race, birth place, education level, marital status, occupation, housing condition, and family yearly income
Lifestyles	Consumption frequencies of major food groups and drinks, active and passive smoking status, alcohol intake, physical activity, sleep habits, and cooking habits
Medical histories	Histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease Use of health services and taking medicines in the past 2 weeks
Family histories of diseases	Family histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease
Reproductive history (for women)	Histories of pregnancy and delivery, menopause status, and history of taking contraceptive pills
Clinic analysis of blood and urine	Blood routine examination, fasting plasma glucose, total cholesterol, triglycerides, low density lipoprotein cholesterol, high density lipoprotein cholesterol, alanine aminotransferase, glycated hemoglobin and homocysteine, creatinine, uric acid, urea nitrogen, tumor biomarkers, EB virus antibody, glycated hemoglobin A1c, homocysteine Urine glucose, urine bilirubin, urine acetone bodies, urine specific gravity, pH, urinary protein, urobilinogen, urine nitrite, urine white blood cell, urine occult blood Urine metals [lithium, beryllium, aluminum, titanium,

Parameters of clinical measurements and imaging	vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead] Urine nicotine and its metabolite [nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl) butanoic Acid Dicyclohexylamine Salt]
Assessments of neurological function and activities of daily living	Height, weight, blood pressure, electrocardiogram, chest X-ray, color doppler ultrasound of liver, gallbladder, spleen, pancreas, kidney, bladder, ureter and prostate (men only), bone mineral density Basal metabolic rate, body mass index, circumference of neck, chest, waist, hip, biceps and thigh, total body fat, percentage of body fat, visceral fat level, fat free mass, lean muscle mass, skeletal muscle, total body water, intracellular water, extracellular water, body protein, body minerals, body cell count, bio-electrical impedance Mini-Cog, Mini-mental State Examination (MMSE), Center for Epidemiologic Studies Depression Scale (CES-D), Activities of Daily Living Scale (ADLS), Social Support Rating Scale (SSRS), Pittsburgh Sleep Quality Index (PSQI)

### Assessments of neurological function and activities of daily living

Standardized scales were applied to estimate cognitive function, depression status, functional disability, social support and sleep quality. The Mini-Cog, a 5-point scale combining three-item recall and Clock Drawing Test<sup>21</sup> was used as preliminary screening instrument for mild cognitive impairment. For those who got 4 or less scores of Mini-Cog, further Chinese version of the Mini-mental State Examination (MMSE) was applied to classify them into two groups [ $\geq 24$  points and  $< 24$  points].<sup>22</sup>

The validity and reliability of the Chinese MMSE have been verified previously<sup>18</sup>.

The Center for Epidemiologic Studies Depression Scale (CES-D) was applied to

1  
2  
3  
4 estimate the depression status of each participant. To favor international comparisons,  
5  
6 we used the cutoff of 16 or more out of a total of 60 points to define the prevalence of  
7  
8 depression.<sup>23,24</sup> The Lawton-Brody Activities of Daily Living Scale (ADLS)  
9  
10 combining basic (ability to toilet, feed, dress, groom, bathe and walk) and  
11  
12 instrumental (ability to shop, prepare food, perform housekeeping, wash laundry,  
13  
14 arrange transport, administer medication, use a telephone and manage finances) scales  
15  
16 was used to assess functional disability of each participant. The participants with  
17  
18 higher ADLS scores (ranging from 14-64) exhibit worse independence.<sup>25</sup> The  
19  
20 Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven  
21  
22 component scores, was applied to assess the sleep quality of all participants.<sup>26</sup> The  
23  
24 participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality.  
25  
26 The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of  
27  
28 the social support, namely subjective support (emotional support, four items),  
29  
30 objective support (tangible support, three items) and availability support (three items).  
31  
32 Higher SSRS scores represent a better social support. The validity and reliability of  
33  
34 SSRS have been verified previously.<sup>27</sup>

### 45 **Clinic analysis of blood and urine**

46  
47  
48 After at least 8 hours of overnight fasting, venous blood samples from each  
49  
50 participant were separately collected into the EDTA anticoagulant tubes (a 2 ml and a  
51  
52 5 ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and  
53  
54 then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature  
55  
56 to separate plasma and serum. The serum samples were used for biochemical analyses,  
57  
58  
59  
60

1  
2  
3  
4 including fasting blood glucose, blood lipid [total cholesterol (TCHO), triglyceride  
5  
6 (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein  
7  
8 cholesterol (HDL-C)], hepatic function [(total protein, albumin, total bilirubin (TB),  
9  
10 alanine aminotransferase (ALT) and aspartate aminotransferase (AST)], kidney  
11  
12 function (creatinine, uric acid and urea nitrogen), tumor biomarkers  
13  
14 [carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)] and Epstein-Barr  
15  
16 Virus (EBV) antibody. The lithium-heparinized whole blood was used for blood  
17  
18 routine test, including the total number of white blood cell (WBC), the differential  
19  
20 white blood cell counts (lymphocyte, monocyte, granulocytes, eosinophils and  
21  
22 basophils), red blood cell counts (RBC), hemoglobin contents and blood platelet  
23  
24 parameters [platelet count, mean platelet volume (MPV), platelet distribution width  
25  
26 (PDW), blood platelet quantity (PLT), platelet volume ratio and platelet large cell  
27  
28 ratio (P-LCR)]. The EDTA-anticoagulated whole blood (0.3 ml) and plasma  
29  
30 specimens (1 ml) were used for DNA and RNA extraction, and testing of glycated  
31  
32 hemoglobin A1c (HbA1c) and homocysteine (HCY), respectively.  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42

43 Additionally, the early spot morning urine sample (8 ml) from each participant  
44  
45 was collected for urine routine examination (including urine glucose, urine bilirubin,  
46  
47 urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine  
48  
49 nitrite, urine WBC and urine latent blood), urine concentrations of 24 kinds of metals  
50  
51 (lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron,  
52  
53 cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum,  
54  
55 cadmium, indium, tin, antimony, barium, thallium, lead), and urinary concentrations  
56  
57  
58  
59  
60



1  
2  
3  
4 of nicotine and its 10 metabolites. The resting blood and urine specimens were stored  
5  
6 at -80°C and -20°C refrigerators, respectively. The flow diagram of blood and urine  
7  
8 collection and separation is shown as Figure 2.  
9  
10

### 11 **Parameters of clinical measurements and imaging**

12  
13  
14 Each participant took part in the physical examination conducted by trained  
15  
16 physicians in the district hospital. The inspection-palpation-percussion-auscultation  
17  
18 (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity,  
19  
20 (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity,  
21  
22 oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The  
23  
24 measurements of baseline anthropometric indices for each participant were performed  
25  
26 on the day of physical examination. Standing height, weight and waist were measured  
27  
28 with the subjects in light clothing and without shoes by ultrasonic weighing apparatus  
29  
30 (HNH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse  
31  
32 rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300,  
33  
34 OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the  
35  
36 right arm supported at heart-level. Statistical analysis was based on the average of the  
37  
38 two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray,  
39  
40 abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas,  
41  
42 urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate  
43  
44 B-type ultrasound inspection (only for males) and bone mineral density scan were  
45  
46 then conducted. Out of 9411 participants, 3292 took part in the body composition  
47  
48 measurements. The visceral fat and fluid imbalances in each segment of the body and  
49  
50 the phase angle for cellular indicator of cell integrity were measured by bioelectrical  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 impedance analysis using an Inbody 770 body composition analyser (Biospace, Seoul,  
5  
6 Korea). The body segments were analysed, including elementary body composition  
7  
8 [body weight, body mass index (BMI), protein mass and minerals mass], total body  
9  
10 water (TBW) analysis [intracellular water, extracellular water (ECW) and  
11  
12 ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total  
13  
14 body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb  
15  
16 circumferences as well as waist-to-hip ratio, visceral fat area and visceral fat level)  
17  
18 and basal metabolic rate, etc.  
19  
20  
21  
22  
23

24  
25 The instruments used for the physical examination and the body composition  
26  
27 measurements are listed as Supplemental Table 1.  
28  
29

### 30 **The follow-up procedure**

31  
32 Follow-up will be conducted every 5 years to update exposure data and outcomes  
33  
34 since 2019. The questionnaire survey, physical examination, the body composition  
35  
36 measures, and neurological function and mental health assessments will be  
37  
38 re-conducted during the follow-up. Blood and urine specimens will be collected  
39  
40 according to the design procedures at baseline. The incidence of non-communicable  
41  
42 chronic diseases, including neurological and mental disorders, hypertension,  
43  
44 dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging  
45  
46 related diseases will be annually verified through medical records review and the  
47  
48 National Electronic Disease Surveillance in China.  
49  
50  
51  
52  
53

54  
55 All death cases will be verified by Chinese Cause of Death Registration System  
56  
57 in Shenzhen Center for Disease Control and Prevention. The diagnosis of  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

aforementioned conditions and the causes of death will be classified according to the 10<sup>th</sup> version of the International Statistical Classification of Diseases (ICD-10). The flow diagram of the cohort design is presented as Figure 3.

### **Patient and public involvement**

Participants were not involved in the development of study design or conduct. However, each participant received a health report of their examinations and tests.

## **FINDINGS TO DATE**

A total of 9411 people were recruited into the Shenzhen Aging Related Disorder Cohort. The participants were from 33 provinces, municipalities directly under the Central Government and autonomous regions of China (except for Tibet Autonomous Region). Among them, 48.65% of the cohort participants were from the outside areas of Guangdong province, in which Shenzhen city is located (Figure 4). The mean age of the participants was 67.73 years (ranging from 60 to 92 years) at baseline. Among all participants, 42.74 % were males. 91.14% of the participants were Han Chinese, and 54.41% had obtained high school education or above. Most of them (85.49%) were married. Annual household income of more than 160000 RMB accounted for 43.71% of the participants (Table 2). Among the males, the percentages of current smokers, current alcohol users and regular physical exerciser were 22.48%, 24.27% and 84.81%, respectively, whereas the corresponding ones were 0.41%, 2.38% and 77.51% in women. The average scores of Pittsburgh Sleep Quality Index were 3.84 in men and 4.46 in women, respectively. The average consumption frequencies of rice,

1  
2  
3  
4 wheat, vegetable, fruit, and meat were 1.98, 0.79, 1.62, 0.95 and 1.00 times/day, and  
5  
6 those of coarse grain, fish, egg, milk, bean and pickle were 5.08, 3.12, 5.51, 3.52, 2.31  
7  
8  
9 and 1.10 times/week, respectively (Table 3).  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

For peer review only

**Table 2 Baseline characteristics of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4022)	Female (n=5389)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.73±5.41	68.38±5.59	67.24±5.23	10.12	<0.0001
Age groups (years, n, %)				89.80	<0.0001
60 - 64	3142 (33.39)	1167 (29.02)	1975 (36.65)		
65 - 69	3274 (34.79)	1399 (34.78)	1875 (34.79)		
70 - 74	1818 (19.32)	848 (21.08)	970 (18.00)		
≥75	1177 (12.51)	608 (15.12)	569 (10.56)		
Race (n, %)				6.88	0.03
Han Chinese	8577 (91.14)	3684 (91.60)	4893 (90.80)		
Other ethnic groups	57 (0.61)	15 (0.37)	42 (0.78)		
Missing	777 (8.26)	323 (8.03)	454 (8.42)		
Migration time to Shenzhen (n, %)				65.89	<0.0001
<1950	1450 (15.41)	554 (13.77)	896 (16.63)		
1950-	404 (4.29)	174 (4.33)	230 (4.27)		
1970-	3735 (39.69)	1722 (42.81)	2013 (37.35)		
1990-	2661 (28.28)	1022 (25.41)	1639 (30.41)		
2010-	729 (7.75)	365 (9.08)	364 (6.75)		
Missing	432 (4.59)	185 (4.60)	247 (4.58)		
Education level (n, %)				571.31	<0.0001
Primary school or illiteracy	1637 (17.39)	390 (9.70)	1247 (23.14)		
Middle school	2564 (27.24)	934 (23.22)	1630 (30.25)		
High school	3143 (33.40)	1450 (36.05)	1693 (31.42)		
University or college or higher	1977 (21.01)	1210 (30.08)	767 (14.23)		
Missing	90 (0.96)	38 (0.94)	52 (0.96)		
Marital status (n, %)				413.93	<0.0001
Single	46 (0.49)	20 (0.50)	26 (0.48)		
Married	8045 (85.49)	3762 (93.54)	4283 (79.48)		
Widowed	1023 (10.87)	147 (3.65)	876 (16.26)		

Divorced	119 (1.26)	26 (0.65)	93 (1.73)		
Cohabited	2 (0.02)	0	2 (0.04)		
Missing	176 (1.87)	67 (1.67)	109 (2.02)		
Family yearly income (yuan, n, %)				32.87	<0.0001
<40,000	306 (3.25)	87 (2.16)	219 (4.06)		
40,000 -	857 (9.11)	339 (8.43)	518 (9.61)		
80,000 -	1401 (14.89)	626 (15.56)	775 (14.38)		
120,000 -	1951 (20.73)	852 (21.18)	1099 (20.39)		
≥160,000	4114 (43.71)	1787 (44.43)	2327 (43.18)		
Missing	782 (8.31)	331 (8.23)	451 (8.37)		
Exposure to occupational hazards**				127.85	<0.0001
Yes	1563 (16.61)	834 (20.74)	729 (13.53)		
No	5361 (56.97)	2309 (57.41)	3052 (56.63)		
Missing	2487 (26.43)	879 (21.85)	1608 (29.84)		
Exposure to kitchen fumes (n, %)				1104.43	<0.0001
Yes	6284 (66.77)	1943 (48.31)	4341 (80.55)		
No	2975 (31.61)	2017 (50.15)	958 (17.78)		
Missing	152 (1.62)	62 (1.54)	90 (1.67)		
Menolipsis (n=5233, %)		-	5230 (99.94)		
Parturition (n=5233, times)		-	2.02±1.04		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and categorical variables, respectively.

\*\*Occupational hazards included high temperature, noise, radiation, metal, dust, organic solvent, and farm chemical.

**Table 3 Baseline lifestyle and diet habits of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4041)	Female (n=5370)	t/x <sup>2</sup> *	P
Smoking status (n, %)				2994.95	<0.0001
Never smoker	7449 (79.15)	2129 (52.93)	5320 (98.72)		
Former smoker	974 (10.35)	961 (23.89)	13 (0.24)		
Current smoker	926 (9.84)	904 (22.48)	22 (0.41)		
Missing	62 (0.66)	28 (0.70)	34 (0.63)		
Passive smoker (n, %)				419.58	<0.0001
Yes	1054 (11.20)	144 (3.58)	910 (16.89)		
No	8282 (88.00)	3830 (95.23)	4452 (82.61)		
Missing	75 (0.80)	48 (1.19)	27 (0.50)		
Drinking status (n, %)				1383.99	<0.0001
Never drinker	7998 (84.99)	2794 (69.47)	5204 (96.57)		
Former drinker	247 (2.62)	227 (5.64)	20 (0.37)		
Current drinker	1104 (11.73)	976 (24.27)	128 (2.38)		
Missing	62 (0.66)	25 (0.62)	37 (0.69)		
Afternoon nap (n, %)				30.79	<0.0001
Yes	7020 (74.59)	3116 (77.47)	3904 (72.44)		
No	2301 (24.45)	871 (21.66)	1430 (26.54)		
Missing	90 (0.96)	35 (0.87)	55 (1.02)		
Sleep duration at night (n=9185, hours/day, mean±SD)	7.45±1.11	7.49±1.13	7.43±1.10	2.34	0.02
Pittsburgh Sleep Quality Index (n=7772, mean±SD)	4.20±2.61	3.84±2.41	4.46±2.72	-10.50	<0.0001
Physical activity (n, %)				80.11	<0.0001
Yes	7588 (80.63)	3411 (84.81)	4177 (77.91)		
No	1749 (18.58)	581 (14.45)	1168 (21.98)		
Missing	74 (0.79)	30 (0.75)	44 (0.82)		
Rice (n=9259, times/day, mean±SD)	1.98±0.65	2.00±0.65	1.96±0.65	3.04	0.002
Wheat (n=9224, times/day, mean±SD)	0.79±0.57	0.78±0.57	0.80±0.57	-2.24	0.03
Coarse grain (n=9241, times/week, mean±SD)	5.08±3.28	4.88±3.35	5.22±3.22	-4.80	<0.0001

Vegetables (n=9267, times/day, mean±SD)	1.62±0.71	1.60±0.72	1.63±0.71	-1.81	0.07
Fruit (n=9256, times/day, mean±SD)	0.95±0.50	0.92±0.51	0.97±0.50	-4.68	<0.0001
Meat (n=9258, times/day, mean±SD)	1.00±0.60	1.03±0.61	0.98±0.60	4.17	<0.0001
Fish (n=9240, times/week, mean±SD)	3.12±3.33	3.22±3.41	3.04±3.27	2.53	0.01
Shrimp/shell (n=9204, times/week, mean±SD)	1.20±3.04	1.29±3.14	1.12±2.95	2.59	0.009
Egg (n=9263, times/week, mean±SD)	5.51±2.64	5.52±2.65	5.50±2.63	0.39	0.70
Milk (n=9256, times/week, mean±SD)	3.52±3.23	3.34±3.19	3.66±3.25	-4.68	<0.0001
Bean (n=9225, times/week, mean±SD)	2.31±2.52	2.36±2.60	2.27±2.46	1.69	0.09
Pickle (n=9267, times/week, mean±SD)	1.10±2.20	1.08±2.14	1.11±2.25	-0.63	0.53
Processed meat (n=9266, times/week, mean±SD)	0.25±1.01	0.24±0.94	0.26±1.06	-0.93	0.35
Green tea (n, %)				612.93	<0.0001
Yes	3348 (35.58)	1999 (49.70)	1349 (25.63)		
No	5760 (61.20)	1912 (47.54)	3848 (71.49)		
Missing	303 (3.22)	111 (2.76)	192 (3.56)		
Black tea (n, %)				253.99	<0.0001
Yes	1741 (18.50)	1040 (25.88)	700 (12.99)		
No	7331 (77.90)	2847 (70.79)	4484 (83.21)		
Missing	339 (3.60)	134 (3.33)	205 (3.80)		
Coffee (n, %)				3.21	0.20
Yes	144 (1.53)	72 (1.79)	72 (1.34)		
No	8872 (94.27)	3784 (94.08)	5088 (94.43)		
Missing	395 (4.20)	166 (4.13)	229 (4.25)		
Juice (n, %)				0.40	0.82
Yes	47 (0.50)	18 (0.45)	29 (0.54)		
No	8970 (95.31)	3837 (95.40)	5133 (95.25)		
Missing	394 (4.19)	167 (4.15)	227 (4.21)		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and for the categorical variables, respectively.



1  
2  
3  
4 Table 4 and Table 5 presents the baseline levels of biochemical traits of the  
5  
6 participants in the Shenzhen Aging Related Disorder Cohort. The average values of  
7  
8 TCHO, TG, HDL-C, LDL-C and fasting blood glucose were 5.50, 1.64, 1.54, 3.13  
9  
10 and 6.17 mmol/l, respectively. The mean concentrations of total bilirubin, albumin,  
11  
12 ALT, AST, blood urea nitrogen, creatinine and uric acid were 15.55  $\mu\text{mol/l}$ , 44.55 g/l,  
13  
14 21.93 U/l, 22.07 U/l, 5.78 mmol/l, 80.03  $\mu\text{mol/l}$  and 373.79  $\mu\text{mol/l}$ . 0.20%, 0.07% and  
15  
16 0.09% of the participants presented positive reactions for EBV, CEA and AFP tests,  
17  
18 respectively. The rates of positive/suspected positive urine glucose, bilirubin, acetone  
19  
20 bodies, protein, bilinogen, nitrite and occult blood were 40.98%, 1.41%, 0.92%,  
21  
22 14.17%, 1.52%, 2.67% and 26.86%, respectively.  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 4 Baseline levels of biochemical traits in blood of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
<b>Blood routine</b>					
WBC (n=9377, × 10 <sup>9</sup> /l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.55	13.48	<0.0001
RBC (n=9377, × 10 <sup>12</sup> /l, mean±SD)	4.60±0.50	4.80±0.51	4.45±0.48	35.59	<0.0001
Hemoglobin (n=9377, g/dl, mean±SD)	13.74±1.27	14.52±1.20	13.15±0.77	59.52	<0.0001
Platelet count (n=9377, × 10 <sup>9</sup> /l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
<b>Lipid levels</b>					
TCHO (n=9376, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.08	-23.50	<0.0001
TG (n=9376, mmol/l, mean±SD)	1.64±1.08	1.56±1.08	1.70±1.07	-6.24	<0.0001
HDL-C (n=9376, mmol/l, mean±SD)	1.54±0.37	1.44±0.34	1.63±0.37	-25.85	<0.0001
LDL-C (n=9376, mmol/l, mean±SD)	3.13±0.85	3.00±0.83	3.22±0.88	-12.65	<0.0001
Fasting blood glucose (n=9366, mmol/l, mean±SD)	6.17±1.78	6.22±1.84	6.13±1.77	2.59	0.01
HbA1c (n=6487, %, mean±SD)	6.27±1.06	6.31±1.14	6.24±0.99	2.32	0.02
HCY (n=6488, μmol/l, mean±SD)	15.14±6.75	17.42±7.52	13.47±5.66	23.25	<0.0001
<b>Hepatic function</b>					
Total protein (n=9378, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.22	-8.42	<0.0001
Total bilirubin (n=9378, μmol/l, mean±SD)	15.55±5.06	16.34±5.60	14.97±4.33	12.71	<0.0001
Albumin (n=9378, g/l, mean±SD)	44.55±2.06	44.68±2.09	44.46±2.03	5.05	<0.0001
ALT (n=9378, U/l, mean±SD)	21.93±19.53	22.70±14.29	21.35±22.65	3.52	0.0004
AST (n=9378, U/l, mean±SD)	22.07±12.27	21.88±9.22	22.21±14.12	-1.38	0.17
<b>Kidney function</b>					
Blood urea nitrogen (n=9369, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.44	11.769	<0.0001
Creatinine (n=9369, μmol/l, mean±SD)	80.03±24.11	93.36±26.30	70.10±16.37	49.30	<0.0001
Uric acid (n=9369, μmol/l, mean±SD)	373.79±90.64	408.49±88.68	347.93±83.14	33.58	<0.0001
EB Virus (n, %)				0.60	0.74
Negative	9354 (99.39)	3997 (99.38)	5357 (99.41)		
Positive	19 (0.20)	7 (0.17)	12 (0.22)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		

CEA (n, %)					0.68**
Negative	9367 (99.53)	4001 (99.48)	5366 (99.57)		
Positive	7 (0.07)	4 (0.10)	3 (0.06)		
Missing	37 (0.39)	17 (0.42)	20 (0.37)		
AFP (n, %)				0.94	0.62
Negative	9364 (99.50)	3999 (99.43)	5365 (99.55)		
Positive	9 (0.09)	5 (0.12)	4 (0.07)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

**Table 5 Baseline levels of biochemical traits in urine of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Urine glucose (n, %)				76.90	<0.0001
Negative	8862 (94.17)	3696 (91.89)	5166 (95.86)		
Positive/suspected positive	469 (4.98)	292 (7.26)	177 (3.22)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine bilirubin (n, %)				2.08	0.35
Negative	9198 (97.74)	3923 (97.54)	5275 (97.88)		
Positive/suspected positive	133 (1.41)	65 (1.62)	68 (1.26)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine acetone bodies (n, %)				5.55	0.06
Negative	9244 (98.23)	3940 (97.96)	5304 (98.42)		
Positive/suspected positive	87 (0.92)	48 (1.19)	39 (0.72)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine specific gravity (n=9331, mean±SD)	1.02±0.01	1.02±0.01	1.02±0.01	3.28	0.001
Urinary protein (n, %)				18.46	<0.0001
Negative	7997 (84.98)	3346 (83.19)	4651 (86.31)		
Positive/suspected positive	1334 (14.17)	643 (15.91)	691 (12.87)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urobilinogen (n, %)				33.40	<0.0001
Negative	9186 (97.61)	3891 (96.74)	5295 (98.26)		
Positive/suspected positive	143 (1.52)	95 (2.36)	48 (0.89)		
Missing	82 (0.87)	36 (0.90)	46 (0.85)		
Urine nitrite (n, %)				116.02	<0.0001
Negative	9080 (96.48)	3964 (98.56)	5116 (94.93)		
Positive/suspected positive	251 (2.67)	24 (0.60)	225 (4.21)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine white blood cell (n, %)				874.22	<0.0001
Negative	7406 (78.70)	3737 (92.91)	3669 (68.08)		

Positive/suspected positive	1925 (20.45)	251 (6.24)	1674 (31.06)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine occult blood (n, %)				263.04	<0.0001
Negative	6803 (72.29)	3252 (80.86)	3551 (65.89)		
Positive/suspected positive	2528 (26.86)	736 (18.30)	1792 (33.25)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

1  
2  
3  
4 The mean values of BMI, SBP, DBP and pulse rate were 24.39 kg/m<sup>2</sup>, 138.47  
5  
6 mmHg, 77.35 mmHg and 75.32 times/minute, respectively. There were 46.19%,  
7  
8  
9 77.47%, 60.09%, 29.49% and 83.37% of participants presented abnormality during  
10  
11 the examination of electrocardiogram, chest X-ray, color doppler ultrasound of  
12  
13 liver/gallbladder/spleen/pancreas, color doppler ultrasound of urinary system and  
14  
15 bone density scan, respectively. The average values of waist hip ratio, basal metabolic  
16  
17 rate, total body water, body fat mass, percentage of body fat, fat free mass, skeletal  
18  
19 muscle, body protein and body minerals were 0.88, 1281.47 kcal, 31.10 L, 19.98 kg,  
20  
21 31.94%, 42.20 kg, 22.87 kg, 8.24 kg and 2.85 kg, respectively, among 3292  
22  
23 participants who took the examination of body components (Table 6).  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 6 Baseline levels of clinical measurements parameters of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
BMI (n=9263, kg/m <sup>2</sup> , mean±SD)	24.39±3.39	24.39±3.29	24.39±3.46	-0.06	<0.0001
Blood pressure (mmHg, mean±SD)					
Systolic blood pressure (n=9330)	138.47±19.42	137.19±18.74	139.43±19.96	-5.37	<0.0001
Diastolic blood pressure (n=9330)	77.35±10.72	79.23±10.69	75.93±10.52	14.82	<0.0001
Pulse rate (n=6681, times/min)	75.32±11.39	74.61±11.58	75.85±11.21	-4.43	<0.0001
Electrocardiogram (n, %)				7.40	0.02
Normal	4995 (53.08)	2073 (51.54)	2922 (54.22)		
Abnormal	4347 (46.19)	1915 (47.61)	2432 (45.13)		
Missing	69 (0.73)	34 (0.85)	35 (0.65)		
Chest X-ray				5.46	0.07
Normal	1911 (20.31)	813 (20.21)	1098 (20.37)		
Abnormal	7291 (77.47)	3136 (77.97)	4155 (77.10)		
Missing	209 (2.22)	73 (1.82)	136 (2.53)		
Color doppler ultrasound of liver/ gallbladder/ spleen/				17.02	0.007
Normal	3678 (39.08)	1559 (38.76)	2119 (39.32)		
Abnormal	5655 (60.09)	2416 (60.07)	3239 (60.10)		
Uncertainty/Missing**	78 (0.83)	47 (1.17)	31 (0.58)		
Color doppler ultrasound of urinary system (n, %)				267.05	<0.0001
Normal	6026 (64.03)	2305 (57.31)	3721 (69.05)		
Abnormal	2775 (29.49)	1533 (38.12)	1242 (23.05)		
Uncertainty/Missing**	610 (6.48)	184 (4.57)	426 (7.90)		
Color doppler ultrasound of prostate (n=4022, %)					
Normal		1139 (28.32)	-		
Abnormal		2770 (68.87)	-		
Uncertainty/Missing**		113 (2.81)	-		
Bone mineral density (n, %)				583.26	<0.0001
Normal	1395 (14.82)	1003 (24.94)	392 (7.27)		

bmjopen-2019-034372 on April 23, 2024 by guest. Protected by copyright.

Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		
Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio ( <b>n=3292</b> , mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate ( <b>n=3292</b> , kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water ( <b>n=3292</b> , k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.01	69.47	<0.0001
Intracellular water ( <b>n=3292</b> , L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.21	69.68	<0.0001
Extracellular water ( <b>n=3292</b> , L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.2	67.67	<0.0001
Body fat mass ( <b>n=3292</b> , kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.44	-10.25	<0.0001
Percentage of body fat ( <b>n=3292</b> , %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.65	-40.37	<0.0001
Fat free mass ( <b>n=3292</b> , Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.64	68.92	<0.0001
Skeletal muscle ( <b>n=3292</b> , Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.26	69.67	<0.0001
SLM ( <b>n=3292</b> , Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.44	69.54	<0.0001
Body protein ( <b>n=3292</b> , kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.77	69.62	<0.0001
Body minerals ( <b>n=3292</b> , kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.27	55.68	<0.0001
InBody score ( <b>n=3292</b> , mean±SD)	69.05±4.92	68.15±5.16	69.67±4.55	-8.50	<0.0001

BMI, body mass index; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Uncertainty was caused by unsatisfied examination conditions.



1  
2  
3 Table 7 shows the prevalence of main non-communicable chronic diseases. The  
4 prevalence of overweight/obesity, hypertension, diabetes mellitus, dyslipidemia,  
5 chronic bronchitis, myocardial infarction, coronary heart disease, stroke, cancer,  
6 arthritis, Alzheimer's disease, Parkinson's disease, brain injury, cognitive impairment  
7 and depression status was 54.38%, 58.24%, 22.30%, 75.49%, 1.45%, 0.55%, 5.69%,  
8 1.10%, 2.18%, 5.04%, 0.18%, 0.23%, 5.75%, 5.39%, and 3.28%, respectively. The  
9 mean scores for ADL and SSRS were 14.15 and 39.54, respectively.  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 7 The prevalence of the common non-communicable disorders in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t <sup>2</sup> *	P
Overweight/Obesity <sup>a</sup> (n=9307, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	1.96	0.01
Hypertension <sup>b</sup> (n=9374, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus <sup>c</sup> (n=9340, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	20.39	0.001
Dyslipidemia <sup>d</sup> (n=9377, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	229.42	<0.0001
Chronic bronchitis <sup>e</sup> (n=9354, %)	136 (1.45)	71 (1.78)	65 (1.21)	0.09	0.02
COPD <sup>e</sup> (n=9357, %)	18 (0.19)	12 (0.30)	6 (0.11)	0.23	0.04
Asthma <sup>e</sup> (n=9356, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis <sup>e</sup> (n=9315, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina <sup>e</sup> (n=9311, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction <sup>e</sup> (n=9312, %)	51 (0.55)	35 (0.88)	16 (0.30)	1.07	0.0002
Coronary heart disease <sup>e</sup> (n=9315, %)	530 (5.69)	239 (6.01)	291 (5.45)	0.33	0.25
Stroke <sup>e</sup> (n=9309, %)	102 (1.10)	57 (1.43)	45 (0.84)	0.30	0.007
Cancer <sup>e</sup> (n=9303, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis <sup>e</sup> (n=9311, %)	47 (0.50)	24 (0.60)	23 (0.43)	0.35	0.24
Arthritis <sup>e</sup> (n=9308, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine <sup>e</sup> (n=9311, %)	58 (0.62)	16 (0.40)	42 (0.79)	0.47	0.02
Nephritis <sup>e</sup> (n=9312, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease <sup>e</sup> (n=9309, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease <sup>e</sup> (n=9309, %)	21 (0.23)	13 (0.33)	8 (0.15)	0.23	0.08
Brain injury <sup>e</sup> (n=9267, %)	533 (5.75)	227 (5.74)	306 (5.76)	0.001	0.97
MMSE score < 24 (n=8678, %)	468 (5.39)	205 (5.42)	263 (5.37)	0.01	0.92
Depression status <sup>f</sup> (n=9243, %)	303 (3.28)	111 (2.81)	192 (3.63)	0.67	0.06
ADL (n=9240, scores, mean±SD)	14.15±1.58	14.16±1.73	14.14±1.44	0.78	0.43
SSRS (n=8117, score, mean±SD)	39.54±7.89	39.17±7.90	39.83±7.88	0.75	0.0002

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

<sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

<sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq 90$  mmHg and / or systolic blood pressure (SBP)  $\geq 140$  mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

<sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq 7.0$  mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

<sup>d</sup> Dyslipidemia was defined as TCHO  $\geq 5.2$  mmol/L, or TG  $\geq 1.7$  mmol/L, or HDL-C  $< 0.1$  mmol/L, or LDL-C  $> 3.4$  mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

<sup>e</sup> The disease was defined as self-reported disease.

<sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

### Strengths and limitations

This is the community-dwelling aging related disorder cohort with main focus on neurological and mental disorders. We comprehensively collected epidemiological data, clinical examination, environmental exposures, body components and biological samples in Chinese population, which will facilitate the identification of the causality of various aging related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. As an epitome of the areas with the rapid economic development and growth of immigrant population, Shenzhen reflects the aging process of population in cities with rapid economic development in China. The setting up of our cohort is able to provide more epidemiological evidence for the prevention and control of aging related diseases in China, especially in those areas with upcoming booming economy. Except for routine follow-up by questionnaires, the incidence of aging related diseases, especially neurological and mental disorders will be annually verified from the National Electronic Disease Surveillance System and National Mortality Surveillance System in Shenzhen CDC, which guarantees the integrity and validity of outcomes of interest in our cohort. Comprehensive measurement of internal exposures is another strength of our cohort. A total of 24 metals as well as, nicotine and its related metabolites in urine have been detected for all participants at baseline. Assessment of exposure to environmental pollutants will be extended to pesticides in 2020.

However, there are also limitations of our cohort. First, all participants are adults aged 60 years or older, then we could not have information on their early-life exposures. However, the high incidence of aging related disorders in older adults in the context of rapid epidemiological transition will provide us with sufficient power for further analysis. Second, the medical histories of the participants in our cohort

1  
2  
3 were self-reported. But the link between our cohort and disease surveillance system in  
4  
5 Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and  
6  
7 reliability of the information. Third, only 3292 participants took part in the body  
8  
9 components analysis at baseline. However, the selection bias tends to be small since  
10  
11 the baseline characteristics are comparable between individuals with and without  
12  
13 body component data (Supplemental Table 2). Forth, recruitment of 9411 participants  
14  
15 at baseline makes our sample size relatively smaller compared with other cohorts in  
16  
17 the world. However, according to the study design, an annual 2000 new participants  
18  
19 will be recruited to enlarge the cohort until 2028, which will ensure the statistical  
20  
21 power for most association studies in the future.  
22  
23  
24  
25  
26  
27  
28

### 29 **Collaboration**

30  
31 The datasets generated and/or analysed during the current study are not publicly  
32  
33 available at this stage, but are available from the corresponding author on reasonable  
34  
35 request. However, specific ideas and proposals for potential collaborations would be  
36  
37 welcomed and invited to contact the corresponding authors via e-mail to L.J.  
38  
39 [JLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].  
40  
41  
42  
43  
44

### 45 **Abbreviations**

46  
47 MMSE, Mini-mental State Examination; CES-D, Center for Epidemiologic Studies  
48  
49 Depression Scale; ADLS, Lawton-Brody Activities of Daily Living Scale; PSQI,  
50  
51 Pittsburgh sleep quality index; SSRS, Social Support Rate Scale; TCHO, total  
52  
53 cholesterol; TG, triglyceride; LDL-C, low density lipoprotein cholesterol; HDL-C,  
54  
55 high density lipoprotein cholesterol; TB, total bilirubin; ALT, alanine  
56  
57 aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen;  
58  
59 AFP, alpha fetoprotein; EBV, Epstein-Barr Virus; WBC, white blood cell; RBC, red  
60  
blood cell counts; MPV, mean platelet volume; PDW, platelet distribution width; PLT,

1  
2  
3 blood platelet quantity; P-LCR, platelet volume ratio and platelet large cell ratio;  
4 HbA1c, glycated hemoglobin A1c; HCY, homocysteine; IPPA,  
5 inspection-palpation-percussion-auscultation; ECG, electrocardiogram; BMI, body  
6 mass index; TBW, total body water; ECW, extracellular water.  
7  
8  
9

## 10 11 12 13 **Acknowledgments**

14  
15 The study has received great support from Shenzhen center for disease control and  
16 prevention, Shenzhen Luohu Hospital for Traditional Chinese Medicine, and  
17 Shenzhen Luohu Center for Disease Control and Prevention. The contributions of all  
18 the working staffs and participants are greatly acknowledged.  
19  
20  
21  
22  
23  
24  
25  
26

## 27 28 **Contributors**

29  
30 JY and JL conceived of the study, participated in its design, coordinated the study and  
31 reviewed the manuscript for important intellectual content. LL and WL participated  
32 in the study design, collected data, drafted the manuscript and performed the  
33 descriptive data analysis. LN, ZG, YL, WC, WL, LW, JZ, JY, XH, TL, EG, ZL, KH,  
34 YH, CY and QZ participated in data collection, helped drafted the manuscript and  
35 reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, TL,  
36 EG, FY and XY constructed the data base and JY and JL were responsible for data  
37 management. All authors read and approved the final manuscript.  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50

## 51 52 **Funding**

53  
54 This project is supported by Sanming Project of Medicine in Shenzhen  
55 [SZSM201611090], and Shenzhen Basic Research Plan for Medical Health  
56  
57  
58  
59  
60

1  
2  
3 [SZGW2018004, SZXJ2017013]. The funders have no role in manuscript preparation  
4 or submission.  
5  
6  
7  
8  
9

### 10 **Competing interests**

11  
12  
13 The authors declare that they have no competing interests.  
14  
15  
16

### 17 **Patient consent for publication**

18  
19 Not required.  
20  
21  
22  
23  
24  
25

### 26 **Ethics approval**

27  
28 All participants agreed to join in the cohort and provide informed written consent. The  
29 study has been approved by the Review Board of Shenzhen Center for Disease  
30 Control and Prevention.  
31  
32  
33  
34  
35  
36  
37

### 38 **Provenance and peer review**

39  
40 Not commissioned; externally peer review.  
41  
42  
43  
44

### 45 **Data sharing statement**

46  
47 The datasets generated and/or analysed during the current study are not publicly  
48 available at this stage, but are available from the corresponding author on reasonable  
49 request. However, specific ideas and proposals for potential collaborations would be  
50 welcomed and invited to contact the corresponding authors via e-mail to L.J.  
51 [JJLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].  
52  
53  
54  
55  
56  
57  
58  
59  
60

## REFERENCES

1. GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1859-922.
2. Foreman KJ, Marquez N, Dolgert A, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. *Lancet* 2018;392:2052-90.
3. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390:1211-59.
4. GBD 2016 Lifetime Risk of Stroke Collaborators, Feigin VL, Nguyen G, Cercy K, et al. Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016. *N Engl J Med* 2018;379:2429-37.
5. Global Burden of Disease Cancer Collaboration, Fitzmaurice C, Akinyemiju TF, Alam T, et al. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2016: A Systematic Analysis for the Global Burden of Disease Study. *JAMA Oncol* 2018;4:1553-68.
6. Wimo A, Jonsson L, Bond J, et al. The worldwide economic impact of



- dementia 2010. *Alzheimers Dement* 2013;9:1-11 e13.
7. Alzheimer's Disease International. World Alzheimer report 2015: the global impact of dementia. <https://www.alz.co.uk/research/world-report-2015>. Accessed 1 June 2016.
  8. Chang AY, Skirbekk VF, Tyrovolas S, et al. Measuring population ageing: an analysis of the Global Burden of Disease Study 2017. *Lancet Public Health* 2019;4:e159-e167.
  9. Alladi S, Hachinski V. World dementia: One approach does not fit all. *Neurology* 2018;91:264-70.
  10. Prince M, Ali GC, Guerchet M, et al. Recent global trends in the prevalence and incidence of dementia, and survival with dementia. *Alzheimers Res Ther* 2016;8:23.
  11. He X, Song M, Qu J, et al. Basic and translational aging research in China: present and future. *Protein Cell* 2019;10:476-84.
  12. Liu S, Li Y, Zeng X, et al. Burden of Cardiovascular Diseases in China, 1990-2016: Findings From the 2016 Global Burden of Disease Study. *JAMA Cardiol* 2019; doi: 10.1001/jamacardio.2019.0295.
  13. Zhou M, Wang H, Zhu J, et al. Cause-specific mortality for 240 causes in China during 1990-2013: a systematic subnational analysis for the Global Burden of Disease Study 2013. *Lancet* 2016;387:251-72.
  14. Liu M, Liu SW, Wang LJ, et al. Burden of diabetes, hyperglycaemia in China from to 2016: Findings from the 1990 to 2016, global burden of disease study. *Diabetes Metab* 2019;45:286-93.
  15. Yang JJ, Yu D, Wen W, et al. Association of Diabetes With All-Cause and Cause-Specific Mortality in Asia: A Pooled Analysis of More Than 1 Million

- 1  
2  
3 Participants. *JAMA Netw Open* 2019;2:e192696.  
4  
5  
6 16. Stein DJ, He Y, Phillips A, et al. Global mental health and neuroscience:  
7 potential synergies. *Lancet Psychiatry* 2015;2:178-85.  
8  
9  
10 17. Ji Y, Shi Z, Zhang Y, et al. Prevalence of dementia and main subtypes in rural  
11 northern China. *Dement Geriatr Cogn Disord* 2015;39:294-302.  
12  
13  
14 18. Zeng Y, Feng Q, Hesketh T, et al. Survival, disabilities in activities of daily  
15 living, and physical and cognitive functioning among the oldest-old in China:  
16 a cohort study. *Lancet* 2017;389:1619-29.  
17  
18  
19 19. GBD 2016 Parkinson's Disease Collaborators. Global, regional, and national  
20 burden of Parkinson's disease, 1990-2016: a systematic analysis for the Global  
21 Burden of Disease Study 2016. *Lancet Neurol* 2018;17:939-53.  
22  
23  
24 20. Keogh-Brown MR, Jensen HT, Arrighi HM, et al. The Impact of Alzheimer's  
25 Disease on the Chinese Economy. *EBioMedicine* 2015 22;4:184-90.  
26  
27  
28 21. Borson S, Scanlan JM, Chen P, et al. The Mini-Cog as a screen for dementia:  
29 validation in a population-based sample. *J Am Geriatr Soc* 2003;51:1451-4.  
30  
31  
32 22. Lv X, Li W, Ma Y, et al. Cognitive decline and mortality among  
33 community-dwelling Chinese older people. *BMC Med* 2019;17:63.  
34  
35  
36 23. Pequignot R, Dufouil C, Peres K, et al. Depression Increases the Risk of Death  
37 Independently From Vascular Events in Elderly Individuals: The Three-City  
38 Study. *J Am Geriatr Soc* 2019;67:546-52.  
39  
40  
41 24. Jeuring HW, Hoogendijk EO, Comijs HC, et al. The tide has turned: incidence  
42 of depression declined in community living young-old adults over one decade.  
43  
44  
45 *Epidemiol Psychiatr Sci* 2019:1-8.  
46  
47  
48 25. O'Caomh R, Gao Y, Svendrovski A, et al. Effect of Visit-to-Visit Blood  
49 Pressure Variability on Cognitive and Functional Decline in Mild to Moderate  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3 Alzheimer's Disease. *J Alzheimers Dis* 2019;68:1499-510.  
4

- 5  
6 26. Curtis BJ, Williams PG, Anderson JS. Objective cognitive functioning in  
7  
8 self-reported habitual short sleepers not reporting daytime dysfunction:  
9  
10 examination of impulsivity via delay discounting. *Sleep* 2018;41.  
11  
12 27. Xiao S. Theoretical foundation and research and application of Social Support  
13  
14 Rating Scale. *J Clin Psychiatry* 1994;4:98-100.  
15  
16  
17  
18  
19

### 20 **Figure legends**

21  
22 Figure 1 Location of Shenzhen in China

23  
24 Figure 2 The flow diagram of collecting and separation blood and urine specimen

25  
26 Figure 3 The flow diagram of the cohort design

27  
28 Figure 4 The birthplace distribution of the studied individuals  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

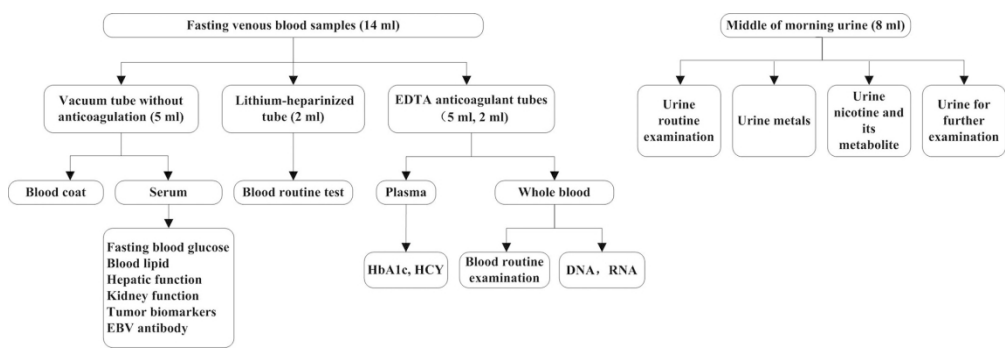


Figure 2 The flow diagram of collecting and separation blood and urine specimen  
180x60mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.

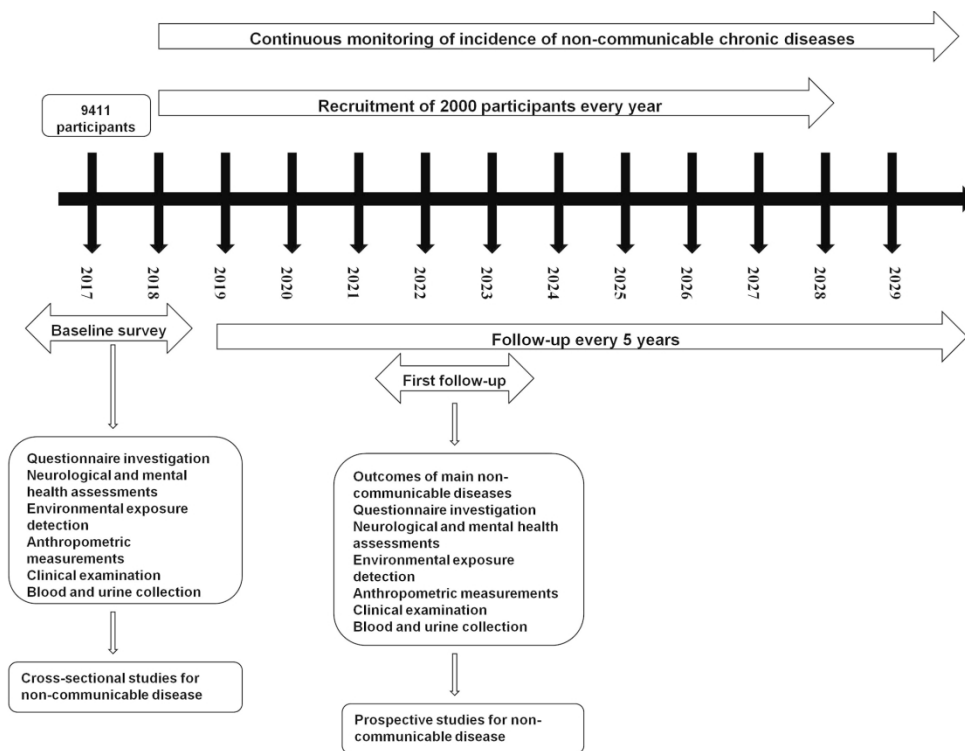


Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

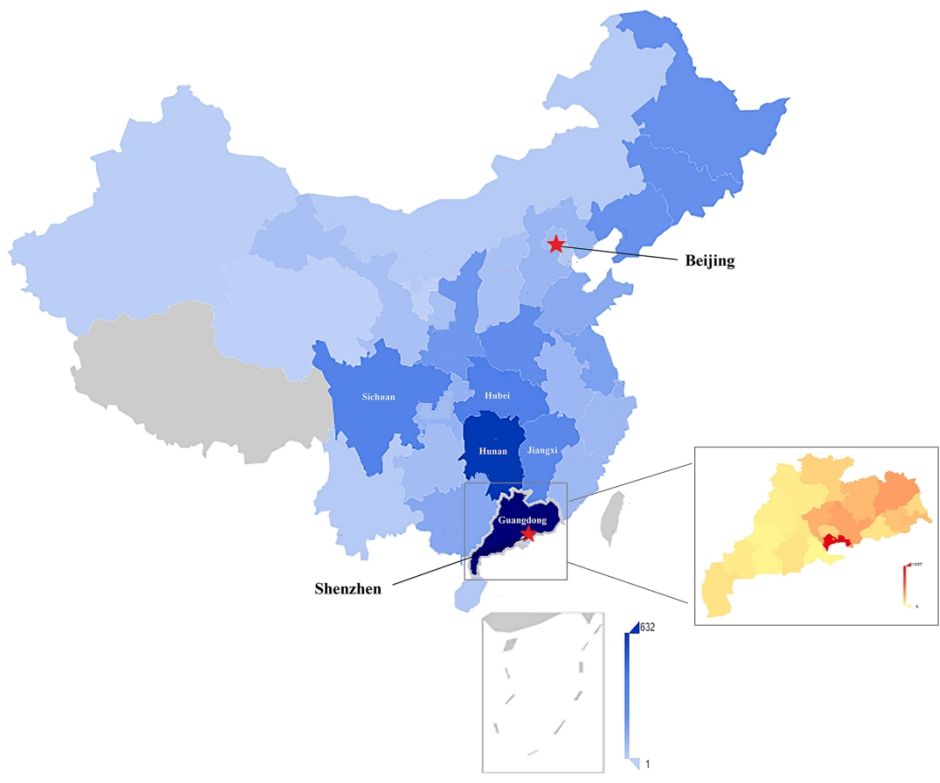


Figure 4 The birthplace distribution of the studied individuals  
180x147mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.

**Supplemental Table 1 Summary of the instruments messages for clinical indicators analysis at baseline**

Items	Equipment used
Standing height	HNH-219, OMRON Healthcare Co., Ltd, Japan
Body weight	HNH-219, OMRON Healthcare Co., Ltd, Japan
Resting blood pressure	HBP-1300, OMRON Healthcare Co., Ltd, Japan
12-lead electrocardiography	ECG-1350c, Nihon Kohden Corporation, Japan
Chest X-ray	Optimus, Royal Dutch Philips Electronics Ltd., Netherlands
Abdominal B-type ultrasound inspection	Affiniti50, Royal Dutch Philips Electronics Ltd., Netherlands
	EPIQ5, Royal Dutch Philips Electronics Ltd., Netherlands
	S25, SonoScape Medical Corp., Guangdong, China
Fasting plasma glucose	7600-010, Hitachi, Ltd., Tokyo, Japan
Glycated hemoglobin	Premier Hb9210, Trinity Biotech Plc., Bray, Ireland
Homocysteine	AU5800, Beckman Coulter, Inc., California, USA
Blood lipids	7600-010, Hitachi, Ltd., Tokyo, Japan
Hepatic function	7600-010, Hitachi, Ltd., Tokyo, Japan
Renal function	7600-010, Hitachi, Ltd., Tokyo, Japan
Blood routine	XT-1800I, SYSMEX Corporation, Japan
EB virus	Uranus AE100, Aikang Medtech Co., Ltd, China
Tumor biomarkers	Uranus AE100, Aikang Medtech Co., Ltd, China
Urine routine	URIT-500B, URIT Medical Electronic Group Co., China
Bone mineral density	MetriScan, Miles Medical Inc., California, USA
	BMD-1000D, Hongyang Medical Apparatus Co., Ltd, China



---

1		
2		
3		
4	Body water	Inbody 770, InBody Co., Ltd, Seoul, Korea
5	Body protein	Inbody 770, InBody Co., Ltd, Seoul, Korea
6		
7	Body minerals	Inbody 770, InBody Co., Ltd, Seoul, Korea
8	Body muscle	Inbody 770, InBody Co., Ltd, Seoul, Korea
9		
10	Skeletal muscle mass	Inbody 770, InBody Co., Ltd, Seoul, Korea
11		
12	Body fat	Inbody 770, InBody Co., Ltd, Seoul, Korea
13	Body cell count	Inbody 770, InBody Co., Ltd, Seoul, Korea
14		
15	Basal metabolic rate	Inbody 770, InBody Co., Ltd, Seoul, Korea
16		
17	Waist circumference	Inbody 770, InBody Co., Ltd, Seoul, Korea
18	Hip circumference	Inbody 770, InBody Co., Ltd, Seoul, Korea
19		
20	Bio-electrical impedance	Inbody 770, InBody Co., Ltd, Seoul, Korea
21		
22	Urine metals	NEXION 300X PerkinElmer Inc., USA
23	Urine nicotine and its metabolite	Agilent 6890N-5973 GC-MS system, Agilent Technologies Inc., Santa Clara, CA, USA
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		

---

**Supplemental Table 2 Comparison between the individuals with and without body component data at baseline**

Variables	Participants with body component (n=3292)	Participants without body component (n=6119)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.54±5.25	67.83±5.50	2.56	0.01
Male (n, %)	1327 (40.31)	2695 (44.04)	12.19	0.0005
Han Chinese (n, %)	2954 (99.29)	5623 (99.36)	0.14	0.70
Education level (n, %)			4.01	0.26
Primary school or illiteracy	547 (16.79)	1090 (17.97)		
Middle school	913 (28.03)	1651 (27.23)		
High school	1081 (33.19)	2062 (34.00)		
University or college or higher	716 (21.98)	1261 (20.79)		
Marital status (n, %)			7.74	0.10
Single	14 (0.43)	32 (0.53)		
Married	2825 (87.60)	5220 (86.86)		
Widowed	336 (10.42)	687 (11.43)		
Divorced	48 (1.49)	71 (1.18)		
Cohabited	2 (0.06)	0		
Ever smoker (n, %)	643 (19.64)	1257 (20.69)	1.45	0.23
Passive smoker (n, %)	380 (11.63)	674 (11.11)	0.57	0.45
Ever drinker (n, %)	485 (14.82)	866 (14.25)	0.55	0.46
Pittsburgh Sleep Quality Index (n, mean ± SD)	4.33 ± 2.60	4.12 ± 2.61	-3.41	0.0006
Physical active (n, %)	2664 (81.24)	4924 (81.28)	0.002	0.97
Overweight/Obesity <sup>a</sup> (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02

1					
2					
3	Hypertension <sup>b</sup> (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
4					
5	Diabetes mellitus <sup>c</sup> (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
6					
7	Hyperlipidemia <sup>d</sup> (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
8					
9	Chronic bronchitis <sup>e</sup> (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
10					
11	COPD <sup>e</sup> (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
12					
13	Asthma <sup>e</sup> (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
14					
15	Tuberculosis <sup>e</sup> (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
16					
17	Angina <sup>e</sup> (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
18					
19	Myocardial infarction <sup>e</sup> (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
20					
21	Coronary heart disease <sup>e</sup> (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
22					
23	Stroke <sup>e</sup> (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
24					
25	Cancer <sup>e</sup> (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
26					
27	Chronic hepatitis <sup>e</sup> (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
28					
29	Arthritis <sup>e</sup> (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
30					
31	Migraine <sup>e</sup> (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
32					
33	Nephritis <sup>e</sup> (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
34					
35	Alzheimer's disease <sup>e</sup> (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
36					
37	Parkinson's disease <sup>e</sup> (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
38					
39	Brain injury <sup>e</sup> (n, %)	193 (5.96)	340 (5.64)	0.40	0.53
40					
41	MMSE score < 24 (n, %)	167 (5.48)	301 (5.35)	0.07	0.79
42					
43	Depression status <sup>f</sup> (n, %)	126 (3.87)	177 (2.95)	5.63	0.02
44					
45	ADL (n, scores, mean ± SD)	14.09 ± 1.23	14.18 ± 1.73	2.82	0.005
46					

SSRS (n, score, mean $\pm$ SD)	39.88 $\pm$ 7.68	39.36 $\pm$ 8.00	-2.88	0.004
--------------------------------	------------------	------------------	-------	-------

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

<sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

<sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq$ 90mmHg and / or systolic blood pressure (SBP)  $\geq$ 140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

<sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq$ 7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

<sup>d</sup> Dyslipidemia was defined as TCHO  $\geq$ 5.2 mmol/L, or TG  $\geq$ 1.7 mmol/L, or HDL-C  $<$ 0.1 mmol/L, or LDL-C  $>$ 3.4 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

<sup>e</sup> The disease was defined as self-reported disease.

<sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

# BMJ Open

## Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging Related Disorder Cohort in China

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-034317.R1
Article Type:	Cohort profile
Date Submitted by the Author:	04-Jan-2020
Complete List of Authors:	<p>Liu, Li; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Wei; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Nie, Lulin; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Guo, Zhiwei; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Luo, Yi; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Chen, Weihong; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Liu, Weimin; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Feiqi, Zhu; The Third Affiliated Hospital of Shenzhen University Medical College, Cognitive Impairment Ward of Neurology Department</p> <p>Wang, Lu; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhang, Jiafei; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Wang, Xian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Li, Tian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Gao, Erwei ; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhou, Li; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>He, Kaiwu; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>

	<p>Huang, Yidan; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Chunjie; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhu, Qingqing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Ye, Fang; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yu, Xingchen; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Jing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Jianjun; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3  
4 Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging  
5 Related Disorder Cohort in China  
6  
7  
8

9 Li Liu<sup>1†</sup>, Wei Liu<sup>2†</sup>, Lulin Nie<sup>2</sup>, Zhiwei Guo<sup>3</sup>, Yi Luo<sup>3</sup>, Weihong Chen<sup>4</sup>, Weimin Liu<sup>4</sup>,  
10 Feiqi Zhu<sup>5</sup>, Lu Wang<sup>6</sup>, Jiafei Zhang<sup>6</sup>, Xian Wang<sup>6</sup>, Tian Li<sup>6</sup>, Erwei Gao<sup>6</sup>, Li Zhou<sup>2</sup>,  
11 Kaiwu He<sup>2</sup>, Yidan Huang<sup>6</sup>, Chunjie Yuan<sup>6</sup>, Qingqing Zhu<sup>6</sup>, Fang Ye<sup>6</sup>, Xingchen Yu<sup>1</sup>,  
12 Jing Yuan<sup>6\*</sup>, Jianjun Liu<sup>2\*</sup>  
13  
14  
15  
16  
17  
18

19 <sup>1</sup> Department of Epidemiology and Biostatistics and State Key Laboratory of  
20 Environmental Health for Incubating, School of Public Health, Tongji Medical  
21 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
22  
23

24 <sup>2</sup> Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology,  
25 Shenzhen Center for Disease Control and Prevention, Shenzhen, Guangdong, PR.  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

<sup>3</sup> Shenzhen Luohu Hospital for Traditional Chinese Medicine, Shenzhen Luohu  
Hospital Group, Shenzhen, Guangdong, PR. China

<sup>4</sup> Shenzhen Luohu Center for Disease Control and Prevention, Shenzhen, Guangdong,  
PR. China

<sup>5</sup> Cognitive Impairment Ward of Neurology Department, The Third Affiliated  
Hospital of Shenzhen University Medical College, Shenzhen, Guangdong, PR. China

<sup>6</sup> Department of Occupational and Environmental Health and State Key Laboratory of  
Environmental Health for Incubating, School of Public Health, Tongji Medical  
College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China

† Li Liu and Wei Liu contributed equally.

**Corresponding to:**

Jianjun Liu

Key Laboratory of Modern Toxicology of Shenzhen



1  
2  
3  
4 Institute of Toxicology

5 Shenzhen Center for Disease Control and Prevention, Shenzhen, 518055, Guangdong,

6  
7 PR China

8  
9 Tel: +86 755 25508584

10  
11 E-mail: [JJLIUSZCDC@163.com](mailto:JJLIUSZCDC@163.com)

12  
13  
14  
15 Jing Yuan

16  
17 Department of Occupational and Environmental Health

18  
19 State Key Laboratory of Environmental Health for Incubating

20  
21 School of Public Health, Tongji Medical College, Huazhong University of Science

22  
23 and Technology, No. 13 Hangkong Road, Wuhan 430030, China

24  
25 Tel: +86 27 83693209

26  
27 E-mail: [jyuan@tjh.tjmu.edu.cn](mailto:jyuan@tjh.tjmu.edu.cn)

## ABSTRACT

**Purpose:** The Shenzhen Aging Related Disorder Cohort is designed to detect the associations of lifestyle, environmental and genetic factors with major aging related disorders, especially neurological and mental disorders.

**Participants:** The cohort is a community-dwelling prospective study of 9411 elderly individuals aged 60 to 92 years from 51 community health service centers in Luohu district of Shenzhen city, Guangdong province, China. The baseline data were collected between 2017 and 2018, including demographics and socioeconomics, lifestyles, medical history, family history of major non-communicable chronic disease, environmental exposures, clinical analysis of blood and urine and clinical imaging measurements, anthropometric measures and neurological function and mental health assessments. Blood and urinary samples were collected at baseline. All participants will be followed for physiological and psychological changes, incidence of aging related disorders, and updated lifestyle and environmental exposures every 5 years.

**Findings to date:** The mean age of the participants was 67.73 years at baseline. Among all participants, 42.74 % were males. The prevalences of individuals with unhealthy conditions were found as follows: overweight/obesity (54.38%), hypertension (58.24%), diabetes mellitus (22.30%), dyslipidemia (75.69%), chronic bronchitis (1.45%), myocardial infarction (0.55%), coronary heart disease (5.69%), stroke (1.10%), cancer (2.18%), arthritis (5.04%), Alzheimer's disease (0.18%), Parkinson's disease (0.23%), brain injury (5.75%), cognitive impairment (5.39%) and

1  
2  
3  
4 depression status (3.28%). The mean scores for the Lawton-Brody Activities of Daily  
5  
6 Living Scale and the Social Support Rate Scale were 14.15 and 39.54, respectively.  
7  
8

9 **Future plans:** The data collection is expected to be ended at the end of 2030. The  
10  
11 data provide for the purpose of identification of the causality of aging related  
12  
13 disorders, especially neurological and mental disorders through integrating  
14  
15 environmental, genetic and lifestyle factors. The datasets generated and/or analysed  
16  
17 during the current study are not publicly available at this stage, but are available from  
18  
19 the corresponding author on reasonable request.  
20  
21  
22  
23  
24  
25  
26

27 **Keywords:** Cohort study, Aging related disorders, Lifestyle, Environmental exposure,  
28  
29 Genetic susceptibility, Neurological disease, Mental health  
30  
31  
32  
33  
34

### 35 **Strengths and limitations of this study**

36  
37

38 1. The Shenzhen Aging Related Disorder Cohort is a community-dwelling cohort with  
39  
40 the comprehensive collections of epidemiological data, clinical examinations,  
41  
42 environmental exposures, body components and biological samples in elderly Chinese  
43  
44 population, which would facilitate the identification of the causality of various aging  
45  
46 related disorders, especially neurological and mental disorders through integrating  
47  
48 environmental, genetic and lifestyle factors.  
49  
50  
51

52  
53 2. Several ways will be applied to identify the morbidities and mortalities of  
54  
55 aging-related diseases during the follow-up through questionnaire investigation,  
56  
57 physical examinations, and searching the National Electronic Disease Surveillance  
58  
59  
60

1  
2  
3  
4 System as well as the National Mortality Surveillance System, which guarantee the  
5  
6 integrity and validity of the health outcomes of interest in our cohort.  
7  
8

9 3. Only adults aged 60 years or older were included into the current study, which  
10  
11 might hinder the detection of influencing factors for early-onset mental and  
12  
13 neurological diseases.  
14  
15

16  
17 4. The medical histories of the participants in the current cohort were mainly  
18  
19 self-reported, which might cause biased estimation between disease histories and  
20  
21 aging-related disorders.  
22  
23

24  
25 5. Only a subsample (34.98%) of the participants at baseline took part in the  
26  
27 measurement of body components.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017,<sup>1</sup> and it is forecasted that the life expectancy will keep increasing until 2040.<sup>2</sup> Consequently, population aging has become one of the major challenges facing most countries worldwide. The proportion of people with ageing related disorders, especially non-communicable chronic diseases has been growing.<sup>3</sup> For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,<sup>4</sup> the cancer incidence increased by 28% from 2006 and 2016,<sup>5</sup> and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.<sup>6,7</sup> In 2017, aging related diseases accounted for 51.3% of the global burden of diseases among adults.<sup>8</sup>

As a county with rapid economic and social development, China has stepped into an aging society. The growing incidences of aging related disorders have threatened public health and economy.<sup>9</sup> Besides cardiovascular diseases, cancer and diabetes,<sup>10-13</sup> neurological and mental disorders have attracted growing attention due to their dramatically increased contribution to disease burden, the relative lack of resources for intervention of various mental diseases, and the need for more research to find the best ways to provide mental health services.<sup>14,15</sup> Data from the Chinese Longitudinal Healthy Longevity Study revealed an annual increase of 0.7%-2.2% of cognitive impairment rate and an annual decrease of 0.4%-3.8% of objective physical performance capacity among the oldest old Chinese between 1998 and 2008.<sup>16</sup> The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,<sup>17</sup> and that of Alzheimer's disease was estimated to have quadrupled from 6 to 28

1  
2  
3  
4 million between 2011 and 2015.<sup>18</sup> However, to date, there are no known effective  
5  
6 treatments for most aging related disorders, especially for neurological diseases, it is  
7  
8 therefore urgent to identify the risk factors, particularly those modifiable ones to  
9  
10 facilitate the early intervention and prevention of the onset of aging related disorders.  
11  
12

13  
14 Shenzhen, a major city in Guangdong province, China, situates immediately north  
15  
16 of Hongkong. As the first special economic zone and the birthplace of economic  
17  
18 miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd  
19  
20 most competitive financial center in the world in 2017. Along with the highest-speed  
21  
22 urbanization, Shenzhen has attracted large internal migration across the country, and  
23  
24 experienced dramatic socioeconomic changes and accelerated aging process during  
25  
26 the past decades. According to the 2015 Shenzhen Statistics, people aged 60 years or  
27  
28 older accounted for 6.6% of total permanent resident population, and the estimated  
29  
30 annual growth rate is approximate 6.5% during the period 2016-2020, which means  
31  
32 that Shenzhen would step into aging society around 2020, and the elderly population  
33  
34 of Shenzhen will show an explosive growth thereafter. Given the population diversity,  
35  
36 rapid urbanization, high-speed aging process as well as adequate medical and health  
37  
38 resources in Shenzhen city, a dynamic, prospective cohort study, the Shenzhen Aging  
39  
40 Related Disorder Cohort, has been designed to provide evidence for addressing  
41  
42 opportunities regarding aging related disorders as an aging-oriented research model  
43  
44 for areas with most rapid urbanization and socioeconomic structure changes in  
45  
46 developing countries.  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56

57  
58 The purposes of the Shenzhen Aging Related Disorder Cohort were to:  
59  
60

1  
2  
3  
4 1) determine the prevalence of aging related disorders, including neurological  
5  
6 disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases,  
7  
8 diabetes mellitus, neoplasms, injuries and other non-communicable diseases in  
9  
10 Shenzhen;  
11  
12

13  
14 2) detect the incidences of major mental and neurological disorders, including  
15  
16 mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;  
17  
18

19  
20 3) estimate the disease burden of aging related disorders, especially from  
21  
22 neurological and mental disorders in Shenzhen;  
23  
24

25 4) describe the temporal dynamics of aging related disorders in Shenzhen;  
26  
27

28 5) assess the effects of environmental factors, lifestyle, and genetic factors on the  
29  
30 initiation and progression of aging related disorders, especially for neurological and  
31  
32 mental disorders;  
33  
34

35 6) develop risk prediction tools for multiple aging related disorders;  
36  
37

38 7) generate health intervention and management strategies for aging related  
39  
40 disorders, especially for neurological and mental disorders.  
41  
42  
43  
44

## 45 **COHORT DESCRIPTION**

### 46 **The participants of the cohort**

47  
48 The Shenzhen Aging Related Disorder Cohort was established between 2017 and  
49  
50 2018 based on participants from 51 community health service centers in Luohu  
51  
52 district of Shenzhen city, Guangdong province, China (Figure 1). The community  
53  
54 health service center is the basic health administration unit located in each  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 community, which is responsible for disease prevention, health care, promoting  
5  
6 recovery in each stage of health-illness process, health education, family planning and  
7  
8  
9 medical treatment of all the population in the area under its jurisdiction. Firstly,  
10  
11 among 11 districts of Shenzhen city, Luohu district was selected considering its  
12  
13 representative to Shenzhen city in terms of socioeconomic structure and population  
14  
15 size (Supplementary Table 1). Secondly, all 51 community health service centers in  
16  
17 Luohu district were included. Individuals with severe physical disabilities or mental  
18  
19 disorders which could affect daily activities or language communication were  
20  
21 excluded through checking the medical insurance for urban residents and the National  
22  
23 Electronic Disease Surveillance System considering that they could not response well  
24  
25 to the questionnaire investigation, clinical examination and further follow-ups. Then,  
26  
27 all registered permanent elderly residents aged at least 60 years old and without  
28  
29 severe physical or mental disorders (n=16843) of the selected community health  
30  
31 service centers were invited to participate in the study. Approximately 56% (n=9411)  
32  
33 agreed and provided signed informed consent, but 44% of the local residents refused  
34  
35 the invitation due to unwillingness to spent time on the epidemiological investigation  
36  
37 or less attraction for them or they had finished the physical examination in early 2017.  
38  
39 All participants were asked to bring their unique national identity cards for  
40  
41 questionnaire investigation and physical examination in local health centers or  
42  
43 hospitals. Considering the annual increase of 4000 adults aged 60 years or older in  
44  
45 above mentioned community health service centers from 2016 to 2018, the cohort will  
46  
47 be expanded by recruiting 2000 new entrants from the same community health  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



services from Luohu district every year until 2028. The data collection of the cohort will be ended until 2030. The study has been approved by the Review Board of Shenzhen Center for Disease Control and Prevention.

### **Epidemiological investigation**

The epidemiological data were collected through face-to-face interviews by health professionals. A semi-structured questionnaire was designed to collect demographic information (name, identity card, gender, birthday, education level, marital status, native place, occupation, housing condition, annual family income, etc.), commuting tools, lifestyle (food intake, active and passive smoking status, alcohol consumption, physical activity, cooking and sleep habits, etc.), histories of chronic diseases (hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancer, neurological and mental disorders, etc.), medication history, family histories of aforementioned chronic diseases, and reproductive history (women only). After the investigation, trained investigators checked the integrity and logical errors of each questionnaire. The missing information was fulfilled and logical errors were corrected by further telephone investigation. Data from each questionnaire were entered into computer by two integrators independently using Epidata software (version 3.1). All information was double-checked for the validity. Data items of the questionnaire query are summarized as Table 1.

**Table 1 Summary of studied items at baseline in the Shenzhen Aging Related Disorder Cohort**

Categories	Measurements
Demographics and socioeconomics	Birthday, gender, residential address, race, birth place, education level, marital status, occupation, housing

	condition, and family yearly income
Lifestyles	Consumption frequencies of major food groups and drinks, active and passive smoking status, alcohol intake, physical activity, sleep habits, and cooking habits
Medical histories	Histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease
	Use of health services and taking medicines in the past 2 weeks
Family histories of diseases	Family histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease
Reproductive history (for women)	Histories of pregnancy and delivery, menopause status, and history of taking contraceptive pills
Clinic analysis of blood and urine	Blood routine examination, fasting plasma glucose, total cholesterol, triglycerides, low density lipoprotein cholesterol, high density lipoprotein cholesterol, alanine aminotransferase, glycated hemoglobin and homocysteine, creatinine, uric acid, urea nitrogen, tumor biomarkers, EB virus antibody, glycated hemoglobin A1c, homocysteine
	Urine glucose, urine bilirubin, urine acetone bodies, urine specific gravity, pH, urinary protein, urobilinogen, urine nitrite, urine white blood cell, urine occult blood
	Urine metals [lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead]
	Urine nicotine and its metabolite [nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl) butanoic Acid Dicyclohexylamine Salt]

Parameters of clinical measurements and imaging	Height, weight, blood pressure, electrocardiogram, chest X-ray, color doppler ultrasound of liver, gallbladder, spleen, pancreas, kidney, bladder, ureter and prostate (men only), bone mineral density
Assessments of neurological function and activities of daily living	Basal metabolic rate, body mass index, circumference of neck, chest, waist, hip, biceps and thigh, total body fat, percentage of body fat, visceral fat level, fat free mass, lean muscle mass, skeletal muscle, total body water, intracellular water, extracellular water, body protein, body minerals, body cell count, bio-electrical impedance Mini-Cog, Mini-mental State Examination (MMSE), Center for Epidemiologic Studies Depression Scale (CES-D), Activities of Daily Living Scale (ADLS), Social Support Rating Scale (SSRS), Pittsburgh Sleep Quality Index (PSQI)

### **Assessments of neurological function and activities of daily living**

Standardized scales were applied to estimate cognitive function, depression status, functional disability, social support and sleep quality. The Mini-Cog, a 5-point scale combining three-item recall and Clock Drawing Test<sup>19</sup> was used as preliminary screening instrument for mild cognitive impairment. For those who got 4 or less scores of Mini-Cog, further Chinese version of the Mini-mental State Examination (MMSE) was applied to classify them into two groups [ $\geq 24$  points and  $< 24$  points].<sup>20</sup> The validity and reliability of the Chinese MMSE have been verified previously<sup>16</sup>. The Center for Epidemiologic Studies Depression Scale (CES-D) was applied to estimate the depression status of each participant. To favor international comparisons, we used the cutoff of 16 or more out of a total of 60 points to define the prevalence of depression.<sup>21,22</sup> The Lawton-Brody Activities of Daily Living Scale (ADLS) combining basic (ability to toilet, feed, dress, groom, bathe and walk) and instrumental (ability to shop, prepare food, perform housekeeping, wash laundry, arrange transport, administer medication, use a telephone and manage finances) scales

1  
2  
3  
4 was used to assess functional disability of each participant. The participants with  
5  
6 higher ADLS scores (ranging from 14-64) exhibit worse independence.<sup>23</sup> The  
7  
8 Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven  
9  
10 component scores, was applied to assess the sleep quality of all participants.<sup>24</sup> The  
11  
12 participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality.  
13  
14 The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of  
15  
16 the social support, namely subjective support (emotional support, four items),  
17  
18 objective support (tangible support, three items) and availability support (three items).  
19  
20 Higher SSRS scores represent a better social support. The validity and reliability of  
21  
22 SSRS have been verified previously.<sup>25</sup>  
23  
24  
25  
26  
27  
28  
29

### 30 **Clinic analysis of blood and urine**

31  
32 After at least 8 hours of overnight fasting, venous blood samples from each  
33  
34 participant were separately collected into the EDTA anticoagulant tubes (a 2 ml and a  
35  
36 5 ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and  
37  
38 then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature  
39  
40 to separate plasma and serum. The serum samples were used for biochemical analyses,  
41  
42 including fasting blood glucose, blood lipid, hepatic function, kidney function  
43  
44 (creatinine, uric acid and urea nitrogen), tumor biomarkers and Epstein-Barr Virus  
45  
46 (EBV) antibody. The lithium-heparinized whole blood was used for blood routine test,  
47  
48 including the total number of white blood cell (WBC), red blood cell counts (RBC),  
49  
50 hemoglobin contents and blood platelet counts. The detailed biochemical indexes of  
51  
52 blood are listed in Supplemental Table 2. The EDTA-anticoagulated whole blood (0.3  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 ml) and plasma specimens (1 ml) were used for DNA and RNA extraction, and testing  
5  
6  
7 of glycated hemoglobin A1c (HbA1c) and homocysteine (HCY), respectively.  
8

9  
10 Additionally, the early spot morning urine sample (8 ml) from each participant  
11  
12 was collected for urine routine examination, urine concentrations of 24 kinds of  
13  
14 metals, and urinary concentrations of nicotine and its 10 metabolites. The detailed  
15  
16 biochemical indexes of urine are listed in Supplemental Table 2. The resting blood  
17  
18 and urine specimens were stored at -80°C and -20°C refrigerators, respectively. The  
19  
20 flow diagram of blood and urine collection and separation is shown as Figure 2.  
21  
22  
23

### 24 **Parameters of clinical measurements and imaging**

25  
26 Each participant took part in the physical examination conducted by trained  
27  
28 physicians in the district hospital. The inspection-palpation-percussion-auscultation  
29  
30 (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity,  
31  
32 oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The  
33  
34 measurements of baseline anthropometric indices for each participant were performed  
35  
36 on the day of physical examination. Standing height, weight and waist were measured  
37  
38 with the subjects in light clothing and without shoes by ultrasonic weighing apparatus  
39  
40 (HNN-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse  
41  
42 rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300,  
43  
44 OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the  
45  
46 right arm supported at heart-level. Statistical analysis was based on the average of the  
47  
48 two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray,  
49  
50 abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas,  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate  
5  
6 B-type ultrasound inspection (only for males) and bone mineral density scan were  
7  
8 then conducted. Out of 9411 participants, 3292 took part in the body composition  
9  
10 measurements. The visceral fat and fluid imbalances in each segment of the body and  
11  
12 the phase angle for cellular indicator of cell integrity were measured by bioelectrical  
13  
14 impedance analysis using an Inbody 570 body composition analyser (Biospace, Seoul,  
15  
16 Korea). The body segments were analysed, including elementary body composition  
17  
18 [body weight, body mass index (BMI), protein mass and minerals mass], total body  
19  
20 water (TBW) analysis [intracellular water, extracellular water (ECW) and  
21  
22 ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total  
23  
24 body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb  
25  
26 circumferences as well as waist-to-hip ratio, visceral fat area and visceral fat level)  
27  
28 and basal metabolic rate, etc.  
29  
30  
31  
32  
33  
34  
35  
36

37 The instruments used for the physical examination and the body composition  
38  
39 measurements are listed as Supplemental Table 3.  
40  
41

### 42 **The follow-up procedure**

43  
44  
45 Follow-up will be conducted every 5 years to update exposures and outcomes by the  
46  
47 staffs in the community health service centers, who have established good relationship  
48  
49 with the elderly during daily disease prevention, treatment and recovery to reduce the  
50  
51 potential impact of losses to follow up on the validity of the study result. An annual  
52  
53 health education on aging-related disorders will be provided by Shenzhen Center for  
54  
55 Disease Control and Prevention, and the daily medical consultation will be provided  
56  
57  
58  
59  
60

1  
2  
3  
4 by the community health service centers for the participants to assure the retention of  
5  
6 the participants. The questionnaire survey, physical examination, the body  
7  
8 composition measures, and neurological function and mental health assessments will  
9  
10 be re-conducted during the follow-up. Blood and urine specimens will be collected  
11  
12 according to the design procedures at baseline. The incidence of non-communicable  
13  
14 chronic diseases, including neurological and mental disorders, hypertension,  
15  
16 dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging  
17  
18 related diseases will be annually verified through searching the IDs of participants of  
19  
20 the cohort, which were collected during the baseline questionnaire interviews in the  
21  
22 medical insurance for urban residents, the National Electronic Disease Surveillance  
23  
24 system and the National Mortality Surveillance System. The disease reports will be  
25  
26 abstracted manually. For those presenting significant decline of cognition in MMSE  
27  
28 but without diagnosis of mental or neurological disorders from the medical insurance  
29  
30 for urban residents or the National Electronic Disease Surveillance System, the  
31  
32 clinical diagnosis of mental disorders will be further performed by an expert panel  
33  
34 from Shenzhen Luohu Hospital Group.

35  
36  
37 All death cases will be verified by Chinese Cause of Death Registration System  
38  
39 in Shenzhen Center for Disease Control and Prevention. The diagnosis of  
40  
41 aforementioned conditions and the causes of death will be classified according to the  
42  
43 10<sup>th</sup> version of the International Statistical Classification of Diseases (ICD-10). The  
44  
45 flow diagram of the cohort design is presented as Figure 3. The anticipated rate of  
46  
47 attrition is no more than 15% until the end of 2030.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## Patient and public involvement

Participants were not involved in the development of study design or conduct.

However, each participant received a health report of their examinations and tests.

## FINDINGS TO DATE

A total of 9411 people were recruited into the Shenzhen Aging Related Disorder Cohort. The participants were from 33 provinces, municipalities directly under the Central Government and autonomous regions of China (except for Tibet Autonomous Region). Among them, 48.65% of the cohort participants were from the outside areas of Guangdong province, in which Shenzhen city is located (Figure 4). The age of the participants ranged from 60 to 92 years at baseline. Among all participants, 42.74 % were males. The distributions of race, education levels, marital status, and exposures to occupational hazards and kitchen fumes are shown in Table 2. The baseline lifestyle and diet habits of the participants are presented in Table 3. The significant differences in the demographics and lifestyle between males and females were observed. Males were more likely to have higher education level, possess the habits of smoking, drinking, taking afternoon nap, and drinking tea, be physically active, and have worse sleep quality (all  $P < 0.05$ ) (Tables 2 and 3).



**Table 2 Baseline characteristics of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4022)	Female (n=5389)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.73±5.41	68.38±5.59	67.24±5.23	10.12	<0.0001
Age groups (years, n, %)				89.80	<0.0001
60 - 64	3142 (33.39)	1167 (29.02)	1975 (36.65)		
65 - 69	3274 (34.79)	1399 (34.78)	1875 (34.79)		
70 - 74	1818 (19.32)	848 (21.08)	970 (18.00)		
≥75	1177 (12.51)	608 (15.12)	569 (10.56)		
Race (n, %)				6.88	0.03
Han Chinese	8577 (91.14)	3684 (91.60)	4893 (90.80)		
Other ethnic groups	57 (0.61)	15 (0.37)	42 (0.78)		
Missing	777 (8.26)	323 (8.03)	454 (8.42)		
Migration time to Shenzhen (n, %)				65.89	<0.0001
<1950	1450 (15.41)	554 (13.77)	896 (16.63)		
1950-	404 (4.29)	174 (4.33)	230 (4.27)		
1970-	3735 (39.69)	1722 (42.81)	2013 (37.35)		
1990-	2661 (28.28)	1022 (25.41)	1639 (30.41)		
2010-	729 (7.75)	365 (9.08)	364 (6.75)		
Missing	432 (4.59)	185 (4.60)	247 (4.58)		
Education level (n, %)				571.31	<0.0001
Primary school or illiteracy	1637 (17.39)	390 (9.70)	1247 (23.14)		
Middle school	2564 (27.24)	934 (23.22)	1630 (30.25)		
High school	3143 (33.40)	1450 (36.05)	1693 (31.42)		
University or college or higher	1977 (21.01)	1210 (30.08)	767 (14.23)		
Missing	90 (0.96)	38 (0.94)	52 (0.96)		
Marital status (n, %)				419.31	<0.0001
Single	37 (0.39)	13 (0.32)	24 (0.45)		
Married	8045 (85.49)	3762 (93.54)	4283 (79.48)		
Widowed	1023 (10.87)	147 (3.65)	876 (16.26)		

Divorced	119 (1.26)	26 (0.65)	93 (1.73)		
Cohabited	2 (0.02)	0	2 (0.04)		
Remarried	9 (0.10)	7 (0.17)	2 (0.04)		
Missing	176 (1.87)	67 (1.67)	109 (2.02)		
Family yearly income (yuan, n, %)				32.87	<0.0001
<40,000	306 (3.25)	87 (2.16)	219 (4.06)		
40,000 -	857 (9.11)	339 (8.43)	518 (9.61)		
80,000 -	1401 (14.89)	626 (15.56)	775 (14.38)		
120,000 -	1951 (20.73)	852 (21.18)	1099 (20.39)		
≥160,000	4114 (43.71)	1787 (44.43)	2327 (43.18)		
Missing	782 (8.31)	331 (8.23)	451 (8.37)		
Exposure to occupational hazards**				127.85	<0.0001
Yes	1563 (16.61)	834 (20.74)	729 (13.53)		
No	5361 (56.97)	2309 (57.41)	3052 (56.63)		
Missing	2487 (26.43)	879 (21.85)	1608 (29.84)		
Exposure to kitchen fumes (n, %)				1104.43	<0.0001
Yes	6284 (66.77)	1943 (48.31)	4341 (80.55)		
No	2975 (31.61)	2017 (50.15)	958 (17.78)		
Missing	152 (1.62)	62 (1.54)	90 (1.67)		
Menolipsis (n=5233, %)		-	5230 (99.94)		
Parturition (n=5233, times)		-	2.02±1.04		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and categorical variables, respectively.

\*\*Occupational hazards included high temperature, noise, radiation, metal, dust, organic solvent, and farm chemical.

**Table 3 Baseline lifestyle and diet habits of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4041)	Female (n=5370)	t/x <sup>2</sup> *	P
Smoking status (n, %)				2994.95	<0.0001
Never smoker	7449 (79.15)	2129 (52.93)	5320 (98.72)		
Former smoker	974 (10.35)	961 (23.89)	13 (0.24)		
Current smoker	926 (9.84)	904 (22.48)	22 (0.41)		
Missing	62 (0.66)	28 (0.70)	34 (0.63)		
Passive smoker (n, %)				419.58	<0.0001
Yes	1054 (11.20)	144 (3.58)	910 (16.89)		
No	8282 (88.00)	3830 (95.23)	4452 (82.61)		
Missing	75 (0.80)	48 (1.19)	27 (0.50)		
Drinking status (n, %)				1383.99	<0.0001
Never drinker	7998 (84.99)	2794 (69.47)	5204 (96.57)		
Former drinker	247 (2.62)	227 (5.64)	20 (0.37)		
Current drinker	1104 (11.73)	976 (24.27)	128 (2.38)		
Missing	62 (0.66)	25 (0.62)	37 (0.69)		
Afternoon nap (n, %)				30.79	<0.0001
Yes	7020 (74.59)	3116 (77.47)	3904 (72.44)		
No	2301 (24.45)	871 (21.66)	1430 (26.54)		
Missing	90 (0.96)	35 (0.87)	55 (1.02)		
Sleep duration at night (n=9185, hours/day, mean±SD)	7.45±1.11	7.49±1.13	7.43±1.10	2.34	0.02
Pittsburgh Sleep Quality Index (n=7772, mean±SD)	4.20±2.61	3.84±2.41	4.46±2.72	-10.50	<0.0001
Physical activity (n, %)				80.11	<0.0001
Yes	7588 (80.63)	3411 (84.81)	4177 (77.41)		
No	1749 (18.58)	581 (14.45)	1168 (21.98)		
Missing	74 (0.79)	30 (0.75)	44 (0.82)		
Rice (n=9259, times/day, mean±SD)	1.98±0.65	2.00±0.65	1.96±0.65	3.04	0.002
Wheat (n=9224, times/day, mean±SD)	0.79±0.57	0.78±0.57	0.80±0.57	-2.24	0.03
Coarse grain (n=9241, times/week, mean±SD)	5.08±3.28	4.88±3.35	5.22±3.22	-4.80	<0.0001

Vegetables (n=9267, times/day, mean±SD)	1.62±0.71	1.60±0.72	1.63±0.71	-1.81	0.07
Fruit (n=9256, times/day, mean±SD)	0.95±0.50	0.92±0.51	0.97±0.50	-4.68	<0.0001
Meat (n=9258, times/day, mean±SD)	1.00±0.60	1.03±0.61	0.98±0.60	4.17	<0.0001
Fish (n=9240, times/week, mean±SD)	3.12±3.33	3.22±3.41	3.04±3.27	2.53	0.01
Shrimp/shell (n=9204, times/week, mean±SD)	1.20±3.04	1.29±3.14	1.12±2.95	2.59	0.009
Egg (n=9263, times/week, mean±SD)	5.51±2.64	5.52±2.65	5.50±2.63	0.39	0.70
Milk (n=9256, times/week, mean±SD)	3.52±3.23	3.34±3.19	3.66±3.25	-4.68	<0.0001
Bean (n=9225, times/week, mean±SD)	2.31±2.52	2.36±2.60	2.27±2.46	1.69	0.09
Pickle (n=9267, times/week, mean±SD)	1.10±2.20	1.08±2.14	1.11±2.25	-0.63	0.53
Processed meat (n=9266, times/week, mean±SD)	0.25±1.01	0.24±0.94	0.26±1.06	-0.93	0.35
Green tea (n, %)				612.93	<0.0001
Yes	3348 (35.58)	1999 (49.70)	1349 (25.63)		
No	5760 (61.20)	1912 (47.54)	3848 (71.49)		
Missing	303 (3.22)	111 (2.76)	192 (3.56)		
Black tea (n, %)				253.99	<0.0001
Yes	1741 (18.50)	1040 (25.88)	700 (12.99)		
No	7331 (77.90)	2847 (70.79)	4484 (83.21)		
Missing	339 (3.60)	134 (3.33)	205 (3.80)		
Coffee (n, %)				3.21	0.20
Yes	144 (1.53)	72 (1.79)	72 (1.34)		
No	8872 (94.27)	3784 (94.08)	5088 (94.43)		
Missing	395 (4.20)	166 (4.13)	229 (4.25)		
Juice (n, %)				0.40	0.82
Yes	47 (0.50)	18 (0.45)	29 (0.54)		
No	8970 (95.31)	3837 (95.40)	5133 (95.25)		
Missing	394 (4.19)	167 (4.15)	227 (4.21)		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and for the categorical variables, respectively.

1  
2  
3  
4 The baseline levels of biochemical traits of the participants in the Shenzhen  
5  
6 Aging Related Disorder Cohort were detected, including blood routine, lipid levels,  
7  
8 blood glucose, homocysteine, hepatic function, kidney function, tumor biomarkers,  
9  
10 Epstein-Barr Virus (EBV) antibody and urine routine. The detailed items are provided  
11  
12 as Supplemental Table 2. With the Exception of aspartate aminotransferase (AST),  
13  
14 EB Virus status, carcino-embryonic antigen (CEA), alpha fetoprotein (AFP) and urine  
15  
16 bilirubin, all other biochemical traits presented significant difference between males  
17  
18 and females (all  $P < 0.05$ , Tables 4 and 5).  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 4 Baseline levels of biochemical traits in blood of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
<b>Blood routine</b>					
WBC (n=9377, × 10 <sup>9</sup> /l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.50	13.48	<0.0001
RBC (n=9377, × 10 <sup>12</sup> /l, mean±SD)	4.60±0.50	4.80±0.51	4.45±0.48	35.59	<0.0001
Hemoglobin (n=9377, g/dl, mean±SD)	13.74±1.27	14.52±1.20	13.15±0.77	59.52	<0.0001
Platelet count (n=9377, × 10 <sup>9</sup> /l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
<b>Lipid levels</b>					
TCHO (n=9376, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.00	-23.50	<0.0001
TCHO ≥5.18 mmol/L (n, %)	5732 (61.13)	2019 (50.67)	3703 (68.93)	321.83	<0.0001
TG (n=9376, mmol/l, mean±SD)	1.64±1.08	1.56±1.08	1.70±1.07	-6.24	<0.0001
TG ≥1.7 mmol/L (n, %)	3232 (34.47)	1226 (30.62)	2006 (37.34)	45.90	<0.0001
HDL-C (n=9376, mmol/l, mean±SD)	1.54±0.37	1.44±0.34	1.63±0.33	-25.85	<0.0001
HDL-C <1.0 mmol/L (n, %)	349 (3.72)	256 (6.39)	93 (1.73)	139.16	<0.0001
LDL-C (n=9376, mmol/l, mean±SD)	3.13±0.85	3.00±0.83	3.22±0.80	-12.65	<0.0001
LDL-C ≥3.37 mmol/L (n, %)	3633 (38.63)	1296 (32.37)	2326 (43.30)	115.62	<0.0001
Fasting blood glucose (n=9366, mmol/l, mean±SD)	6.17±1.78	6.22±1.84	6.13±1.70	2.59	0.01
Fasting blood glucose value ≥7.0 mmol/l (%)	1561 (16.67)	716 (17.90)	845 (15.75)	7.59	0.006
HbA1c (n=6487, %, mean±SD)	6.27±1.06	6.31±1.14	6.24±0.99	2.32	0.02
HCY (n=6488, μmol/l, mean±SD)	15.14±6.75	17.42±7.52	13.47±5.66	23.25	<0.0001
<b>Hepatic function</b>					
Total protein (n=9378, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.02	-8.42	<0.0001
Abnormal total protein (n, %)	33 (0.35)	9 (0.22)	24 (0.26)	3.23	0.07
Total bilirubin (n=9378, μmol/l, mean±SD)	15.55±5.06	16.34±5.60	14.97±4.63	12.71	<0.0001
Abnormal total bilirubin (n, %)	3036 (32.37)	1562 (38.99)	1474 (27.44)	139.90	<0.0001
Albumin (n=9378, g/l, mean±SD)	44.55±2.06	44.68±2.09	44.46±2.03	5.05	<0.0001
Abnormal albumin (n, %)	77 (0.82)	41 (1.02)	36 (0.67)	3.50	0.06
ALT (n=9378, U/l, mean±SD)	21.93±19.53	22.70±14.29	21.35±22.65	3.52	0.0004
Abnormal ALT (n, %)	619 (6.60)	283 (7.06)	336 (6.25)	2.44	0.12

AST (n=9378, U/l, mean±SD)	22.07±12.27	21.88±9.22	22.21±14.12	-1.38	0.17
Abnormal AST (n, %)	310 (3.31)	108 (2.70)	202 (3.72)	8.14	0.004
<b>Kidney function</b>					
Blood urea nitrogen (n=9369, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.46	11.769	<0.0001
Creatinine (n=9369, µmol/l, mean±SD)	80.03±24.11	93.36±26.30	70.10±16.37	49.30	<0.0001
Uric acid (n=9369, µmol/l, mean±SD)	373.79±90.64	408.49±88.68	347.93±83.14	33.58	<0.0001
EB Virus (n, %)				0.60	0.74
Negative	9354 (99.39)	3997 (99.38)	5357 (99.41)		
Positive	19 (0.20)	7 (0.17)	12 (0.22)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		
CEA (n, %)					0.68**
Negative	9367 (99.53)	4001 (99.48)	5366 (99.57)		
Positive	7 (0.07)	4 (0.10)	3 (0.06)		
Missing	37 (0.39)	17 (0.42)	20 (0.37)		
AFP (n, %)				0.94	0.62
Negative	9364 (99.50)	3999 (99.43)	5365 (99.55)		
Positive	9 (0.09)	5 (0.12)	4 (0.07)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

**Table 5 Baseline levels of biochemical traits in urine of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Urine glucose (n, %)				76.90	<0.0001
Negative	8862 (94.17)	3696 (91.89)	5166 (95.86)		
Positive/suspected positive	469 (4.98)	292 (7.26)	177 (3.22)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine bilirubin (n, %)				2.08	0.35
Negative	9198 (97.74)	3923 (97.54)	5275 (97.88)		
Positive/suspected positive	133 (1.41)	65 (1.62)	68 (1.26)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine acetone bodies (n, %)				5.55	0.06
Negative	9244 (98.23)	3940 (97.96)	5304 (98.42)		
Positive/suspected positive	87 (0.92)	48 (1.19)	39 (0.72)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine specific gravity (n=9331, mean±SD)	1.02±0.01	1.02±0.01	1.02±0.01	3.28	0.001
Urinary protein (n, %)				18.46	<0.0001
Negative	7997 (84.98)	3346 (83.19)	4651 (86.31)		
Positive/suspected positive	1334 (14.17)	643 (15.91)	691 (12.87)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urobilinogen (n, %)				33.40	<0.0001
Negative	9186 (97.61)	3891 (96.74)	5295 (98.26)		
Positive/suspected positive	143 (1.52)	95 (2.36)	48 (0.89)		
Missing	82 (0.87)	36 (0.90)	46 (0.85)		
Urine nitrite (n, %)				116.02	<0.0001
Negative	9080 (96.48)	3964 (98.56)	5116 (94.93)		
Positive/suspected positive	251 (2.67)	24 (0.60)	225 (4.21)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine white blood cell (n, %)				874.22	<0.0001
Negative	7406 (78.70)	3737 (92.91)	3669 (68.08)		



Positive/suspected positive	1925 (20.45)	251 (6.24)	1674 (31.06)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine occult blood (n, %)				263.04	<0.0001
Negative	6803 (72.29)	3252 (80.86)	3551 (65.89)		
Positive/suspected positive	2528 (26.86)	736 (18.30)	1792 (33.25)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

1  
2  
3  
4 Table 6 presents the baseline levels of clinical measurement parameters of  
5  
6 participants in the Shenzhen Aging Related Disorder Cohort, including blood  
7  
8 pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler  
9  
10 ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary  
11  
12 system, color doppler ultrasound of prostate, bone mineral density. Owing to the  
13  
14 relatively long waiting time, less interest and attention for their body components,  
15  
16 only 34.98% (3292 of 9411) of the participants completed the measurements of body  
17  
18 component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total  
19  
20 body water, intracellular water, extracellular water, body fat mass, percentage of body  
21  
22 fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody  
23  
24 score. All clinical parameters presented significant difference between men and  
25  
26 women (all  $P < 0.05$ ). With the exception of age, sex, the prevalence of  
27  
28 overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as  
29  
30 the other characteristics were comparable between individuals with and without body  
31  
32 component data at baseline (Supplemental Table 4).  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 6 Baseline levels of clinical measurement parameters of the participants in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Blood pressure (mmHg, mean±SD)					
Systolic blood pressure (n=9330)	138.47±19.42	137.19±18.74	139.43±19.96	-5.37	<0.0001
Diastolic blood pressure (n=9330)	77.35±10.72	79.23±10.69	75.93±10.52	14.82	<0.0001
Pulse rate (n=6681, times/min)	75.32±11.39	74.61±11.58	75.85±11.21	-4.43	<0.0001
Electrocardiogram (n, %)				7.40	0.02
Normal	4995 (53.08)	2073 (51.54)	2922 (54.22)		
Abnormal	4347 (46.19)	1915 (47.61)	2432 (45.13)		
Missing	69 (0.73)	34 (0.85)	35 (0.65)		
Chest X-ray				5.46	0.07
Normal	1911 (20.31)	813 (20.21)	1098 (20.37)		
Abnormal	7291 (77.47)	3136 (77.97)	4155 (77.10)		
Missing	209 (2.22)	73 (1.82)	136 (2.53)		
Color doppler ultrasound of liver/ gallbladder/ spleen/				17.02	0.007
Normal	3678 (39.08)	1559 (38.76)	2119 (39.32)		
Abnormal	5655 (60.09)	2416 (60.07)	3239 (60.10)		
Uncertainty/Missing**	78 (0.83)	47 (1.17)	31 (0.58)		
Color doppler ultrasound of urinary system (n, %)				267.05	<0.0001
Normal	6026 (64.03)	2305 (57.31)	3721 (69.05)		
Abnormal	2775 (29.49)	1533 (38.12)	1242 (23.05)		
Uncertainty/Missing**	610 (6.48)	184 (4.57)	426 (7.90)		
Color doppler ultrasound of prostate (n=4022, %)					
Normal		1139 (28.32)	-		
Abnormal		2770 (68.87)	-		
Uncertainty/Missing**		113 (2.81)	-		
Bone mineral density (n, %)				583.26	<0.0001
Normal	1395 (14.82)	1003 (24.94)	392 (7.24)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio ( <b>n=3292</b> , mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate ( <b>n=3292</b> , kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water ( <b>n=3292</b> , L, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water ( <b>n=3292</b> , L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water ( <b>n=3292</b> , L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass ( <b>n=3292</b> , kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.44	-10.25	<0.0001
Percentage of body fat ( <b>n=3292</b> , %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.55	-40.37	<0.0001
Fat free mass ( <b>n=3292</b> , Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.84	68.92	<0.0001
Skeletal muscle ( <b>n=3292</b> , Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM ( <b>n=3292</b> , Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.44	69.54	<0.0001
Body protein ( <b>n=3292</b> , kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.77	69.62	<0.0001
Body minerals ( <b>n=3292</b> , kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.27	55.68	<0.0001
InBody score ( <b>n=3292</b> , mean±SD)	69.05±4.92	68.15±5.16	69.67±4.75	-8.50	<0.0001

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

\*\*Uncertainty was caused by unsatisfied examination conditions.

1  
2  
3 Table 7 shows the prevalences of main non-communicable chronic diseases,  
4 including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia,  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 7 shows the prevalences of main non-communicable chronic diseases, including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia, dyslipidemia, chronic bronchitis, COPD, Asthma, tuberculosis, angina, myocardial infarction, coronary heart disease, stroke, cancer, arthritis, Chronic hepatitis, arthritis, migraine, nephritis, Alzheimer's disease, Parkinson's disease and brain injury. The assessments of mental health based on Mini-mental State Examination (MMSE) and Center for Epidemiologic Studies Depression Scale (CES-D), activities based on Activities of Daily Living Scale (ADLS), and social support based on Social Support Rating Scale (SSRS) were also provided in Table 7. Except for asthma, tuberculosis, angina, coronary heart disease, chronic hepatitis, nephritis, Alzheimer's disease, brain injury, MMSE score, depression status and ADL as well as other health related outcomes presented significant difference between males and females (all  $P < 0.05$ ).

**Table 7 The prevalence of the common non-communicable disorders in the Shenzhen Aging Related Disorder Cohort**

Variables	Total	Male	Female	t <sup>2</sup> *	P
Overweight/Obesity <sup>a</sup> (n=9307, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	1.96	0.01
Hypertension <sup>b</sup> (n=9374, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus <sup>c</sup> (n=9340, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	20.39	0.001
Dyslipidemia <sup>d</sup> (n=9377, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	239.42	<0.0001
Chronic bronchitis <sup>e</sup> (n=9354, %)	136 (1.45)	71 (1.78)	65 (1.21)	0.09	0.02
COPD <sup>e</sup> (n=9357, %)	18 (0.19)	12 (0.30)	6 (0.11)	0.23	0.04
Asthma <sup>e</sup> (n=9356, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis <sup>e</sup> (n=9315, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina <sup>e</sup> (n=9311, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction <sup>e</sup> (n=9312, %)	51 (0.55)	35 (0.88)	16 (0.30)	1.07	0.0002
Coronary heart disease <sup>e</sup> (n=9315, %)	530 (5.69)	239 (6.01)	291 (5.45)	0.33	0.25
Stroke <sup>e</sup> (n=9309, %)	102 (1.10)	57 (1.43)	45 (0.84)	0.30	0.007
Cancer <sup>e</sup> (n=9303, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis <sup>e</sup> (n=9311, %)	47 (0.50)	24 (0.60)	23 (0.43)	0.35	0.24
Arthritis <sup>e</sup> (n=9308, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine <sup>e</sup> (n=9311, %)	58 (0.62)	16 (0.40)	42 (0.79)	0.47	0.02
Nephritis <sup>e</sup> (n=9312, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease <sup>e</sup> (n=9309, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease <sup>e</sup> (n=9309, %)	21 (0.23)	13 (0.33)	8 (0.15)	0.23	0.08
Brain injury <sup>e</sup> (n=9267, %)	533 (5.75)	227 (5.74)	306 (5.76)	0.001	0.97
MMSE score < 24 (n=8678, %)	468 (5.39)	205 (5.42)	263 (5.37)	0.01	0.92
Depression status <sup>f</sup> (n=9243, %)	303 (3.28)	111 (2.81)	192 (3.63)	0.67	0.06
ADL (n=9240, scores, mean±SD)	14.15±1.58	14.16±1.73	14.14±1.44	0.78	0.43
SSRS (n=8117, score, mean±SD)	39.54±7.89	39.17±7.90	39.83±7.88	0.75	0.0002

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

1  
2  
3  
4  
5 <sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

6 <sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq 90$  mmHg and / or systolic blood pressure (SBP)  $\geq 140$  mmHg, or self-reported  
7 hypertension diagnosed by a physician, or taking antihypertension drugs.

8 <sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq 7.0$  mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or  
9 taking hypoglycemic agent or insulin.

10 <sup>d</sup> Dyslipidemia was defined as TCHO  $\geq 5.18$  mmol/L, or TG  $\geq 1.7$  mmol/L, or HDL-C  $< 1.0$  mmol/L, or LDL-C  $\geq 3.37$  mmol/L or self-reported  
11 hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

12 <sup>e</sup> The disease was defined as self-reported disease.

13 <sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

### Strengths and limitations

This is the community-dwelling aging related disorder cohort with main focus on neurological and mental disorders. We comprehensively collected epidemiological data, clinical examination, environmental exposures, body components and biological samples in Chinese population, which will facilitate the identification of the causality of various aging related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. As an epitome of the areas with the rapid economic development and growth of immigrant population, Shenzhen reflects the aging process of population in cities with rapid economic development in China. The setting up of our cohort is able to provide more epidemiological evidence for the prevention and control of aging related diseases in China, especially in those areas with upcoming booming economy. Except for routine follow-up by questionnaires, the incidence of aging related diseases, especially neurological and mental disorders will be annually verified from the National Electronic Disease Surveillance System and National Mortality Surveillance System in Shenzhen CDC, which guarantees the integrity and validity of outcomes of interest in our cohort. Comprehensive measurement of internal exposures is another strength of our cohort. A total of 24 metals as well as, nicotine and its related metabolites in urine have been detected for all participants at baseline. Assessment of exposure to environmental pollutants will be extended to pesticides in 2020. Compared with the previous cohorts, including China Kadoorie biobank<sup>26</sup>, the China Health and Retirement Longitudinal Study<sup>27</sup> and Chinese Longitudinal Healthy Longevity Survey<sup>28</sup>, the Shenzhen Aging related disorder cohort might help to provide more epidemiological evidence for the causes of neurological and mental disorders through



1  
2  
3 wide exploration of the environmental exposures, such as lifestyle, metals, metabolite  
4  
5 of tobacco and pesticide.  
6  
7

8 However, there are also limitations of our cohort. First, all participants are adults  
9  
10 aged 60 years or older, then we could not have information on their early-life  
11  
12 exposures. However, the high incidence of aging related disorders in older adults in  
13  
14 the context of rapid epidemiological transition will provide us with sufficient power  
15  
16 for further analysis. Second, the medical histories of the participants in our cohort  
17  
18 were self-reported. But the link between our cohort and disease surveillance system in  
19  
20 Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and  
21  
22 reliability of the information. Third, only 3292 participants took part in the body  
23  
24 components analysis at baseline. However, the selection bias tends to be small since  
25  
26 most baseline characteristics are comparable between individuals with and without  
27  
28 body component data (Supplemental Table 4). Forth, recruitment of 9411 participants  
29  
30 at baseline makes our sample size relatively smaller compared with other cohorts in  
31  
32 the world. However, according to the study design, an annual 2000 new participants  
33  
34 will be recruited to enlarge the cohort until 2028, which will ensure the statistical  
35  
36 power for most association studies in the future.  
37  
38  
39  
40  
41  
42  
43  
44

### 45 **Collaboration**

46  
47 The datasets generated and/or analysed during the current study are not publicly  
48  
49 available at this stage, but are available from the corresponding author on reasonable  
50  
51 request from employees of a recognized academic institution, health service  
52  
53 organization or charitable research organization with experience in medical research  
54  
55 with the clear statement of their research interest, analysis proposal, data protection  
56  
57 measures and corporation mechanisms. However, specific ideas and proposals for  
58  
59  
60

potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

## Abbreviations

MMSE, Mini-mental State Examination; CES-D, Center for Epidemiologic Studies Depression Scale; ADLS, Lawton-Brody Activities of Daily Living Scale; PSQI, Pittsburgh sleep quality index; SSRS, Social Support Rate Scale; TCHO, total cholesterol; TG, triglyceride; LDL-C, low density lipoprotein cholesterol; HDL-C, high density lipoprotein cholesterol; TB, total bilirubin; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; AFP, alpha fetoprotein; EBV, Epstein-Barr Virus; WBC, white blood cell; RBC, red blood cell counts; MPV, mean platelet volume; PDW, platelet distribution width; PLT, blood platelet quantity; P-LCR, platelet volume ratio and platelet large cell ratio; HbA1c, glycated hemoglobin A1c; HCY, homocysteine; IPPA, inspection-palpation-percussion-auscultation; ECG, electrocardiogram; BMI, body mass index; TBW, total body water; ECW, extracellular water.

## Acknowledgments

The study has received great support from Shenzhen center for disease control and prevention, Shenzhen Luohu Hospital for Traditional Chinese Medicine, and Shenzhen Luohu Center for Disease Control and Prevention. The contributions of all the working staffs and participants are greatly acknowledged.

## Contributors

JY and JL conceived of the study, participated in its design, coordinated the study and reviewed the manuscript for important intellectual content. LL and WL participated in the study design, collected data, drafted the manuscript and performed the

1  
2  
3 descriptive data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XH, TL, EG, ZL,  
4  
5 KH, YH, CY and QZ participated in data collection, helped drafted the manuscript  
6  
7 and reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW,  
8  
9 FZ, TL, EG, FY and XY constructed the data base and JY and JL were responsible for  
10  
11 data management. All authors read and approved the final manuscript.  
12  
13  
14  
15  
16

## 17 **Funding**

18  
19  
20 This project is supported by Sanming Project of Medicine in Shenzhen  
21  
22 [SZSM201611090], and Shenzhen Basic Research Plan for Medical Health  
23  
24 [SZGW2018004, SZXJ2017013]. The funders have no role in the study design, data  
25  
26 collection, analysis and interpretation as well as manuscript preparation and  
27  
28 submission.  
29  
30  
31  
32  
33

## 34 **Competing interests**

35  
36  
37 The authors declare that they have no competing interests.  
38  
39  
40  
41

## 42 **Patient consent for publication**

43  
44 Not required.  
45  
46  
47  
48  
49

## 50 **Ethics approval**

51  
52 All participants agreed to join in the cohort and provide informed written consent. The  
53  
54 study has been approved by the Review Board of Shenzhen Center for Disease  
55  
56 Control and Prevention (approval numbers: R2017001 and R2018020).  
57  
58  
59  
60

## Provenance and peer review

Not commissioned; externally peer review.

## Data sharing statement

The datasets generated and/or analysed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request. However, specific ideas and proposals for potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

**REFERENCES**

1. GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1859-922.
2. Foreman KJ, Marquez N, Dolgert A, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. *Lancet* 2018;392:2052-90.
3. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390:1211-59.
4. GBD 2016 Lifetime Risk of Stroke Collaborators, Feigin VL, Nguyen G, Cercy K, et al. Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016. *N Engl J Med* 2018;379:2429-37.
5. Global Burden of Disease Cancer Collaboration, Fitzmaurice C, Akinyemiju TF, Alam T, et al. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2016: A Systematic Analysis for the Global Burden of Disease Study. *JAMA Oncol* 2018;4:1553-68.
6. Wimo A, Jonsson L, Bond J, et al. The worldwide economic impact of

- dementia 2010. *Alzheimers Dement* 2013;9:1-11 e13.
7. Alzheimer's Disease International. World Alzheimer report 2015: the global impact of dementia. <https://www.alz.co.uk/research/world-report-2015>. Accessed 1 June 2016.
  8. Chang AY, Skirbekk VF, Tyrovolas S, et al. Measuring population ageing: an analysis of the Global Burden of Disease Study 2017. *Lancet Public Health* 2019;4:e159-e167.
  9. He X, Song M, Qu J, et al. Basic and translational aging research in China: present and future. *Protein Cell* 2019;10:476-84.
  10. Liu S, Li Y, Zeng X, et al. Burden of Cardiovascular Diseases in China, 1990-2016: Findings From the 2016 Global Burden of Disease Study. *JAMA Cardiol* 2019; doi: 10.1001/jamacardio.2019.0295.
  11. Zhou M, Wang H, Zhu J, et al. Cause-specific mortality for 240 causes in China during 1990-2013: a systematic subnational analysis for the Global Burden of Disease Study 2013. *Lancet* 2016;387:251-72.
  12. Liu M, Liu SW, Wang LJ, et al. Burden of diabetes, hyperglycaemia in China from to 2016: Findings from the 1990 to 2016, global burden of disease study. *Diabetes Metab* 2019;45:286-93.
  13. Yang JJ, Yu D, Wen W, et al. Association of Diabetes With All-Cause and Cause-Specific Mortality in Asia: A Pooled Analysis of More Than 1 Million Participants. *JAMA Netw Open* 2019;2:e192696.
  14. Stein DJ, He Y, Phillips A, et al. Global mental health and neuroscience: potential synergies. *Lancet Psychiatry* 2015;2:178-85.
  15. Ji Y, Shi Z, Zhang Y, et al. Prevalence of dementia and main subtypes in rural northern China. *Dement Geriatr Cogn Disord* 2015;39:294-302.

- 1  
2  
3 16. Zeng Y, Feng Q, Hesketh T, et al. Survival, disabilities in activities of daily  
4 living, and physical and cognitive functioning among the oldest-old in China:  
5 a cohort study. *Lancet* 2017;389:1619-29.  
6  
7
- 8  
9  
10 17. GBD 2016 Parkinson's Disease Collaborators. Global, regional, and national  
11 burden of Parkinson's disease, 1990-2016: a systematic analysis for the Global  
12 Burden of Disease Study 2016. *Lancet Neurol* 2018;17:939-53.  
13  
14
- 15 18. Keogh-Brown MR, Jensen HT, Arrighi HM, et al. The Impact of Alzheimer's  
16 Disease on the Chinese Economy. *EBioMedicine* 2015 22;4:184-90.  
17  
18
- 19 19. Borson S, Scanlan JM, Chen P, et al. The Mini-Cog as a screen for dementia:  
20 validation in a population-based sample. *J Am Geriatr Soc* 2003;51:1451-4.  
21  
22
- 23 20. Lv X, Li W, Ma Y, et al. Cognitive decline and mortality among  
24 community-dwelling Chinese older people. *BMC Med* 2019;17:63.  
25  
26
- 27 21. Pequignot R, Dufouil C, Peres K, et al. Depression Increases the Risk of Death  
28 Independently From Vascular Events in Elderly Individuals: The Three-City  
29 Study. *J Am Geriatr Soc* 2019;67:546-52.  
30  
31
- 32 22. Jeurig HW, Hoogendijk EO, Comijs HC, et al. The tide has turned: incidence  
33 of depression declined in community living young-old adults over one decade.  
34 *Epidemiol Psychiatr Sci* 2019:1-8.  
35  
36
- 37 23. O'Caomh R, Gao Y, Svendrovski A, et al. Effect of Visit-to-Visit Blood  
38 Pressure Variability on Cognitive and Functional Decline in Mild to Moderate  
39 Alzheimer's Disease. *J Alzheimers Dis* 2019;68:1499-510.  
40  
41
- 42 24. Curtis BJ, Williams PG, Anderson JS. Objective cognitive functioning in  
43 self-reported habitual short sleepers not reporting daytime dysfunction:  
44 examination of impulsivity via delay discounting. *Sleep* 2018;41.  
45  
46
- 47 25. Xiao S. Theoretical foundation and research and application of Social Support  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

- 1  
2  
3 Rating Scale. *J Clin Psychiatry* 1994;4:98-100.  
4  
5  
6 26. Chen Z, Chen J, Collins R, et al. China Kadoorie Biobank of 0.5 million  
7  
8 people: survey methods, baseline characteristics and long-term follow-up. *Int J*  
9  
10 *Epidemiol* 2011;40:1652-66.  
11  
12 27. Zhao Y, Hu Y, Smith JP, et al. Cohort profile: the China Health and Retirement  
13  
14 Longitudinal Study (CHARLS). *Int J Epidemiol* 2014;43:61-8.  
15  
16  
17 28. Shi Z, Zhang T, Byles J, et al. Food Habits, Lifestyle Factors and Mortality  
18  
19 among Oldest Old Chinese: The Chinese Longitudinal Healthy Longevity  
20  
21 Survey (CLHLS). *Nutrients* 2015;7:7562-79.  
22  
23  
24  
25

## Figure legends

- 26  
27  
28  
29 Figure 1 Location of Shenzhen in China  
30  
31 Figure 2 The flow diagram of collecting and separation blood and urine specimen  
32  
33 Figure 3 The flow diagram of the cohort design  
34  
35  
36 Figure 4 The birthplace distribution of the studied individuals  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60





Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

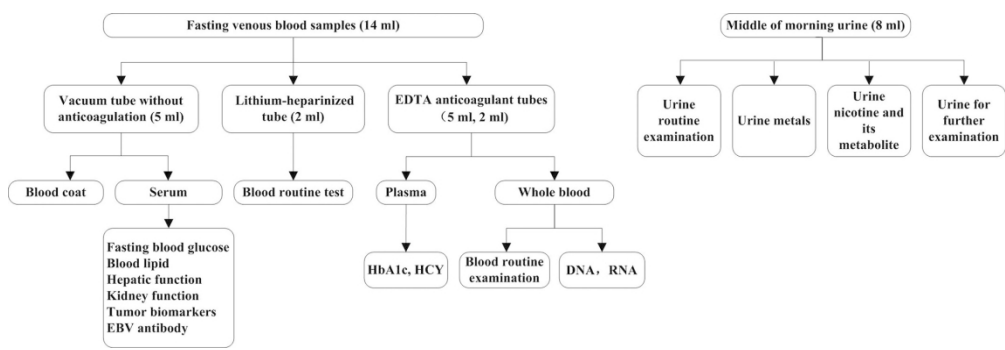


Figure 2 The flow diagram of collecting and separation blood and urine specimen  
180x60mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.

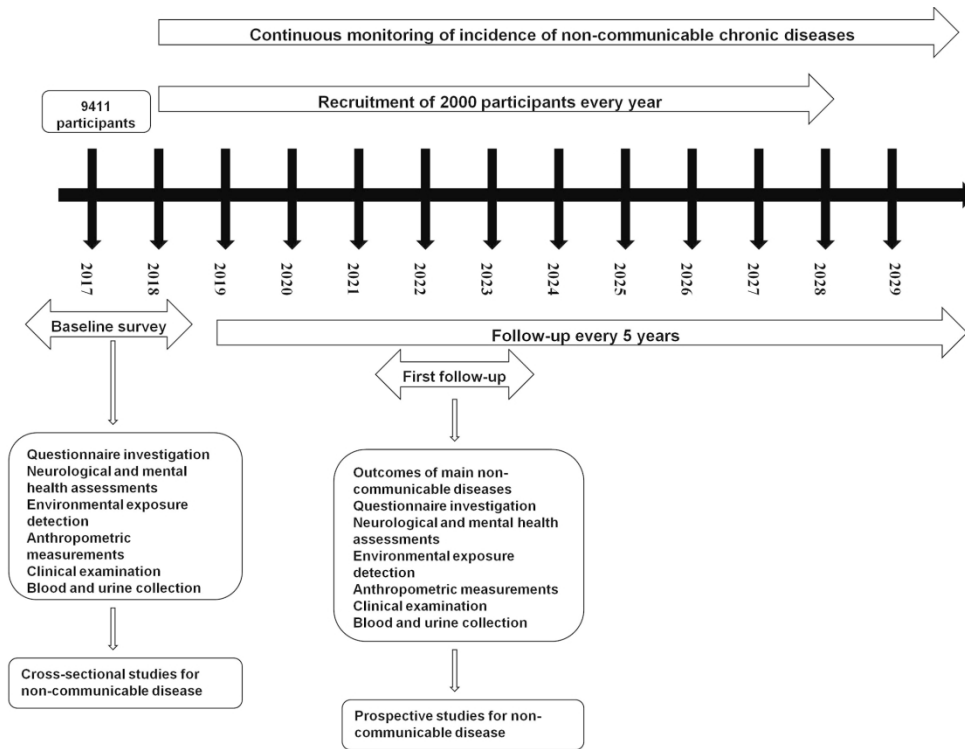


Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

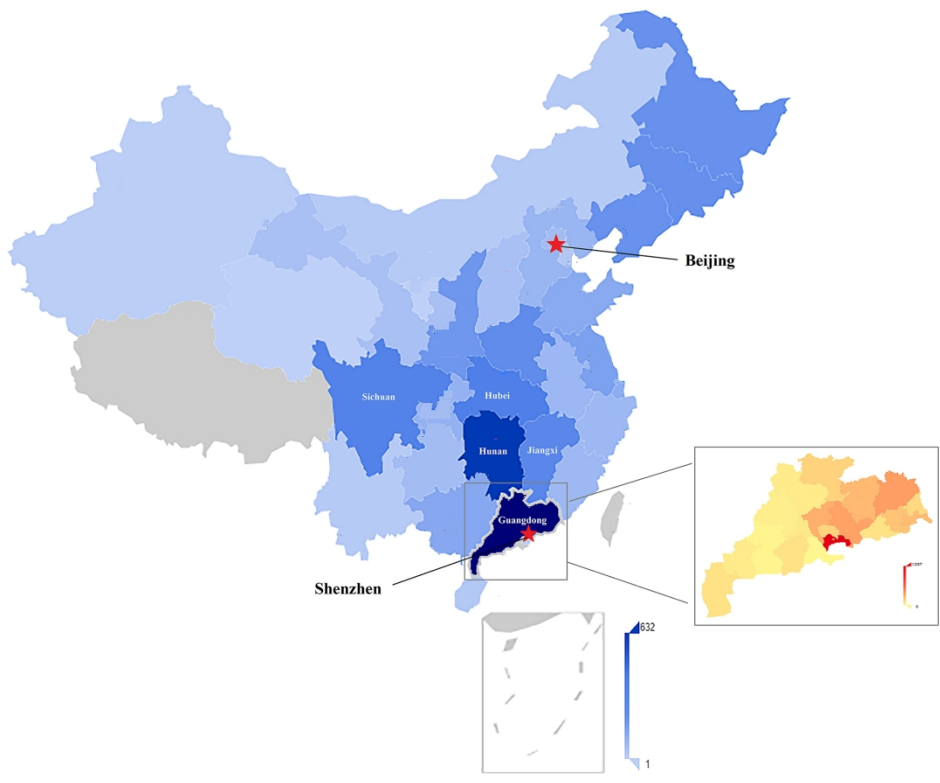


Figure 4 The birthplace distribution of the studied individuals

180x147mm (300 x 300 DPI)

**Supplemental Table 1 Socioeconomic structures of Luohu district and Shenzhen city in 2017**

	Luohu district	Shenzhen city
Total assets (100 million yuan)	4702	47120
Number of enterprises	735	6378
Business Revenue (100 million yuan)	971	10107
Gross domestic product	21,616,969	224,900,586
Indices of gross domestic product	108.4	108.8
Permanent population (10 000 persons)	102.72	1252.83
Total general budgetary expenditure	2,780,283	23,614,624

For peer review only

**Supplemental Table 2 List of clinical indices of individuals at baseline in the Shenzhen Aging Related Disorder Cohort using biosamples**

Categories	Measurements
<b>Blood routine</b>	white blood cell counts (WBC), red blood cell counts (RBC) hemoglobin contents, platelet counts
<b>Lipid levels</b>	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
<b>Blood glucose</b>	fasting plasma glucose, glycated hemoglobin
<b>Homocysteine</b>	
<b>Hepatic function</b>	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
<b>Kidney function</b>	creatinine, uric acid and urea nitrogen
<b>Tumor biomarkers</b>	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
<b>Epstein-Barr Virus (EBV) antibody</b>	
<b>Urine routine</b>	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent blood
<b>Urine metals</b>	lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead
<b>Urine nicotine and its metabolites</b>	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl) butanoic Acid Dicyclohexylamine Salt

**Supplemental Table 3 Summary of the instruments messages for clinical indicators analysis at baseline**

Items	Equipment used
Standing height	HNH-219, OMRON Healthcare Co., Ltd, Japan
Body weight	HNH-219, OMRON Healthcare Co., Ltd, Japan
Resting blood pressure	HBP-1300, OMRON Healthcare Co., Ltd, Japan
12-lead electrocardiography	ECG-1350c, Nihon Kohden Corporation, Japan
Chest X-ray	Optimus, Royal Dutch Philips Electronics Ltd., Netherlands
Abdominal B-type ultrasound inspection	Affiniti50, Royal Dutch Philips Electronics Ltd., Netherlands
	EPIQ5, Royal Dutch Philips Electronics Ltd., Netherlands
	S25, SonoScape Medical Corp., Guangdong, China
Fasting plasma glucose	7600-010, Hitachi, Ltd., Tokyo, Japan
Glycated hemoglobin	Premier Hb9210, Trinity Biotech Plc., Bray, Ireland
Homocysteine	AU5800, Beckman Coulter, Inc., California, USA
Blood lipids	7600-010, Hitachi, Ltd., Tokyo, Japan
Hepatic function	7600-010, Hitachi, Ltd., Tokyo, Japan
Renal function	7600-010, Hitachi, Ltd., Tokyo, Japan
Blood routine	XT-1800I, SYSMEX Corporation, Japan
EB virus	Uranus AE100, Aikang Medtech Co., Ltd, China
Tumor biomarkers	Uranus AE100, Aikang Medtech Co., Ltd, China

1		
2		
3	Urine routine	URIT-500B, URIT Medical Electronic Group Co., China
4		
5	Bone mineral density	MetriScan, Miles Medical Inc., California, USA
6		
7		BMD-1000D, Hongyang Medical Apparatus Co., Ltd, China
8	Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
9		
10	Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
11		
12	Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
13		
14	Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
15	Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
16		
17	Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
18	Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
19		
20	Basal metabolic rate	Inbody 570, InBody Co., Ltd, Seoul, Korea
21		
22	Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
23		
24	Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
25	Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
26		
27	Urine metals	NEXION 300X PerkinElmer Inc., USA
28	Urine nicotine and its metabolite	1200 series/ 6410 Triple Quad LC/MS Agilent Technologies Inc., California, USA
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		



**Supplemental Table 4 Comparison between the individuals with and without body component data at baseline**

Variables	Participants with body component (n=3292)	Participants without body component (n=6119)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.54±5.25	67.83±5.50	2.56	0.01
Male (n, %)	1327 (40.31)	2695 (44.04)	12.19	0.0005
Han Chinese (n, %)	2954 (99.29)	5623 (99.36)	0.14	0.70
Education level (n, %)			4.01	0.26
Primary school or illiteracy	547 (16.79)	1090 (17.97)		
Middle school	913 (28.03)	1651 (27.23)		
High school	1081 (33.19)	2062 (34.00)		
University or college or higher	716 (21.98)	1261 (20.79)		
Marital status (n, %)			7.74	0.10
Single	14 (0.43)	32 (0.53)		
Married	2825 (87.60)	5220 (86.86)		
Widowed	336 (10.42)	687 (11.43)		
Divorced	48 (1.49)	71 (1.18)		
Cohabited	2 (0.06)	0		
Ever smoker (n, %)	643 (19.64)	1257 (20.69)	1.45	0.23
Passive smoker (n, %)	380 (11.63)	674 (11.11)	0.57	0.45
Ever drinker (n, %)	485 (14.82)	866 (14.25)	0.55	0.46
Pittsburgh Sleep Quality Index (n, mean ± SD)	4.33 ± 2.60	4.12 ± 2.61	-3.41	0.0006
Physical active (n, %)	2664 (81.24)	4924 (81.28)	0.002	0.97

1					
2					
3	Overweight/Obesity <sup>a</sup> (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02
4					
5	Hypertension <sup>b</sup> (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
6					
7	Diabetes mellitus <sup>c</sup> (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
8					
9	Hyperlipidemia <sup>d</sup> (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
10					
11	Chronic bronchitis <sup>e</sup> (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
12					
13	COPD <sup>e</sup> (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
14					
15	Asthma <sup>e</sup> (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
16					
17	Tuberculosis <sup>e</sup> (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
18					
19	Angina <sup>e</sup> (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
20					
21	Myocardial infarction <sup>e</sup> (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
22					
23	Coronary heart disease <sup>e</sup> (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
24					
25	Stroke <sup>e</sup> (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
26					
27	Cancer <sup>e</sup> (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
28					
29	Chronic hepatitis <sup>e</sup> (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
30					
31	Arthritis <sup>e</sup> (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
32					
33	Migraine <sup>e</sup> (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
34					
35	Nephritis <sup>e</sup> (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
36					
37	Alzheimer's disease <sup>e</sup> (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
38					
39	Parkinson's disease <sup>e</sup> (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
40					
41	Brain injury <sup>e</sup> (n, %)	193 (5.96)	340 (5.64)	0.40	0.53
42					
43	MMSE score < 24 (n, %)	167 (5.48)	301 (5.35)	0.07	0.79
44					
45					
46					

Depression status <sup>f</sup> (n, %)	126 (3.87)	177 (2.95)	5.63	0.02
ADL (n, scores, mean $\pm$ SD)	14.09 $\pm$ 1.23	14.18 $\pm$ 1.73	2.82	0.005
SSRS (n, score, mean $\pm$ SD)	39.88 $\pm$ 7.68	39.36 $\pm$ 8.00	-2.88	0.004

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparison between continuous variables and the categorical variables, respectively.

<sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

<sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq$ 90mmHg and / or systolic blood pressure (SBP)  $\geq$ 140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

<sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq$ 7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

<sup>d</sup> Dyslipidemia was defined as TCHO  $\geq$ 5.18 mmol/L, or TG  $\geq$ 1.7 mmol/L, or HDL-C  $<$ 1.0 mmol/L, or LDL-C  $\geq$ 3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

<sup>e</sup> The disease was defined as self-reported disease.

<sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

# BMJ Open

## Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging-Related Disorder Cohort in China

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-034317.R2
Article Type:	Cohort profile
Date Submitted by the Author:	27-Feb-2020
Complete List of Authors:	<p>Liu, Li; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Wei; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Nie, Lulin; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Guo, Zhiwei; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Luo, Yi; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Chen, Weihong; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Liu, Weimin; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Feiqi, Zhu; the third affiliated hospital of Shenzhen University Medical College, cognitive impairment ward of Neurology</p> <p>Wang, Lu; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhang, Jiafei; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Wang, Xian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Li, Tian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Gao, Erwei ; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhou, Li; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>He, Kaiwu; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>

	<p>Huang, Yidan; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Chunjie; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhu, Qingqing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Ye, Fang; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yu, Xingchen; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Jing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Jianjun; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3  
4 Cohort profile: the Study Design and Baseline Characteristics of Shenzhen  
5 Aging-Related Disorder Cohort in China  
6  
7  
8

9 Li Liu<sup>1†</sup>, Wei Liu<sup>2†</sup>, Lulin Nie<sup>2</sup>, Zhiwei Guo<sup>3</sup>, Yi Luo<sup>3</sup>, Weihong Chen<sup>4</sup>, WeiminLiu<sup>4</sup>,  
10 Feiqi Zhu<sup>5</sup>, Lu Wang<sup>6</sup>, Jiafei Zhang<sup>6</sup>, Xian Wang<sup>6</sup>, Tian Li<sup>6</sup>, Erwei Gao<sup>6</sup>, Li Zhou<sup>2</sup>,  
11 Kaiwu He<sup>2</sup>, Yidan Huang<sup>6</sup>, Chunjie Yuan<sup>6</sup>, Qingqing Zhu<sup>6</sup>, Fang Ye<sup>6</sup>, Xingchen Yu<sup>1</sup>,  
12 Jing Yuan<sup>6\*</sup>, Jianjun Liu<sup>2\*</sup>  
13  
14  
15  
16  
17

18  
19 <sup>1</sup> Department of Epidemiology and Biostatistics and State Key Laboratory of  
20 Environmental Health for Incubating, School of Public Health, Tongji Medical  
21 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
22  
23

24  
25 <sup>2</sup> Key Laboratory of Modern Toxicology of Shenzhen, Shenzhen Medical Key Subject  
26 of Health Toxicology, Shenzhen Center for Disease Control and Prevention,  
27 Shenzhen, Guangdong, PR. China  
28  
29

30  
31 <sup>3</sup> Shenzhen Luohu Hospital for Traditional Chinese Medicine, Shenzhen Luohu  
32 Hospital Group, Shenzhen, Guangdong, PR. China  
33  
34

35  
36 <sup>4</sup> Shenzhen Luohu Center for Disease Control and Prevention, Shenzhen, Guangdong,  
37 PR. China  
38

39  
40 <sup>5</sup> Cognitive Impairment Ward of Neurology Department, The Third Affiliated  
41 Hospital of Shenzhen University Medical College, Shenzhen, Guangdong, PR. China  
42

43  
44 <sup>6</sup> Department of Occupational and Environmental Health and State Key Laboratory of  
45 Environmental Health for Incubating, School of Public Health, Tongji Medical  
46 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
47  
48  
49

50  
51 † Li Liu and Wei Liu contributed equally.  
52  
53

54  
55 **Corresponding to:**

56 Jianjun Liu

57  
58 Key Laboratory of Modern Toxicology of Shenzhen  
59  
60

1  
2  
3  
4 Shenzhen Medical Key Subject of Health Toxicology  
5  
6 Shenzhen Center for Disease Control and Prevention, Shenzhen, 518055, Guangdong,  
7  
8 PR. China  
9  
10 Tel: +86 755 25508584  
11  
12 E-mail: [JJLIUSZCDC@163.com](mailto:JJLIUSZCDC@163.com)  
13  
14

15  
16 Jing Yuan  
17  
18 Department of Occupational and Environmental Health  
19  
20 State Key Laboratory of Environmental Health for Incubating  
21  
22 School of Public Health, Tongji Medical College, Huazhong University of Science  
23  
24 and Technology, No. 13 Hangkong Road, Wuhan 430030, China  
25  
26 Tel: +86 27 83693209  
27  
28 E-mail: [jyuan@tjh.tjmu.edu.cn](mailto:jyuan@tjh.tjmu.edu.cn)  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



## ABSTRACT

**Purpose:** The Shenzhen Aging-Related Disorder Cohort was designed to detect the associations of lifestyle, environmental and genetic factors with major aging related disorders, especially neurological and mental disorders.

**Participants:** The cohort was a community-dwelling prospective study of 9411 elderly adults aged 60 to 92 years from 51 community health service centers in Luohu district of Shenzhen, China. The baseline data were collected between 2017 and 2018, including demographics and socioeconomics, lifestyles, medical history, family history of major non-communicable chronic disease, environmental exposures, clinical analysis of blood and urine, clinical imaging measurements, anthropometric measures and neurological function and mental health assessments. Blood and urinary samples were collected at baseline. All participants will be followed for physiological and psychological disorders and updated lifestyle and environmental exposures every 5 years.

**Findings to date:** The mean age of the participants was 67.73 years at baseline, and 42.74 % were males. The prevalences of individuals with unhealthy conditions were as follows: overweight/obesity (54.38%), hypertension (58.24%), diabetes mellitus (22.30%), dyslipidemia (75.69%), chronic bronchitis (1.45%), myocardial infarction (0.55%), coronary heart disease (5.69%), stroke (1.10%), cancer (2.18%), arthritis (5.04%), Alzheimer's disease (0.18%), Parkinson's disease (0.23%), brain injury (5.75%), cognitive impairment (5.39%) and depression status (3.28%). The mean

1  
2  
3  
4 scores for the Lawton-Brody Activities of Daily Living Scale and the Social Support  
5  
6 Rate Scale were 14.15 and 39.54, respectively.  
7

8  
9 **Future plans:** 2000 new entrants from Luohu district will be recruited every year  
10  
11 until 2028. The data collection is expected to be ended at the end of 2030. The data  
12  
13 will be used to assess the causality of aging-related disorders, especially neurological  
14  
15 and mental disorders through integrating environmental, genetic and lifestyle factors.  
16  
17 The data sets generated and/or analyzed during the current study are not publicly  
18  
19 available at this stage, but are available from the corresponding author on reasonable  
20  
21 request.  
22  
23  
24  
25  
26  
27  
28  
29

30 **Keywords:** Cohort study, Aging-related disorders, Lifestyle, Environmental  
31  
32 exposure, Genetic susceptibility, Neurological disease, Mental health  
33  
34  
35  
36  
37

### 38 **Strengths and limitations of this study**

39  
40 1. The Shenzhen Aging-Related Disorder Cohort is a community-dwelling cohort  
41  
42 with the comprehensive collections of epidemiological data, clinical examinations,  
43  
44 environmental exposures, body components and biological samples in elderly Chinese  
45  
46 population, which would be used to analyze the causality of various aging-related  
47  
48 disorders, especially neurological and mental disorders through integrating  
49  
50 environmental, genetic and lifestyle factors.  
51  
52  
53

54  
55 2. Several ways will be applied to identify the morbidities and mortalities of  
56  
57 aging-related diseases during the follow-up through questionnaire investigation,  
58  
59  
60

1  
2  
3  
4 physical examinations, and searching the National Electronic Disease Surveillance  
5  
6 System as well as the National Mortality Surveillance System, which guarantee the  
7  
8 integrity and validity of the health outcomes of interest in our cohort.  
9

10  
11  
12 3. Only adults aged 60 years or older were included into the current study, which  
13  
14 might hinder the detection of influencing factors for early-onset mental and  
15  
16 neurological diseases.  
17

18  
19  
20 4. The medical histories of the participants in the current cohort were mainly  
21  
22 self-reported, which might cause biased estimation between disease histories and  
23  
24 aging-related disorders.  
25

26  
27  
28 5. Only a subsample (34.98%) of the participants at baseline took part in the  
29  
30 measurement of body components.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017.<sup>1</sup> It is forecasted that the life expectancy will keep increasing until 2040.<sup>2</sup> Consequently, population aging has become one of the major challenges facing most countries worldwide. The proportion of people with ageing-related disorders, especially non-communicable chronic diseases has been growing.<sup>3</sup> For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,<sup>4</sup> the cancer incidence increased by 28% from 2006 and 2016,<sup>5</sup> and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.<sup>6,7</sup> In 2017, aging-related diseases accounted for 51.3% of the global burden of diseases among adults.<sup>8</sup>

As a county with rapid economic and social development, China has stepped into an aging society. The growing incidences of aging-related disorders have threatened public health and economy.<sup>9</sup> Besides cardiovascular diseases, cancer and diabetes,<sup>10-13</sup> neurological and mental disorders have attracted growing attention due to their dramatically increased contributions to disease burdens, the relative lack of resources for intervention of various mental diseases, and the need for more research to find the best ways to provide mental health services.<sup>14,15</sup> Data from the Chinese Longitudinal Healthy Longevity Study revealed an annual increase of 0.7%-2.2% of cognitive impairment rate and an annual decrease of 0.4%-3.8% of objective physical performance capacity among the oldest old Chinese between 1998 and 2008.<sup>16</sup> The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,<sup>17</sup> and that of Alzheimer's disease was estimated to have quadrupled between 2011 and

1  
2  
3  
4 2015, from 6 to 28 million.<sup>18</sup> However, to date, there are no known effective  
5  
6 treatments for most aging-related disorders, especially for neurological diseases, it is  
7  
8 therefore urgent to identify the risk factors, particularly modifiable ones for  
9  
10 facilitating early intervention and prevention of the onset of aging-related disorders.  
11  
12

13  
14 Shenzhen, a major city in Guangdong province, China, situates immediately north  
15  
16 of Hongkong. As the first special economic zone and the birthplace of economic  
17  
18 miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd  
19  
20 most competitive financial center in the world in 2017. Along with the highest-speed  
21  
22 urbanization, Shenzhen has attracted large internal migration across the country, and  
23  
24 experienced dramatic socioeconomic changes and accelerated aging process during  
25  
26 the past decades. Given the population diversity, rapid urbanization, high-speed aging  
27  
28 process as well as adequate medical and health resources in Shenzhen city, a dynamic,  
29  
30 prospective cohort study, the Shenzhen Aging-Related Disorder Cohort, was designed  
31  
32 to provide evidence for addressing opportunities regarding aging-related disorders as  
33  
34 an aging-oriented research model for areas with most rapid urbanization and  
35  
36 socioeconomic structure changes in developing countries.  
37  
38  
39  
40  
41  
42  
43  
44

45 The purposes of the Shenzhen Aging-Related Disorder Cohort were to:

46  
47  
48 1) determine the prevalence of aging-related disorders, including neurological  
49  
50 disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases,  
51  
52 diabetes mellitus, neoplasms, injuries and other non-communicable diseases in  
53  
54 Shenzhen;  
55  
56

57  
58 2) detect the incidences of major mental and neurological disorders, including  
59  
60

1  
2  
3  
4 mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;

5  
6 3) estimate the disease burden of aging-related disorders, especially that from  
7  
8  
9 neurological and mental disorders in Shenzhen;

10  
11 4) describe the temporal dynamics of aging-related disorders in Shenzhen;

12  
13 5) assess the effects of environmental factors, lifestyle, and genetic factors on the  
14  
15  
16 initiation and progression of aging-related disorders, especially for neurological and  
17  
18  
19 mental disorders;

20  
21 6) develop risk prediction tools for multiple aging-related disorders;

22  
23 7) generate health intervention and management strategies for aging-related  
24  
25  
26 disorders, especially for neurological and mental disorders.  
27  
28  
29

## 30 31 32 **COHORT DESCRIPTION**

### 33 34 **The participants of the cohort**

35  
36  
37 The Shenzhen Aging-Related Disorder Cohort was established between 2017 and  
38  
39  
40 2018 based on participants from 51 community health service centers in Luohu  
41  
42  
43 district of Shenzhen city, Guangdong province, China (Figure 1). The community  
44  
45  
46 health service center is the basic health administration unit located in each  
47  
48  
49 community, which is responsible for disease prevention, health care, promoting  
50  
51  
52 recovery in each stage of health-illness process, health education, family planning and  
53  
54  
55 medical treatment of all the population in the area under its jurisdiction. Firstly,  
56  
57  
58 among 11 districts of Shenzhen city, Luohu district was selected considering its  
59  
60  
61 similarity with Shenzhen city in terms of socioeconomic structure (Supplemental

1  
2  
3  
4 Table 1). Secondly, all 51 community health service centers in Luohu district were  
5  
6 included, which managed 24402 household registered permanent elderly residents  
7  
8 older than 60 years. Individuals with severe physical disabilities or mental disorders  
9  
10 which could affect daily activities or language communication were excluded through  
11  
12 checking the medical insurance for urban residents and the National Electronic  
13  
14 Disease Surveillance System considering that they could not response well to the  
15  
16 questionnaire investigation, clinical examination and further follow-ups. Then, all  
17  
18 household registered permanent elderly residents aged at least 60 years old and  
19  
20 without severe physical or mental disorders (n=16843) of the selected community  
21  
22 health service centers were invited to participate in the study. Approximately 56%  
23  
24 (n=9411) agreed and provided signed informed consent, but 44% of the local  
25  
26 residents refused the invitation due to unwillingness to spent time on the  
27  
28 epidemiological investigation or less attraction for them or they had finished the  
29  
30 physical examination in early 2017. Although the age distribution of our cohort was  
31  
32 comparable with that of Shenzhen city, the current cohort had higher proportion of  
33  
34 females (Supplemental Table 2). All participants were asked to bring their unique  
35  
36 national identity cards for questionnaire investigation and physical examination in  
37  
38 local health centers or hospitals. Considering the annual increase of 4000 adults aged  
39  
40 60 years or older in above mentioned community health service centers between 2016  
41  
42 and 2018, the cohort will be expanded by recruiting 2000 new entrants from the same  
43  
44 community health services from Luohu district every year until 2028. The data  
45  
46 collection of the cohort will be ended until 2030. The study has been approved by the  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Review Board of Shenzhen Center for Disease Control and Prevention.

### **Epidemiological investigation**

The epidemiological data were collected through face-to-face interviews by health professionals. A semi-structured questionnaire was designed to collect demographic information (name, identity card, gender, birthday, education level, marital status, native place, occupation, housing condition, annual family income, etc.), commuting tools, lifestyle (such as food intake, active and passive smoking status, alcohol consumption, physical activity, cooking and sleep habits), histories of chronic diseases (including hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancer, neurological and mental disorders), medication history, family histories of aforementioned chronic diseases, and reproductive history (women only). After the investigation, trained investigators checked the integrity and logical errors of each questionnaire. The missing information was entered and logical errors were corrected by further telephone investigation. Data from each questionnaire were entered into computer by two integrators independently using Epidata software (version 3.1). All information was double-checked for the validity. Data items of the questionnaire query are summarized as Table 1.

**Table 1 Summary of studied items at baseline in the Shenzhen Aging-Related Disorder Cohort**

Categories	Measurements
Demographics and socioeconomics	Birthday, gender, residential address, race, birth place, education level, marital status, occupation, housing condition, and family yearly income
Lifestyles	Consumption frequencies of major food groups and drinks, active and passive smoking status, alcohol intake, physical activity, sleep habits, and cooking habits



1		
2		
3	Medical histories	Histories of hypertension, dyslipidemia, coronary heart
4		disease, stroke, diabetes mellitus, cancers, chronic
5		bronchitis, asthma, pulmonary tuberculosis, chronic
6		hepatitis, nephritis, arthritis, osteoporosis, migraine,
7		epilepsy, depression, Alzheimer's disease, and
8		Parkinson's disease
9		Use of health services and taking medicines in the past 2
10		weeks
11	Family histories of	Family histories of hypertension, dyslipidemia, coronary
12	diseases	heart disease, stroke, diabetes mellitus, cancers, chronic
13		bronchitis, asthma, pulmonary tuberculosis, chronic
14		hepatitis, nephritis, arthritis, osteoporosis, migraine,
15		epilepsy, depression, Alzheimer's disease, and
16		Parkinson's disease
17	Reproductive history (for	Histories of pregnancy and delivery, menopause status,
18	women)	and history of taking contraceptive pills
19	Clinic analysis of blood	Blood routine examination, fasting plasma glucose, total
20	and urine	cholesterol, triglycerides, low density lipoprotein
21		cholesterol, high density lipoprotein cholesterol, alanine
22		aminotransferase, glycated hemoglobin and
23		homocysteine, creatinine, uric acid, urea nitrogen, tumor
24		biomarkers, EB virus antibody, glycated hemoglobin
25		A1c, homocysteine
26		Urine glucose, urine bilirubin, urine acetone bodies,
27		urine specific gravity, pH, urinary protein, urobilinogen,
28		urine nitrite, urine white blood cell, urine occult blood
29		Urine metals [lithium, beryllium, aluminum, titanium,
30		vanadium, chromium, manganese, iron, cobalt, nickel,
31		copper, zinc, arsenic, selenium, rubidium, strontium,
32		molybdenum, cadmium, indium, tin, antimony, barium,
33		thallium, lead]
34		Urine nicotine and its metabolite [nicotine, cotinine,
35		trans-3'-hydroxy cotinine, nicotine-N-β-glucuronide,
36		cotinine N-β-D-glucuronide,
37		trans-3'-hydroxy cotinine O- β -D-glucuronide,
38		(R,S)-nornicotine, (R,S)-norcotinine,
39		(1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac
40		4-Hydroxy-4-(3-pyridyl)butanoic Acid
41		Dicyclohexylamine Salt]
42	Parameters of	Height, weight, blood pressure, electrocardiogram, chest
43	clinical measurements and	X-ray, color doppler ultrasound of liver, gallbladder,
44	imaging	spleen, pancreas, kidney, bladder, ureter and prostate
45		(men only), bone mineral density
46		Basal metabolic rate, body mass index, circumference of
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

Assessments of neurological function and activities of daily living	neck, chest, waist, hip, biceps and thigh, total body fat, percentage of body fat, visceral fat level, fat free mass, lean muscle mass, skeletal muscle, total body water, intracellular water, extracellular water, body protein, body minerals, body cell count, bio-electrical impedance Mini-Cog, Mini-mental State Examination (MMSE), Center for Epidemiologic Studies Depression Scale (CES-D), Activities of Daily Living Scale (ADLS), Social Support Rating Scale (SSRS), Pittsburgh Sleep Quality Index (PSQI)
---	---

### Assessments of neurological function and activities of daily living

Standardized scales were applied to estimate cognitive function, depression status, functional disability, social support and sleep quality. The Mini-Cog, a 5-point scale combining three-item recall and Clock Drawing Test<sup>19</sup> was used as preliminary screening instrument for mild cognitive impairment. For those who got 4 or less scores of Mini-Cog, further Chinese version of the Mini-mental State Examination (MMSE) was applied to classify them into two groups [ $\geq 24$  points and  $< 24$  points].<sup>20</sup> The validity and reliability of the Chinese MMSE have been verified previously<sup>16</sup>. The Center for Epidemiologic Studies Depression Scale (CES-D) was applied to estimate the depression status of each participant. To favor international comparisons, we used the cutoff of 16 or more out of a total of 60 points to define the prevalence of depression.<sup>21,22</sup> The Lawton-Brody Activities of Daily Living Scale (ADLS) combining basic (ability to toilet, feed, dress, groom, bathe and walk) and instrumental (ability to shop, prepare food, perform housekeeping, wash laundry, arrange transport, administer medication, use a telephone and manage finances) scales was used to assess functional disability of each participant. The participants with higher ADLS scores (ranging from 14-64) exhibit worse independence.<sup>23</sup> The

1  
2  
3  
4 Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven  
5  
6 component scores, was applied to assess the sleep quality of all participants.<sup>24</sup> The  
7  
8 participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality.  
9  
10  
11 The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of  
12  
13 the social support, namely subjective support (emotional support, four items),  
14  
15 objective support (tangible support, three items) and availability support (three items).  
16  
17  
18 Higher SSRS scores represent a better social support. The validity and reliability of  
19  
20 SSRS have been verified previously.<sup>25</sup>  
21  
22  
23  
24

### 25 **Clinic analysis of blood and urine**

26  
27 After at least 8 hours of overnight fasting, venous blood samples from each  
28  
29 participant were separately collected into the EDTA anticoagulant tubes (one 2-ml  
30  
31 and one 5-ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2  
32  
33 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room  
34  
35 temperature to separate plasma and serum. The serum samples were used for  
36  
37 biochemical analyses, including fasting blood glucose, blood lipid, hepatic function,  
38  
39 kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers and  
40  
41 Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used  
42  
43 for blood routine test, including the total number of white blood cell (WBC), red  
44  
45 blood cell counts (RBC), hemoglobin contents and blood platelet counts. The detailed  
46  
47 biochemical indexes of blood are listed in Supplemental Table 3. The  
48  
49 EDTA-anticoagulated whole blood (0.3 ml) and plasma specimens (1 ml) were used  
50  
51 for DNA and RNA extractions, and analysis of glycated hemoglobin A1c (HbA1c)  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 and homocysteine (HCY), respectively.  
5

6  
7 Additionally, an early spot morning urine sample (8 ml) was collected from each  
8  
9 participant for urine routine examination, urinary concentrations of 24 metals as well  
10  
11 as nicotine and its 10 metabolites. The detailed biochemical indices of urine are listed  
12  
13 in Supplemental Table 3. The resting blood and urine specimens were stored at -80°C  
14  
15 and -20°C refrigerators, respectively. Flow diagram of collections and separations for  
16  
17 blood and urine samples is shown as Figure 2.  
18  
19  
20

### 21 22 **Parameters of clinical measurements and imaging** 23

24  
25 Each participant took part in the physical examination conducted by trained  
26  
27 physicians in the district hospital. The inspection-palpation-percussion-auscultation  
28  
29 (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity,  
30  
31 oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The  
32  
33 measurements of baseline anthropometric indices for each participant were performed  
34  
35 on the day of physical examination. Standing height, weight and waist were measured  
36  
37 on the day of physical examination. Standing height, weight and waist were measured  
38  
39 with the subjects in light clothing and without shoes by ultrasonic weighing apparatus  
40  
41 (HMH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse  
42  
43 rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300,  
44  
45 OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the  
46  
47 right arm supported at heart-level. Statistical analysis was based on the average of the  
48  
49 two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray,  
50  
51 abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas,  
52  
53 urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 B-type ultrasound inspection (only for males) and bone mineral density scan were  
5  
6 then conducted. Out of 9411 participants, 3292 took part in the body composition  
7  
8 measurements. The visceral fat and fluid imbalances in each segment of the body and  
9  
10 the phase angle for cellular indicator of cell integrity were measured by bioelectrical  
11  
12 impedance analysis using an Inbody 570 body composition analyzer (Biospace, Seoul,  
13  
14 Korea). The body segments were analyzed, including elementary body composition  
15  
16 [body weight, body mass index (BMI), protein mass and minerals mass], total body  
17  
18 water (TBW) analysis [intracellular water, extracellular water (ECW) and  
19  
20 ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total  
21  
22 body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb  
23  
24 circumferences, waist-to-hip ratio, visceral fat area and visceral fat level) and basal  
25  
26 metabolic rate.  
27  
28  
29  
30  
31  
32  
33  
34

35 The instruments used for the physical examination and the body composition  
36  
37 measurements are listed as Supplemental Table 4.  
38  
39

#### 40 **The follow-up procedure**

41  
42 Follow-up will be conducted every 5 years to update exposures and outcomes by the  
43  
44 staffs in the community health service centers, who have established good relationship  
45  
46 with the elderly during daily disease prevention, treatment and recovery to reduce the  
47  
48 potential impact of losses to follow up on the validity of the study result. An annual  
49  
50 health education on aging-related disorders will be provided by Shenzhen Center for  
51  
52 Disease Control and Prevention, and the daily medical consultation will be provided  
53  
54 by the community health service centers for the participants to assure the retention of  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 the participants. The questionnaire survey, physical examination, the body  
5  
6 composition measures, and neurological function and mental health assessments will  
7  
8 be re-conducted during the follow-up. Blood and urine specimens will be collected  
9  
10 according to the design procedures at baseline. The incidence of non-communicable  
11  
12 chronic diseases, including neurological and mental disorders, hypertension,  
13  
14 dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other  
15  
16 aging-related diseases will be annually verified through searching the IDs of  
17  
18 participants of the cohort, which were collected during the baseline questionnaire  
19  
20 interviews in the medical insurance for urban residents, the National Electronic  
21  
22 Disease Surveillance system and the National Mortality Surveillance System. The  
23  
24 disease reports will be extracted manually. For those presenting low MMSE score  
25  
26 (less than 24 points) at baseline or significant decline of cognition in MMSE but  
27  
28 without diagnosis of mental or neurological disorders from the medical insurance for  
29  
30 urban residents or the National Electronic Disease Surveillance System, the clinical  
31  
32 diagnosis of mental disorders will be further performed by an expert panel from  
33  
34 Shenzhen Luohu Hospital Group.  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44

45 All death cases will be verified by Chinese Cause of Death Registration System  
46  
47 in Shenzhen Center for Disease Control and Prevention. The diagnosis of  
48  
49 aforementioned conditions and the causes of death will be classified according to the  
50  
51 10<sup>th</sup> version of the International Statistical Classification of Diseases (ICD-10). The  
52  
53 flow diagram of the cohort design is presented as Figure 3. The anticipated rate of  
54  
55 attrition is no more than 15% until the end of 2030.  
56  
57  
58  
59  
60

## Patient and public involvement

Participants were not involved in the development of study design or conduct.

However, each participant received a health report of their examinations and tests.

## FINDINGS TO DATE

A total of 9411 people were recruited into the Shenzhen Aging-Related Disorder Cohort. The participants were from 33 provinces, municipalities directly under the Central Government and autonomous regions of China (except for Tibet Autonomous Region). Among them, 48.65% of the cohort participants were from the outside areas of Guangdong province (Shenzhen city, a city of Guangdong) (Figure 4). The age of participants ranged from 60 to 92 years at baseline. Among all participants, 42.74 % were males. The distributions of race, education levels, marital status, and exposures to occupational hazards and kitchen fumes are shown in Table 2. The baseline lifestyle and diet habits of participants are presented in Table 3. The significant differences in the demographics and lifestyle between males and females were observed. Males were more likely to have higher education level, possess the habits of smoking, drinking, taking afternoon nap, and drinking tea, be physically active, and have worse sleep quality (all  $P<0.05$ ) (Tables 2 and 3).

**Table 2 Baseline characteristics of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4022)	Female (n=5389)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.73±5.41	68.38±5.59	67.24±5.23	10.12	<0.0001
Age groups (years, n, %)				89.80	<0.0001
60 - 64	3142 (33.39)	1167 (29.02)	1975 (36.65)		
65 - 69	3274 (34.79)	1399 (34.78)	1875 (34.79)		
70 - 74	1818 (19.32)	848 (21.08)	970 (18.00)		
≥75	1177 (12.51)	608 (15.12)	569 (10.56)		
Race (n, %)				6.88	0.03
Han Chinese	8577 (91.14)	3684 (91.60)	4893 (90.80)		
Other ethnic groups	57 (0.61)	15 (0.37)	42 (0.78)		
Missing	777 (8.26)	323 (8.03)	454 (8.42)		
Migration time to Shenzhen (n, %)				65.89	<0.0001
<1950	1450 (15.41)	554 (13.77)	896 (16.63)		
1950-	404 (4.29)	174 (4.33)	230 (4.27)		
1970-	3735 (39.69)	1722 (42.81)	2013 (37.35)		
1990-	2661 (28.28)	1022 (25.41)	1639 (30.41)		
2010-	729 (7.75)	365 (9.08)	364 (6.75)		
Missing	432 (4.59)	185 (4.60)	247 (4.58)		
Education level (n, %)				571.31	<0.0001
Primary school or illiteracy	1637 (17.39)	390 (9.70)	1247 (23.14)		
Middle school	2564 (27.24)	934 (23.22)	1630 (30.25)		
High school	3143 (33.40)	1450 (36.05)	1693 (31.42)		
University or college or higher	1977 (21.01)	1210 (30.08)	767 (14.23)		
Missing	90 (0.96)	38 (0.94)	52 (0.96)		
Marital status (n, %)				419.31	<0.0001
Single	37(0.39)	13(0.32)	24(0.45)		
Married	8045 (85.49)	3762 (93.54)	4283 (79.48)		
Widowed	1023 (10.87)	147 (3.65)	876 (16.26)		



Divorced	119 (1.26)	26 (0.65)	93 (1.73)		
Cohabited	2 (0.02)	0	2 (0.04)		
Remarried	9 (0.10)	7 (0.17)	2 (0.04)		
Missing	176 (1.87)	67 (1.67)	109 (2.02)		
Family yearly income (yuan, n, %)				32.87	<0.0001
<40,000	306 (3.25)	87 (2.16)	219 (4.06)		
40,000 -	857 (9.11)	339 (8.43)	518 (9.61)		
80,000 -	1401 (14.89)	626 (15.56)	775 (14.38)		
120,000 -	1951 (20.73)	852 (21.18)	1099 (20.39)		
≥160,000	4114 (43.71)	1787 (44.43)	2327 (43.18)		
Missing	782 (8.31)	331 (8.23)	451 (8.37)		
Exposure to occupational hazards**				127.85	<0.0001
Yes	1563 (16.61)	834 (20.74)	729 (13.53)		
No	5361 (56.97)	2309 (57.41)	3052 (56.63)		
Missing	2487 (26.43)	879 (21.85)	1608 (29.84)		
Exposure to kitchen fumes (n, %)				1104.43	<0.0001
Yes	6284 (66.77)	1943 (48.31)	4341 (80.55)		
No	2975 (31.61)	2017 (50.15)	958 (17.78)		
Missing	152 (1.62)	62 (1.54)	90 (1.67)		
Menolipsis (n=5233, %)		-	5230 (99.94)		
Parturition (n=5233, times)		-	2.02±1.04		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and categorical variables, respectively.

\*\*Occupational hazards included high temperature, noise, radiation, metal, dust, organic solvent, and farm chemical.

**Table 3 Baseline lifestyle and diet habits of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4041)	Female (n=5370)	t/x <sup>2</sup> *	P
Smoking status (n, %)				2994.95	<0.0001
Never smoker	7449 (79.15)	2129 (52.93)	5320 (98.72)		
Former smoker	974 (10.35)	961 (23.89)	13 (0.24)		
Current smoker	926 (9.84)	904 (22.48)	22 (0.41)		
Missing	62 (0.66)	28 (0.70)	34 (0.63)		
Passive smoker (n, %)				419.58	<0.0001
Yes	1054 (11.20)	144 (3.58)	910 (16.89)		
No	8282 (88.00)	3830 (95.23)	4452 (82.61)		
Missing	75 (0.80)	48 (1.19)	27 (0.50)		
Drinking status (n, %)				1383.99	<0.0001
Never drinker	7998 (84.99)	2794 (69.47)	5204 (96.57)		
Former drinker	247 (2.62)	227 (5.64)	20 (0.37)		
Current drinker	1104 (11.73)	976 (24.27)	128 (2.38)		
Missing	62 (0.66)	25 (0.62)	37 (0.69)		
Afternoon nap (n, %)				30.79	<0.0001
Yes	7020 (74.59)	3116 (77.47)	3904 (72.44)		
No	2301 (24.45)	871 (21.66)	1430 (26.54)		
Missing	90 (0.96)	35 (0.87)	55 (1.02)		
Sleep duration at night (n=9185, hours/day, mean±SD)	7.45±1.11	7.49±1.13	7.43±1.10	2.34	0.02
Pittsburgh Sleep Quality Index (n=7772, mean±SD)	4.20±2.61	3.84±2.41	4.46±2.72	-10.50	<0.0001
Physical activity (n, %)				80.11	<0.0001
Yes	7588 (80.63)	3411 (84.81)	4177 (77.41)		
No	1749 (18.58)	581 (14.45)	1168 (21.98)		
Missing	74 (0.79)	30 (0.75)	44 (0.82)		
Rice (n=9259, times/day, mean±SD)	1.98±0.65	2.00±0.65	1.96±0.65	3.04	0.002
Wheat (n=9224, times/day, mean±SD)	0.79±0.57	0.78±0.57	0.80±0.57	-2.24	0.03
Coarse grain (n=9241, times/week, mean±SD)	5.08±3.28	4.88±3.35	5.22±3.22	-4.80	<0.0001

Vegetables (n=9267, times/day, mean±SD)	1.62±0.71	1.60±0.72	1.63±0.71	-1.81	0.07
Fruit (n=9256, times/day, mean±SD)	0.95±0.50	0.92±0.51	0.97±0.50	-4.68	<0.0001
Meat (n=9258, times/day, mean±SD)	1.00±0.60	1.03±0.61	0.98±0.60	4.17	<0.0001
Fish (n=9240, times/week, mean±SD)	3.12±3.33	3.22±3.41	3.04±3.27	2.53	0.01
Shrimp/shell (n=9204, times/week, mean±SD)	1.20±3.04	1.29±3.14	1.12±2.95	2.59	0.009
Egg (n=9263, times/week, mean±SD)	5.51±2.64	5.52±2.65	5.50±2.63	0.39	0.70
Milk (n=9256, times/week, mean±SD)	3.52±3.23	3.34±3.19	3.66±3.25	-4.68	<0.0001
Bean (n=9225, times/week, mean±SD)	2.31±2.52	2.36±2.60	2.27±2.46	1.69	0.09
Pickle (n=9267, times/week, mean±SD)	1.10±2.20	1.08±2.14	1.11±2.25	-0.63	0.53
Processed meat (n=9266, times/week, mean±SD)	0.25±1.01	0.24±0.94	0.26±1.06	-0.93	0.35
Green tea (n, %)				612.93	<0.0001
Yes	3348 (35.58)	1999 (49.70)	1349 (25.68)		
No	5760 (61.20)	1912 (47.54)	3848 (71.49)		
Missing	303 (3.22)	111 (2.76)	192 (3.56)		
Black tea (n, %)				253.99	<0.0001
Yes	1741 (18.50)	1040 (25.88)	700 (12.99)		
No	7331 (77.90)	2847 (70.79)	4484 (83.21)		
Missing	339 (3.60)	134 (3.33)	205 (3.80)		
Coffee (n, %)				3.21	0.20
Yes	144 (1.53)	72 (1.79)	72 (1.34)		
No	8872 (94.27)	3784 (94.08)	5088 (94.43)		
Missing	395 (4.20)	166 (4.13)	229 (4.25)		
Juice (n, %)				0.40	0.82
Yes	47 (0.50)	18 (0.45)	29 (0.54)		
No	8970 (95.31)	3837 (95.40)	5133 (95.25)		
Missing	394 (4.19)	167 (4.15)	227 (4.21)		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and for the categorical variables, respectively.

1  
2  
3  
4 The baseline levels of of participants in the Shenzhen Aging-Related Disorder  
5  
6 Cohort were detected, including blood routine, lipid levels, blood glucose,  
7  
8 homocysteine, hepatic function, kidney function, tumor biomarkers, Epstein-Barr  
9  
10 Virus (EBV) antibody and urine routine. The detailed items are provided as  
11  
12 Supplemental Table 3. With the exception of the parameters (including aspartate  
13  
14 aminotransferase (AST), EB Virus status, carcino-embryonic antigen (CEA), alpha  
15  
16 fetoprotein (AFP) and urine bilirubin), other indices presented significant difference  
17  
18 between both sexes (all  $P < 0.05$ , Tables 4 and 5).  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 4 Baseline levels of blood biochemical traits of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
<b>Blood routine</b>					
WBC (n=9377, × 10 <sup>9</sup> /l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.50	13.48	<0.0001
RBC (n=9377, × 10 <sup>12</sup> /l, mean±SD)	4.60±0.50	4.80±0.51	4.45±0.49	35.59	<0.0001
Hemoglobin (n=9377, g/dl, mean±SD)	13.74±1.27	14.52±1.20	13.15±0.97	59.52	<0.0001
Platelet count (n=9377, × 10 <sup>9</sup> /l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
<b>Lipid levels</b>					
TCHO (n=9376, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.00	-23.50	<0.0001
TCHO ≥5.18 mmol/L (n, %)	5732 (61.13)	2019 (50.67)	3703 (68.93)	321.83	<0.0001
TG (n=9376, mmol/l, mean±SD)	1.64±1.08	1.56±1.08	1.70±1.07	-6.24	<0.0001
TG ≥1.7 mmol/L (n, %)	3232 (34.47)	1226 (30.62)	2006 (37.34)	45.90	<0.0001
HDL-C (n=9376, mmol/l, mean±SD)	1.54±0.37	1.44±0.34	1.63±0.33	-25.85	<0.0001
HDL-C <1.0 mmol/L (n, %)	349 (3.72)	256 (6.39)	93 (1.73)	139.16	<0.0001
LDL-C (n=9376, mmol/l, mean±SD)	3.13±0.85	3.00±0.83	3.22±0.88	-12.65	<0.0001
LDL-C ≥3.37 mmol/L (n, %)	3633 (38.63)	1296 (32.37)	2326 (43.30)	115.62	<0.0001
Fasting blood glucose (n=9366, mmol/l, mean±SD)	6.17±1.78	6.22±1.84	6.13±1.70	2.59	0.01
Fasting blood glucose value ≥7.0 mmol/l (%)	1561 (16.67)	716 (17.90)	845 (15.75)	7.59	0.006
HbA1c (n=6487, %, mean±SD)	6.27±1.06	6.31±1.14	6.24±0.99	2.32	0.02
HCY (n=6488, μmol/l, mean±SD)	15.14±6.75	17.42±7.52	13.47±5.66	23.25	<0.0001
<b>Hepatic function</b>					
Total protein (n=9378, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.02	-8.42	<0.0001
Abnormal total protein (n, %)	33 (0.35)	9 (0.22)	24 (0.26)	3.23	0.07
Total bilirubin (n=9378, μmol/l, mean±SD)	15.55±5.06	16.34±5.60	14.97±4.63	12.71	<0.0001
Abnormal total bilirubin (n, %)	3036 (32.37)	1562 (38.99)	1474 (27.44)	139.90	<0.0001
Albumin (n=9378, g/l, mean±SD)	44.55±2.06	44.68±2.09	44.46±2.03	5.05	<0.0001
Abnormal albumin (n, %)	77 (0.82)	41 (1.02)	36 (0.67)	3.50	0.06
ALT (n=9378, U/l, mean±SD)	21.93±19.53	22.70±14.29	21.35±22.65	3.52	0.0004
Abnormal ALT (n, %)	619 (6.60)	283 (7.06)	336 (6.25)	2.44	0.12

AST (n=9378, U/l, mean±SD)	22.07±12.27	21.88±9.22	22.21±14.12	-1.38	0.17
Abnormal AST (n, %)	310 (3.31)	108 (2.70)	202 (3.72)	8.14	0.004
<b>Kidney function</b>					
Blood urea nitrogen (n=9369, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.46	11.769	<0.0001
Creatinine (n=9369, µmol/l, mean±SD)	80.03±24.11	93.36±26.30	70.10±16.37	49.30	<0.0001
Uric acid (n=9369, µmol/l, mean±SD)	373.79±90.64	408.49±88.68	347.93±83.14	33.58	<0.0001
EB Virus (n, %)				0.60	0.74
Negative	9354 (99.39)	3997 (99.38)	5357 (99.41)		
Positive	19 (0.20)	7 (0.17)	12 (0.22)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		
CEA (n, %)					0.68**
Negative	9367 (99.53)	4001 (99.48)	5366 (99.57)		
Positive	7 (0.07)	4 (0.10)	3 (0.06)		
Missing	37 (0.39)	17 (0.42)	20 (0.37)		
AFP (n, %)				0.94	0.62
Negative	9364 (99.50)	3999 (99.43)	5365 (99.55)		
Positive	9 (0.09)	5 (0.12)	4 (0.07)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

**Table 5 Baseline levels of urine indices of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Urine glucose (n, %)				76.90	<0.0001
Negative	8862 (94.17)	3696 (91.89)	5166 (95.86)		
Positive/suspected positive	469 (4.98)	292 (7.26)	177 (3.22)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine bilirubin (n, %)				2.08	0.35
Negative	9198 (97.74)	3923 (97.54)	5275 (97.88)		
Positive/suspected positive	133 (1.41)	65 (1.62)	68 (1.26)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine acetone bodies (n, %)				5.55	0.06
Negative	9244 (98.23)	3940 (97.96)	5304 (98.42)		
Positive/suspected positive	87 (0.92)	48 (1.19)	39 (0.72)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine specific gravity (n=9331, mean±SD)	1.02±0.01	1.02±0.01	1.02±0.01	3.28	0.001
Urinary protein (n, %)				18.46	<0.0001
Negative	7997 (84.98)	3346 (83.19)	4651 (86.31)		
Positive/suspected positive	1334 (14.17)	643 (15.91)	691 (12.87)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urobilinogen (n, %)				33.40	<0.0001
Negative	9186 (97.61)	3891 (96.74)	5295 (98.26)		
Positive/suspected positive	143 (1.52)	95 (2.36)	48 (0.89)		
Missing	82 (0.87)	36 (0.90)	46 (0.85)		
Urine nitrite (n, %)				116.02	<0.0001
Negative	9080 (96.48)	3964 (98.56)	5116 (94.93)		
Positive/suspected positive	251 (2.67)	24 (0.60)	225 (4.21)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine white blood cell (n, %)				874.22	<0.0001
Negative	7406 (78.70)	3737 (92.91)	3669 (68.08)		

Positive/suspected positive	1925 (20.45)	251 (6.24)	1674 (31.06)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine occult blood (n, %)				263.04	<0.0001
Negative	6803 (72.29)	3252 (80.86)	3551 (65.89)		
Positive/suspected positive	2528 (26.86)	736 (18.30)	1792 (33.25)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoproteincholesterol; LDL-C, low density lipoproteincholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.



1  
2  
3  
4 Table 6 presents the baseline levels of clinical measurement parameters of  
5  
6 participants in the Shenzhen Aging-Related Disorder Cohort, including blood  
7  
8 pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler  
9  
10 ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary  
11  
12 system, color doppler ultrasound of prostate, bone mineral density. Owing to the  
13  
14 relatively long waiting time, less interest and attention for their body components,  
15  
16 only 34.98% (3292 of 9411) of the participants completed the measurements of body  
17  
18 component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total  
19  
20 body water, intracellular water, extracellular water, body fat mass, percentage of body  
21  
22 fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody  
23  
24 score. All clinical parameters presented significant difference between men and  
25  
26 women (all  $P < 0.05$ ). With the exception of age, sex, the prevalence of  
27  
28 overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as  
29  
30 the other characteristics were comparable between individuals with and without body  
31  
32 component data at baseline (Supplemental Table 5).  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 6 Baseline levels of clinical measurement parameters of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Blood pressure (mmHg, mean±SD)					
Systolic blood pressure (n=9330)	138.47±19.42	137.19±18.74	139.43±19.96	-5.37	<0.0001
Diastolic blood pressure (n=9330)	77.35±10.72	79.23±10.69	75.93±10.52	14.82	<0.0001
Pulse rate (n=6681, times/min)	75.32±11.39	74.61±11.58	75.85±11.21	-4.43	<0.0001
Electrocardiogram(n, %)				7.40	0.02
Normal	4995 (53.08)	2073 (51.54)	2922 (54.22)		
Abnormal	4347 (46.19)	1915 (47.61)	2432 (45.13)		
Missing	69 (0.73)	34 (0.85)	35 (0.65)		
Chest X-ray				5.46	0.07
Normal	1911 (20.31)	813 (20.21)	1098 (20.37)		
Abnormal	7291 (77.47)	3136 (77.97)	4155 (77.10)		
Missing	209 (2.22)	73 (1.82)	136 (2.53)		
Color doppler ultrasound of liver/ gallbladder/ spleen/				17.02	0.007
Normal	3678 (39.08)	1559 (38.76)	2119 (39.32)		
Abnormal	5655 (60.09)	2416 (60.07)	3239 (60.10)		
Uncertainty/Missing**	78 (0.83)	47 (1.17)	31 (0.58)		
Color doppler ultrasound of urinary system (n, %)				267.05	<0.0001
Normal	6026 (64.03)	2305 (57.31)	3721 (69.05)		
Abnormal	2775 (29.49)	1533 (38.12)	1242 (23.05)		
Uncertainty/Missing**	610 (6.48)	184 (4.57)	426 (7.90)		
Color doppler ultrasound of prostate (n=4022, %)					
Normal		1139 (28.32)	-		
Abnormal		2770 (68.87)	-		
Uncertainty/Missing**		113 (2.81)	-		
Bone mineral density (n, %)				583.26	<0.0001
Normal	1395 (14.82)	1003 (24.94)	392 (7.29)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio ( <b>n=3292</b> , mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate ( <b>n=3292</b> , kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water ( <b>n=3292</b> , k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water ( <b>n=3292</b> , L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water ( <b>n=3292</b> , L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass( <b>n=3292</b> ,kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.44	-10.25	<0.0001
Percentage of body fat ( <b>n=3292</b> , %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.55	-40.37	<0.0001
Fat free mass( <b>n=3292</b> ,Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.84	68.92	<0.0001
Skeletal muscle( <b>n=3292</b> ,Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM( <b>n=3292</b> ,Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.44	69.54	<0.0001
Body protein( <b>n=3292</b> ,kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.77	69.62	<0.0001
Body minerals( <b>n=3292</b> ,kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.27	55.68	<0.0001
InBody score( <b>n=3292</b> , mean±SD)	69.05±4.92	68.15±5.16	69.67±4.75	-8.50	<0.0001

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Uncertainty was caused by unsatisfied examination conditions.

1  
2  
3 Table 7 shows the prevalences of main non-communicable chronic diseases,  
4 including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia,  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 7 shows the prevalences of main non-communicable chronic diseases, including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia, chronic bronchitis, COPD, Asthma, tuberculosis, angina, myocardial infarction, coronary heart disease, stroke, cancer, arthritis, Chronic hepatitis, arthritis, migraine, nephritis, Alzheimer's disease, Parkinson's disease and brain injury. The assessments of mental health based on Mini-mental State Examination (MMSE) and Center for Epidemiologic Studies Depression Scale (CES-D), activities based on Activities of Daily Living Scale (ADLS), and social support based on Social Support Rating Scale (SSRS) were also provided in Table 7. Except for asthma, tuberculosis, angina, coronary heart disease, chronic hepatitis, nephritis, Alzheimer's disease, brain injury, MMSE score, depression status and ADL as well as other health related outcomes presented significant difference between males and females (all  $P < 0.05$ ).



1  
2  
3  
4  
5 <sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

6 <sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq 90$  mmHg and / or systolic blood pressure (SBP)  $\geq 140$  mmHg, or self-reported  
7 hypertension diagnosed by a physician, or taking antihypertension drugs.

8 <sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq 7.0$  mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or  
9 taking hypoglycemic agent or insulin.

10 <sup>d</sup> Dyslipidemia was defined as TCHO  $\geq 5.18$  mmol/L, or TG  $\geq 1.7$  mmol/L, or HDL-C  $< 1.0$  mmol/L, or LDL-C  $\geq 3.37$  mmol/L or self-reported  
11 hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

12 <sup>e</sup> The disease was defined as self-reported disease.

13 <sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

### Strengths and limitations

This is the community-dwelling aging-related disorder cohort with main focus on neurological and mental disorders. We comprehensively collected epidemiological data, clinical examination, environmental exposures, body components and biological samples in Chinese population, which will facilitate the identification of the causality of various aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. As an epitome of the areas with the rapid economic development and growth of immigrant population, Shenzhen reflects the aging process of population in cities with rapid economic development in China. The setting up of our cohort is able to provide more epidemiological evidence for the prevention and control of aging-related diseases in China, especially in those areas with upcoming booming economy. With the exception of routine follow-up by questionnaires, the incidence of aging-related diseases, especially neurological and mental disorders will be annually verified from the National Electronic Disease Surveillance System and National Mortality Surveillance System in Shenzhen Center for Disease Control and Prevention, which guarantees the integrity and validity of outcomes of interest in our cohort. Comprehensive measurement of internal exposures is another strength of our cohort. A total of 24 metals as well as nicotine and its metabolites in urine samples have been detected for all participants at baseline. Chronic risk assessment of exposure to environmental pollutants will be extended to pesticides in 2020. Compared with the previous cohorts, including China Kadoorie biobank<sup>26</sup>, the China Health and Retirement Longitudinal Study<sup>27</sup> and Chinese Longitudinal Healthy Longevity Survey<sup>28</sup>, the Shenzhen Aging-related disorder cohort might help to provide more epidemiological evidence for the causality of neurological and mental disorders through wide exploration of the

1  
2  
3 environmental exposures, such as lifestyle, metals, metabolite of tobacco and  
4 pesticide.  
5  
6

7  
8 However, there are some limitations of our cohort. First, although Luohu district  
9 is similar with Shenzhen city in socioeconomic structures among all 11 districts, there  
10 is inevitably some deviations, especially in age composition. However, the age  
11 structure in our cohort is comparable with that of the elderly in Shenzhen city. But our  
12 cohort has higher proportion of females, which may cause deviations of the  
13 demographic features for the whole study population. To reduce the potential bias, we  
14 presented all results by sex. Second, all participants are adults aged 60 years or older,  
15 then we could not have information on their early-life exposures. However, the high  
16 incidence of aging-related disorders in older adults in the context of rapid  
17 epidemiological transition will provide us with sufficient power for further analysis.  
18 Third, the medical histories of the participants in our cohort were self-reported. But  
19 the link between our cohort and disease surveillance system in Shenzhen Center for  
20 Disease Control and Prevention will guarantee the accuracy and reliability of the  
21 information. Fourth, only 3292 participants took part in the body components analysis  
22 at baseline. However, the selection bias tends to be small since most baseline  
23 characteristics are comparable between individuals with and without body component  
24 data (Supplemental Table 5). Fifth, recruitment of 9411 participants at baseline makes  
25 our sample size relatively smaller compared with other cohorts in the world. However,  
26 according to the study design, an annual 2000 new participants will be recruited to  
27 enlarge the cohort until 2028, which will ensure the statistical power for most  
28 association studies in the future.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57

## 58 **Collaboration**

59  
60



1  
2  
3 The datasets generated and/or analyzed during the current study are not publicly  
4 available at this stage, but are available from the corresponding author on reasonable  
5 request from employees of a recognized academic institution, health service  
6 organization or charitable research organization with experience in medical research  
7 with the clear statement of their research interest, analysis proposal, data protection  
8 measures and corporation mechanisms. However, specific ideas and proposals for  
9 potential collaborations would be welcomed and invited to contact the corresponding  
10 authors via e-mail to L.J. [JLIUSZCDC@163.com] and Y. J.  
11 [jyuan@tjh.tjmu.edu.cn].  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

## 26 **Abbreviations**

27  
28 MMSE, Mini-mental State Examination; CES-D, Center for Epidemiologic Studies  
29 Depression Scale; ADLS, Lawton-Brody Activities of Daily Living Scale; PSQI,  
30 Pittsburgh sleep quality index; SSRS, Social Support Rate Scale; TCHO, total  
31 cholesterol; TG, triglyceride; LDL-C, low density lipoprotein cholesterol; HDL-C,  
32 high density lipoprotein cholesterol; TB, total bilirubin; ALT, alanine  
33 aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen;  
34 AFP, alpha fetoprotein; EBV, Epstein-Barr Virus; WBC, white blood cell; RBC, red  
35 blood cell counts; MPV, mean platelet volume; PDW, platelet distribution width; PLT,  
36 blood platelet quantity; P-LCR, platelet volume ratio and platelet large cell ratio;  
37 HbA1c, glycated hemoglobin A1c; HCY, homocysteine; IPPA,  
38 inspection-palpation-percussion-auscultation; ECG, electrocardiogram; BMI, body  
39 mass index; TBW, total body water; ECW, extracellular water.  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## 61 **Acknowledgments**

1  
2  
3 The study has received great support from Shenzhen center for disease control and  
4 prevention, Shenzhen Luohu Hospital for Traditional Chinese Medicine, and  
5 Shenzhen Luohu Center for Disease Control and Prevention. The contributions of all  
6 the working staffs and participants are greatly acknowledged.  
7  
8  
9  
10  
11  
12  
13  
14

## 15 **Contributors**

16  
17 JY and JL conceived of the study, participated in its design, coordinated the study and  
18 reviewed the manuscript for important intellectual content. LL and WL participated in  
19 the study design, collected data, drafted the manuscript and performed the descriptive  
20 data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XW, TL, EG, LZ, KH, YH,  
21 CY, QZ, FY and XY participated in data collection, helped drafted the manuscript and  
22 reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, FZ,  
23 TL, EG, FY and XY constructed the data base and JY and JL were responsible for  
24 data management. All authors read and approved the final manuscript.  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38

## 39 **Funding**

40  
41 This project is supported by Sanming Project of Medicine in Shenzhen  
42 [SZSM201611090], and Shenzhen Basic Research Plan for Medical Health  
43 [SZGW2018004, SZXJ2017013]. The funders have no role in the study design, data  
44 collection, analysis and interpretation as well as manuscript preparation and  
45 submission.  
46  
47  
48  
49  
50  
51  
52  
53  
54

## 55 **Competing interests**

56  
57 The authors declare that they have no competing interests.  
58  
59  
60

## **Patient consent for publication**

Not required.

## **Ethics approval**

All participants agreed to join in the cohort and provide informed written consent. The study has been approved by the Review Board of Shenzhen Center for Disease Control and Prevention (approval numbers: R2017001 and R2018020).

## **Provenance and peer review**

Not commissioned; externally peer review.

## **Data sharing statement**

The datasets generated and/or analysed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request. However, specific ideas and proposals for potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

**REFERENCES**

1. GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1859-922.
2. Foreman KJ, Marquez N, Dolgert A, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. *Lancet* 2018;392:2052-90.
3. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390:1211-59.
4. GBD 2016 Lifetime Risk of Stroke Collaborators, Feigin VL, Nguyen G, Cercy K, et al. Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016. *N Engl J Med* 2018;379:2429-37.
5. Global Burden of Disease Cancer Collaboration, Fitzmaurice C, Akinyemiju TF, Alam T, et al. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2016: A Systematic Analysis for the Global Burden of Disease Study. *JAMA Oncol* 2018;4:1553-68.
6. Wimo A, Jonsson L, Bond J, et al. The worldwide economic impact of

- dementia 2010. *Alzheimers Dement*2013;9:1-11 e13.
7. Alzheimer's Disease International. World Alzheimer report 2015: the global impact of dementia. <https://www.alz.co.uk/research/world-report-2015>. Accessed 1 June 2016.
  8. Chang AY, Skirbekk VF, Tyrovolas S, et al. Measuring population ageing: an analysis of the Global Burden of Disease Study 2017. *Lancet Public Health*2019;4:e159-e167.
  9. He X, Song M, Qu J, et al. Basic and translational aging research in China: present and future. *Protein Cell*2019;10:476-84.
  10. Liu S, Li Y, Zeng X, et al. Burden of Cardiovascular Diseases in China, 1990-2016: Findings From the 2016 Global Burden of Disease Study. *JAMA Cardiol*2019; doi: 10.1001/jamacardio.2019.0295.
  11. Zhou M, Wang H, Zhu J, et al. Cause-specific mortality for 240 causes in China during 1990-2013: a systematic subnational analysis for the Global Burden of Disease Study 2013. *Lancet* 2016;387:251-72.
  12. Liu M, Liu SW, Wang LJ, et al. Burden of diabetes, hyperglycaemia in China from to 2016: Findings from the 1990 to 2016, global burden of disease study. *Diabetes Metab*2019;45:286-93.
  13. Yang JJ, Yu D, Wen W, et al. Association of Diabetes With All-Cause and Cause-Specific Mortality in Asia: A Pooled Analysis of More Than 1 Million Participants. *JAMA Netw Open*2019;2:e192696.
  14. Stein DJ, He Y, Phillips A, et al. Global mental health and neuroscience: potential synergies. *Lancet Psychiatry*2015;2:178-85.
  15. Ji Y, Shi Z, Zhang Y, et al. Prevalence of dementia and main subtypes in rural northern China. *Dement Geriatr Cogn Disord*2015;39:294-302.

16. Zeng Y, Feng Q, Hesketh T, et al. Survival, disabilities in activities of daily living, and physical and cognitive functioning among the oldest-old in China: a cohort study. *Lancet* 2017;389:1619-29.
17. GBD 2016 Parkinson's Disease Collaborators. Global, regional, and national burden of Parkinson's disease, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* 2018;17:939-53.
18. Keogh-Brown MR, Jensen HT, Arrighi HM, et al. The Impact of Alzheimer's Disease on the Chinese Economy. *EBioMedicine* 2015 22;4:184-90.
19. Borson S, Scanlan JM, Chen P, et al. The Mini-Cog as a screen for dementia: validation in a population-based sample. *J Am Geriatr Soc* 2003;51:1451-4.
20. Lv X, Li W, Ma Y, et al. Cognitive decline and mortality among community-dwelling Chinese older people. *BMC Med* 2019;17:63.
21. Pequignot R, Dufouil C, Peres K, et al. Depression Increases the Risk of Death Independently From Vascular Events in Elderly Individuals: The Three-City Study. *J Am Geriatr Soc* 2019;67:546-52.
22. Jeurig HW, Hoogendijk EO, Comijs HC, et al. The tide has turned: incidence of depression declined in community living young-old adults over one decade. *Epidemiol Psychiatr Sci* 2019:1-8.
23. O'Caomh R, Gao Y, Svendrovski A, et al. Effect of Visit-to-Visit Blood Pressure Variability on Cognitive and Functional Decline in Mild to Moderate Alzheimer's Disease. *J Alzheimers Dis* 2019;68:1499-510.
24. Curtis BJ, Williams PG, Anderson JS. Objective cognitive functioning in self-reported habitual short sleepers not reporting daytime dysfunction: examination of impulsivity via delay discounting. *Sleep* 2018;41.
25. Xiao S. Theoretical foundation and research and application of Social Support

1  
2  
3 Rating Scale. *J Clin Psychiatry* 1994;4:98-100.  
4

- 5  
6 26. Chen Z, Chen J, Collins R, et al. China Kadoorie Biobank of 0.5 million people:  
7  
8 survey methods, baseline characteristics and long-term follow-up. *Int J*  
9  
10 *Epidemiol* 2011;40:1652-66.  
11  
12 27. Zhao Y, Hu Y, Smith JP, et al. Cohort profile: the China Health and Retirement  
13  
14 Longitudinal Study (CHARLS). *Int J Epidemiol* 2014;43:61-8.  
15  
16 28. Shi Z, Zhang T, Byles J, et al. Food Habits, Lifestyle Factors and Mortality among  
17  
18 Oldest Old Chinese: The Chinese Longitudinal Healthy Longevity Survey  
19  
20 (CLHLS). *Nutrients* 2015;7:7562-79.  
21  
22  
23  
24  
25

## 26 **Figure legends**

- 27  
28  
29 Figure 1 Location of Shenzhen in China  
30  
31 Figure 2 The flow diagram of collecting and separation blood and urine specimen  
32  
33 Figure 3 The flow diagram of the cohort design  
34  
35  
36 Figure 4 The birthplace distribution of the studied individuals  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



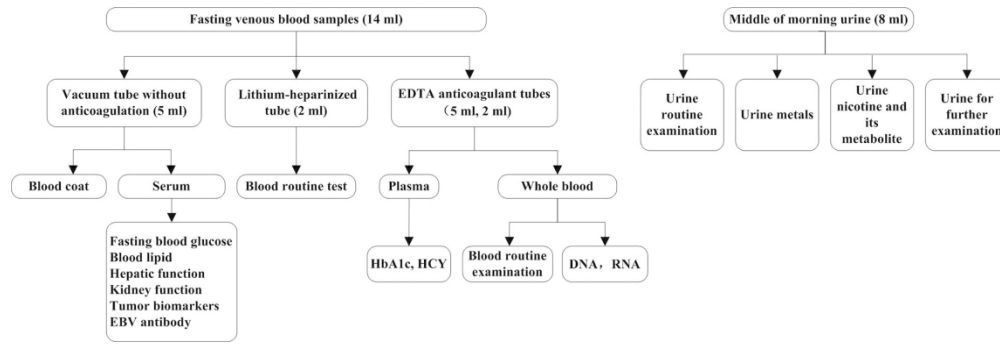


Figure 2 The flow diagram of collecting and separation blood and urine specimen  
180x60mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.

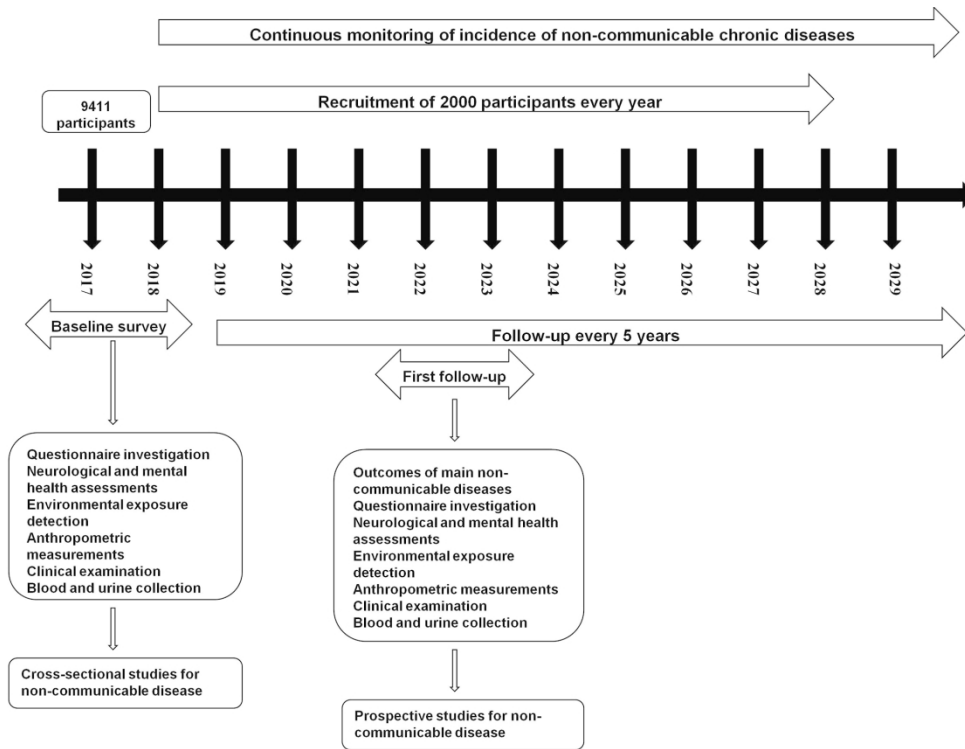


Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

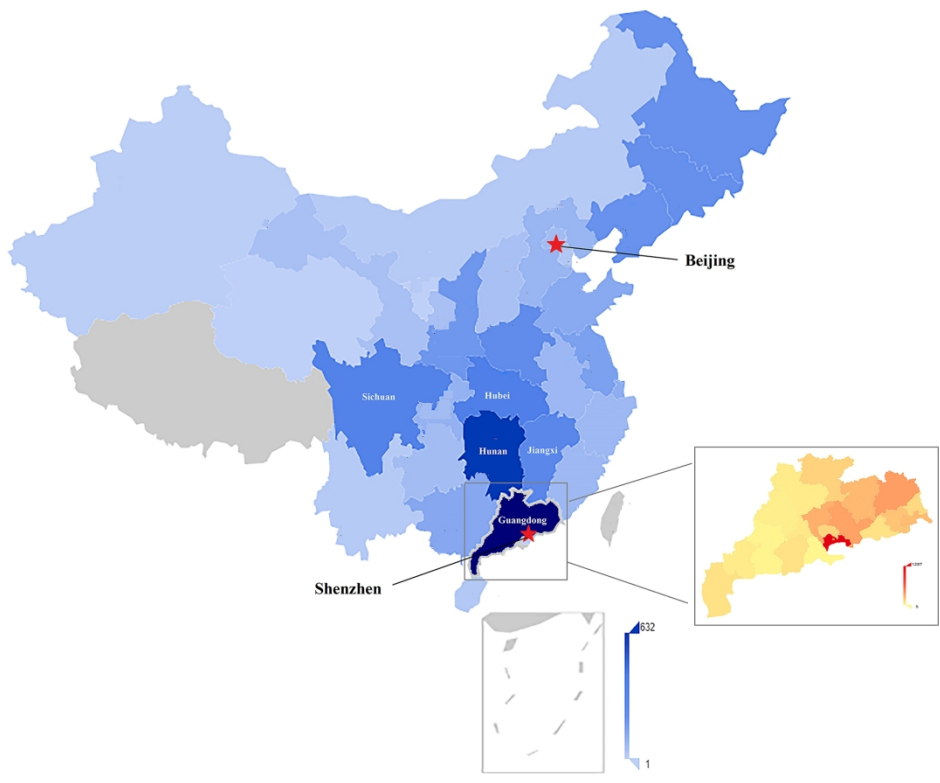


Figure 4 The birthplace distribution of the studied individuals  
180x147mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.

**Supplemental Table 1 Socioeconomic structures of Luohu district and Shenzhen city in 2018**

	Luohu district (n=103.99×10 <sup>4</sup> )	Shenzhen city (n=1302.66×10 <sup>4</sup> )
Sex		
male	559952 (53.85%)	7250711 (55.66%)
female	479948 (46.15%)	5775877 (44.34%)
Age (years)		
0-14	139625 (13.43%)	1569745 (13.03%)
15-59	826107 (79.44%)	10878040 (83.51%)
60-	74168 (7.13%)	578803 (4.44%)
Education level		
Illiteracy	8735 (0.84%)	96379 (0.74%)
Primary school	111477 (10.72%)	1217936 (9.34%)
High school	814554 (78.33%)	10612306 (81.47%)
University	105134 (10.11%)	1099967 (8.44%)
Annual per capita disposable income (RMB)	60595	57543
Total assets (100 million RMB)	4702	47120

Demographics were from the permanent residents.

**Supplemental Table 2. Comparisons of the distributions of age and sex among elderly residents in Shenzhen city, Luohu district and our cohort**

	Shenzhen Aging- Related Disorder cohort	Luohu district	Shenzhen city
Sex			
male	4022 (42.73%)	37492 (50.55%)	290001 (50.10%)
female	5389 (57.26%)	36676 (49.45%)	288802 (49.90%)
Age (years)			
60-69	6416 (68.18%)	48937 (65.98%)	394769 (68.20%)
≥70	2995 (31.82%)	25231 (34.02%)	184034 (31.80%)

**Supplemental Table 3 The list of biochemical analysis of biosamples at baseline in the Shenzhen Aging-Related Disorder Cohort**

Categories	Measurements
<b>Blood routine</b>	white blood cell counts (WBC), red blood cell counts (RBC), hemoglobin contents, platelet counts
<b>Lipid levels</b>	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
<b>Blood glucose</b>	fasting plasma glucose, glycated hemoglobin
<b>Homocysteine</b>	
<b>Hepatic function</b>	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
<b>Kidney function</b>	creatinine, uric acid and urea nitrogen
<b>Tumor biomarkers</b>	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
<b>Epstein-Barr Virus (EBV) antibody</b>	
<b>Urine routine</b>	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent blood
<b>Urine metals</b>	lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead
<b>Urine nicotine and its metabolites</b>	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl) butanoic Acid Dicyclohexylamine Salt

**Supplemental Table 4 Summary of the instruments messages for clinical indicators analysis at baseline**

Items	Equipment used
Standing height	HNH-219, OMRON Healthcare Co., Ltd, Japan
Body weight	HNH-219, OMRON Healthcare Co., Ltd, Japan
Resting blood pressure	HBP-1300, OMRON Healthcare Co., Ltd, Japan
12-lead electrocardiography	ECG-1350c, Nihon Kohden Corporation, Japan
Chest X-ray	Optimus, Royal Dutch Philips Electronics Ltd., Netherlands
Abdominal B-type ultrasound inspection	Affiniti50, Royal Dutch Philips Electronics Ltd., Netherlands
	EPIQ5, Royal Dutch Philips Electronics Ltd., Netherlands
	S25, SonoScape Medical Corp., Guangdong, China
Fasting plasma glucose	7600-010, Hitachi, Ltd., Tokyo, Japan
Glycated hemoglobin	Premier Hb9210, Trinity Biotech Plc., Bray, Ireland
Homocysteine	AU5800, Beckman Coulter, Inc., California, USA
Blood lipids	7600-010, Hitachi, Ltd., Tokyo, Japan
Hepatic function	7600-010, Hitachi, Ltd., Tokyo, Japan
Renal function	7600-010, Hitachi, Ltd., Tokyo, Japan
Blood routine	XT-1800I, SYSMEX Corporation, Japan
EB virus	Uranus AE100, Aikang Medtech Co., Ltd, China
Tumor biomarkers	Uranus AE100, Aikang Medtech Co., Ltd, China
Urine routine	URIT-500B, URIT Medical Electronic Group Co., China
Bone mineral density	MetriScan, Miles Medical Inc., California, USA
	BMD-1000D, Hongyang Medical Apparatus Co., Ltd, China

---

1		
2		
3		
4	Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
5	Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
6	Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
7	Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
8	Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
9		
10	Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
11	Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
12	Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
13	Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
14	Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
15	Basal metabolic rate	Inbody 570, InBody Co., Ltd, Seoul, Korea
16	Basal metabolic rate	Inbody 570, InBody Co., Ltd, Seoul, Korea
17	Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
18	Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
19	Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
20	Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
21	Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
22	Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
23	Urine metals	NEXION 300X PerkinElmer Inc., USA
24	Urine nicotine and its metabolite	1200 series/ 6410 Triple Quad LC/MS Agilent Technologies Inc., California, USA

---

**Supplemental Table 5 Comparisons between the individuals with and without body component data at baseline**

Variables	Participants with body component (n=3292)	Participants without body component (n=6119)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.54±5.25	67.83±5.50	2.56	0.01
Male (n, %)	1327 (40.31)	2695 (44.04)	12.19	0.0005
Han Chinese (n, %)	2954 (99.29)	5623 (99.36)	0.14	0.70
Education level (n, %)			4.01	0.26
Primary school or illiteracy	547 (16.79)	1090 (17.97)		
Middle school	913 (28.03)	1651 (27.23)		
High school	1081 (33.19)	2062 (34.00)		
University or college or higher	716 (21.98)	1261 (20.79)		
Marital status (n, %)			7.74	0.10
Single	14 (0.43)	32 (0.53)		
Married	2825 (87.60)	5220 (86.86)		
Widowed	336 (10.42)	687 (11.43)		
Divorced	48 (1.49)	71 (1.18)		
Cohabited	2 (0.06)	0		
Ever smoker (n, %)	643 (19.64)	1257 (20.69)	1.45	0.23
Passive smoker (n, %)	380 (11.63)	674 (11.11)	0.57	0.45
Ever drinker (n, %)	485 (14.82)	866 (14.25)	0.55	0.46
Pittsburgh Sleep Quality Index (n, mean ± SD)	4.33 ± 2.60	4.12 ± 2.61	-3.41	0.0006
Physical active (n, %)	2664 (81.24)	4924 (81.28)	0.002	0.97
Overweight/Obesity <sup>a</sup> (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02



1					
2					
3					
4	Hypertension <sup>b</sup> (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
5	Diabetes mellitus <sup>c</sup> (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
6	Hyperlipidemia <sup>d</sup> (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
7	Chronic bronchitis <sup>e</sup> (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
8	COPD <sup>e</sup> (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
9	Asthma <sup>e</sup> (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
10	Tuberculosis <sup>e</sup> (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
11	Angina <sup>e</sup> (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
12	Myocardial infarction <sup>e</sup> (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
13	Coronary heart disease <sup>e</sup> (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
14	Stroke <sup>e</sup> (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
15	Cancer <sup>e</sup> (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
16	Chronic hepatitis <sup>e</sup> (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
17	Arthritis <sup>e</sup> (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
18	Migraine <sup>e</sup> (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
19	Nephritis <sup>e</sup> (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
20	Alzheimer's disease <sup>e</sup> (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
21	Parkinson's disease <sup>e</sup> (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
22	Brain injury <sup>e</sup> (n, %)	193 (5.96)	340 (5.64)	0.40	0.53
23	MMSE score < 24 (n, %)	167 (5.48)	301 (5.35)	0.07	0.79
24	Depression status <sup>f</sup> (n, %)	126 (3.87)	177 (2.95)	5.63	0.02
25	ADL (n, scores, mean ± SD)	14.09 ± 1.23	14.18 ± 1.73	2.82	0.005
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

SSRS (n, score, mean $\pm$ SD)	39.88 $\pm$ 7.68	39.36 $\pm$ 8.00	-2.88	0.004
--------------------------------	------------------	------------------	-------	-------

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

<sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

<sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq$ 90mmHg and / or systolic blood pressure (SBP)  $\geq$ 140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

<sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq$ 7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

<sup>d</sup> Dyslipidemia was defined as TCHO  $\geq$ 5.18 mmol/L, or TG  $\geq$ 1.7 mmol/L, or HDL-C  $<$ 1.0 mmol/L, or LDL-C  $\geq$ 3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

<sup>e</sup> The disease was defined as self-reported disease.

<sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

# BMJ Open

## Cohort profile: the Study Design and Baseline Characteristics of Shenzhen Aging-Related Disorder Cohort in China

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-034317.R3
Article Type:	Cohort profile
Date Submitted by the Author:	11-Mar-2020
Complete List of Authors:	<p>Liu, Li; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Wei; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Nie, Lulin; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>Guo, Zhiwei; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Luo, Yi; Shenzhen Luohu Hospital for Traditional Chinese Medicine</p> <p>Chen, Weihong; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Liu, Weimin; Shenzhen Luohu Center for Disease Control and Prevention</p> <p>Feiqi, Zhu; the third affiliated hospital of Shenzhen University Medical College, cognitive impairment ward of Neurology</p> <p>Wang, Lu; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhang, Jiafei; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Wang, Xian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Li, Tian; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Gao, Erwei ; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhou, Li; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p> <p>He, Kaiwu; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>

	<p>Huang, Yidan; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Chunjie; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Zhu, Qingqing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Ye, Fang; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yu, Xingchen; Department of Epidemiology and Biostatistics and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Yuan, Jing; Department of Occupational and Environmental Health and State Key Laboratory of Environmental Health for Incubating, School of Public Health, Tongji Medical College, Huazhong University of Science and Technology</p> <p>Liu, Jianjun; Key Laboratory of Modern Toxicology of Shenzhen, Institute of Toxicology, Shenzhen Center for Disease Control and Prevention</p>
<b>Primary Subject Heading</b>:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease

SCHOLARONE™  
Manuscripts

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our [licence](#).

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which [Creative Commons](#) licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

1  
2  
3  
4 Cohort profile: the Study Design and Baseline Characteristics of Shenzhen  
5 Aging-Related Disorder Cohort in China  
6  
7  
8

9 Li Liu<sup>1†</sup>, Wei Liu<sup>2†</sup>, Lulin Nie<sup>2</sup>, Zhiwei Guo<sup>3</sup>, Yi Luo<sup>3</sup>, Weihong Chen<sup>4</sup>, WeiminLiu<sup>4</sup>,  
10 Feiqi Zhu<sup>5</sup>, Lu Wang<sup>6</sup>, Jiafei Zhang<sup>6</sup>, Xian Wang<sup>6</sup>, Tian Li<sup>6</sup>, Erwei Gao<sup>6</sup>, Li Zhou<sup>2</sup>,  
11 Kaiwu He<sup>2</sup>, Yidan Huang<sup>6</sup>, Chunjie Yuan<sup>6</sup>, Qingqing Zhu<sup>6</sup>, Fang Ye<sup>6</sup>, Xingchen Yu<sup>1</sup>,  
12 Jing Yuan<sup>6\*</sup>, Jianjun Liu<sup>2\*</sup>  
13  
14  
15  
16  
17

18  
19 <sup>1</sup> Department of Epidemiology and Biostatistics and State Key Laboratory of  
20 Environmental Health for Incubating, School of Public Health, Tongji Medical  
21 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
22  
23

24 <sup>2</sup> Key Laboratory of Modern Toxicology of Shenzhen, Shenzhen Medical Key Subject  
25 of Health Toxicology, Shenzhen Center for Disease Control and Prevention,  
26 Shenzhen, Guangdong, PR. China  
27  
28

29 <sup>3</sup> Shenzhen Luohu Hospital for Traditional Chinese Medicine, Shenzhen Luohu  
30 Hospital Group, Shenzhen, Guangdong, PR. China  
31  
32

33 <sup>4</sup> Shenzhen Luohu Center for Disease Control and Prevention, Shenzhen, Guangdong,  
34 PR. China  
35  
36

37 <sup>5</sup> Cognitive Impairment Ward of Neurology Department, The Third Affiliated  
38 Hospital of Shenzhen University Medical College, Shenzhen, Guangdong, PR. China  
39  
40

41 <sup>6</sup> Department of Occupational and Environmental Health and State Key Laboratory of  
42 Environmental Health for Incubating, School of Public Health, Tongji Medical  
43 College, Huazhong University of Science and Technology, Wuhan, Hubei, PR. China  
44  
45  
46  
47  
48

49  
50 † Li Liu and Wei Liu contributed equally.  
51  
52

53  
54 **Corresponding to:**

55  
56 Jianjun Liu

57  
58 Key Laboratory of Modern Toxicology of Shenzhen  
59  
60

1  
2  
3  
4 Shenzhen Medical Key Subject of Health Toxicology  
5  
6 Shenzhen Center for Disease Control and Prevention, Shenzhen, 518055, Guangdong,  
7  
8 PR. China  
9  
10 Tel: +86 755 25508584  
11  
12 E-mail: [JJLIUSZCDC@163.com](mailto:JJLIUSZCDC@163.com)  
13  
14

15  
16 Jing Yuan  
17  
18 Department of Occupational and Environmental Health  
19  
20 State Key Laboratory of Environmental Health for Incubating  
21  
22 School of Public Health, Tongji Medical College, Huazhong University of Science  
23  
24 and Technology, No. 13 Hangkong Road, Wuhan 430030, China  
25  
26 Tel: +86 27 83693209  
27  
28 E-mail: [jyuan@tjh.tjmu.edu.cn](mailto:jyuan@tjh.tjmu.edu.cn)  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## ABSTRACT

**Purpose:** The Shenzhen Aging-Related Disorder Cohort was designed to detect the associations of lifestyle, environmental and genetic factors with major aging related disorders, especially neurological and mental disorders.

**Participants:** The cohort was a community-dwelling prospective study of 9411 elderly adults aged 60 to 92 years from 51 community health service centers in Luohu district of Shenzhen, China. The baseline data were collected between 2017 and 2018, including demographics and socioeconomics, lifestyles, medical history, family history of major non-communicable chronic disease, environmental exposures, clinical analysis of blood and urine, clinical imaging measurements, anthropometric measures and neurological function and mental health assessments. Blood and urinary samples were collected at baseline. All participants will be followed for physiological and psychological disorders and updated lifestyle and environmental exposures every 5 years.

**Findings to date:** The mean age of the participants was 67.73 years at baseline, and 42.74 % were males. The prevalences of individuals with unhealthy conditions were as follows: overweight/obesity (54.38%), hypertension (58.24%), diabetes mellitus (22.30%), dyslipidemia (75.69%), chronic bronchitis (1.45%), myocardial infarction (0.55%), coronary heart disease (5.69%), stroke (1.10%), cancer (2.18%), arthritis (5.04%), Alzheimer's disease (0.18%), Parkinson's disease (0.23%), brain injury (5.75%), cognitive impairment (5.39%) and depression status (3.28%). The mean



1  
2  
3  
4 scores for the Lawton-Brody Activities of Daily Living Scale and the Social Support  
5  
6 Rate Scale were 14.15 and 39.54, respectively.  
7

8  
9 **Future plans:** 2000 new entrants from Luohu district will be recruited every year  
10  
11 until 2028. The data collection is expected to be ended at the end of 2030. The data  
12  
13 will be used to assess the causality of aging-related disorders, especially neurological  
14  
15 and mental disorders through integrating environmental, genetic and lifestyle factors.  
16  
17 The data sets generated and/or analyzed during the current study are not publicly  
18  
19 available at this stage, but are available from the corresponding author on reasonable  
20  
21 request.  
22  
23  
24  
25  
26  
27  
28  
29

30 **Keywords:** Cohort study, Aging-related disorders, Lifestyle, Environmental  
31  
32 exposure, Genetic susceptibility, Neurological disease, Mental health  
33  
34  
35  
36  
37

### 38 **Strengths and limitations of this study**

39  
40 1. The Shenzhen Aging-Related Disorder Cohort is a community-dwelling cohort  
41  
42 with the comprehensive collections of epidemiological data, clinical examinations,  
43  
44 environmental exposures, body components and biological samples in elderly Chinese  
45  
46 population, which would be used to analyze the causality of various aging-related  
47  
48 disorders, especially neurological and mental disorders through integrating  
49  
50 environmental, genetic and lifestyle factors.  
51  
52  
53

54  
55 2. Several ways will be applied to identify the morbidities and mortalities of  
56  
57 aging-related diseases during the follow-up through questionnaire investigation,  
58  
59  
60

1  
2  
3  
4 physical examinations, and searching the National Electronic Disease Surveillance  
5  
6 System as well as the National Mortality Surveillance System, which guarantee the  
7  
8 integrity and validity of the health outcomes of interest in our cohort.  
9

10  
11  
12 3. Only adults aged 60 years or older were included into the current study, which  
13  
14 might hinder the detection of influencing factors for early-onset mental and  
15  
16 neurological diseases.  
17

18  
19  
20 4. The medical histories of the participants in the current cohort were mainly  
21  
22 self-reported, which might cause biased estimation between disease histories and  
23  
24 aging-related disorders.  
25

26  
27  
28 5. Only a subsample (34.98%) of the participants at baseline took part in the  
29  
30 measurement of body components.  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017.<sup>1</sup> It is forecasted that the life expectancy will keep increasing until 2040.<sup>2</sup> Consequently, population aging has become one of the major challenges facing most countries worldwide. The proportion of people with ageing-related disorders, especially non-communicable chronic diseases has been growing.<sup>3</sup> For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,<sup>4</sup> the cancer incidence increased by 28% from 2006 and 2016,<sup>5</sup> and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.<sup>6,7</sup> In 2017, aging-related diseases accounted for 51.3% of the global burden of diseases among adults.<sup>8</sup>

As a county with rapid economic and social development, China has stepped into an aging society. The growing incidences of aging-related disorders have threatened public health and economy.<sup>9</sup> Besides cardiovascular diseases, cancer and diabetes,<sup>10-13</sup> neurological and mental disorders have attracted growing attention due to their dramatically increased contributions to disease burdens, the relative lack of resources for intervention of various mental diseases, and the need for more research to find the best ways to provide mental health services.<sup>14,15</sup> Data from the Chinese Longitudinal Healthy Longevity Study revealed an annual increase of 0.7%-2.2% of cognitive impairment rate and an annual decrease of 0.4%-3.8% of objective physical performance capacity among the oldest old Chinese between 1998 and 2008.<sup>16</sup> The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,<sup>17</sup> and that of Alzheimer's disease was estimated to have quadrupled between 2011 and

1  
2  
3  
4 2015, from 6 to 28 million.<sup>18</sup> However, to date, there are no known effective  
5  
6 treatments for most aging-related disorders, especially for neurological diseases, it is  
7  
8 therefore urgent to identify the risk factors, particularly modifiable ones for  
9  
10 facilitating early intervention and prevention of the onset of aging-related disorders.  
11  
12

13  
14 Shenzhen, a major city in Guangdong province, China, situates immediately north  
15  
16 of Hongkong. As the first special economic zone and the birthplace of economic  
17  
18 miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd  
19  
20 most competitive financial center in the world in 2017. Along with the highest-speed  
21  
22 urbanization, Shenzhen has attracted large internal migration across the country, and  
23  
24 experienced dramatic socioeconomic changes and accelerated aging process during  
25  
26 the past decades. Given the population diversity, rapid urbanization, high-speed aging  
27  
28 process as well as adequate medical and health resources in Shenzhen city, a dynamic,  
29  
30 prospective cohort study, the Shenzhen Aging-Related Disorder Cohort, was designed  
31  
32 to provide evidence for addressing opportunities regarding aging-related disorders as  
33  
34 an aging-oriented research model for areas with most rapid urbanization and  
35  
36 socioeconomic structure changes in developing countries.  
37  
38  
39  
40  
41  
42  
43  
44

45 The purposes of the Shenzhen Aging-Related Disorder Cohort were to:

46  
47  
48 1) determine the prevalence of aging-related disorders, including neurological  
49  
50 disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases,  
51  
52 diabetes mellitus, neoplasms, injuries and other non-communicable diseases in  
53  
54 Shenzhen;  
55  
56

57  
58 2) detect the incidences of major mental and neurological disorders, including  
59  
60

1  
2  
3  
4 mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;

5  
6 3) estimate the disease burden of aging-related disorders, especially that from  
7  
8  
9 neurological and mental disorders in Shenzhen;

10  
11 4) describe the temporal dynamics of aging-related disorders in Shenzhen;

12  
13 5) assess the effects of environmental factors, lifestyle, and genetic factors on the  
14  
15  
16  
17 initiation and progression of aging-related disorders, especially for neurological and  
18  
19  
20 mental disorders;

21  
22 6) develop risk prediction tools for multiple aging-related disorders;

23  
24 7) generate health intervention and management strategies for aging-related  
25  
26  
27 disorders, especially for neurological and mental disorders.  
28  
29  
30  
31

## 32 **COHORT DESCRIPTION**

### 33 **The participants of the cohort**

34  
35  
36  
37 The Shenzhen Aging-Related Disorder Cohort was established between 2017 and  
38  
39  
40 2018 based on participants from 51 community health service centers in Luohu  
41  
42  
43 district of Shenzhen city, Guangdong province, China (Figure 1). The community  
44  
45  
46 health service center is the basic health administration unit located in each  
47  
48  
49 community, which is responsible for disease prevention, health care, promoting  
50  
51  
52 recovery in each stage of health-illness process, health education, family planning and  
53  
54  
55 medical treatment of all the population in the area under its jurisdiction. Firstly,  
56  
57  
58 among 11 districts of Shenzhen city, Luohu district was selected considering its  
59  
60  
61 similarity with Shenzhen city in terms of socioeconomic structure (Supplemental

1  
2  
3  
4 Table 1). Secondly, all 51 community health service centers in Luohu district were  
5  
6 included, which managed 24402 household registered permanent elderly residents  
7  
8 older than 60 years. Individuals with severe physical disabilities or mental disorders  
9  
10 which could affect daily activities or language communication were excluded through  
11  
12 checking the medical insurance for urban residents and the National Electronic  
13  
14 Disease Surveillance System considering that they could not response well to the  
15  
16 questionnaire investigation, clinical examination and further follow-ups. Then, all  
17  
18 household registered permanent elderly residents aged at least 60 years old and  
19  
20 without severe physical or mental disorders (n=16843) of the selected community  
21  
22 health service centers were invited to participate in the study. Approximately 56%  
23  
24 (n=9411) agreed and provided signed informed consent, but 44% of the local  
25  
26 residents refused the invitation due to unwillingness to spent time on the  
27  
28 epidemiological investigation or less attraction for them or they had finished the  
29  
30 physical examination in early 2017. Although the age distribution of our cohort was  
31  
32 comparable with that of Shenzhen city, the current cohort had higher proportion of  
33  
34 females when compared with the elderly permanent residents in Luohu district or  
35  
36 Shenzhen city (Supplemental Table 2). All participants were asked to bring their  
37  
38 unique national identity cards for questionnaire investigation and physical  
39  
40 examination in local health centers or hospitals. Considering the annual increase of  
41  
42 4000 adults aged 60 years or older in above mentioned community health service  
43  
44 centers between 2016 and 2018, the cohort will be expanded by recruiting 2000 new  
45  
46 entrants from the same community health services from Luohu district every year  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 until 2028. The data collection of the cohort will be ended until 2030. The study has  
5  
6 been approved by the Review Board of Shenzhen Center for Disease Control and  
7  
8 Prevention.  
9

### 10 11 **Epidemiological investigation**

12  
13  
14 The epidemiological data were collected through face-to-face interviews by health  
15  
16 professionals. A semi-structured questionnaire was designed to collect demographic  
17  
18 information (name, identity card, gender, birthday, education level, marital status,  
19  
20 native place, occupation, housing condition, annual family income, etc.), commuting  
21  
22 tools, lifestyle (such as food intake, active and passive smoking status, alcohol  
23  
24 consumption, physical activity, cooking and sleep habits), histories of chronic  
25  
26 diseases (including hypertension, dyslipidemia, coronary heart disease, stroke,  
27  
28 diabetes mellitus, cancer, neurological and mental disorders), medication history,  
29  
30 family histories of aforementioned chronic diseases, and reproductive history (women  
31  
32 only). After the investigation, trained investigators checked the integrity and logical  
33  
34 errors of each questionnaire. The missing information was entered and logical errors  
35  
36 were corrected by further telephone investigation. Data from each questionnaire were  
37  
38 entered into computer by two integrators independently using Epidata software  
39  
40 (version 3.1). All information was double-checked for the validity. Data items of the  
41  
42 questionnaire query are summarized as Table 1.  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53

54 **Table 1 Summary of studied items at baseline in the Shenzhen Aging-Related**  
55 **Disorder Cohort**

56 Categories	57 Measurements
58 Demographics and 59 socioeconomics	60 Birthday, gender, residential address, race, birth place, education level, marital status, occupation, housing

	condition, and family yearly income
Lifestyles	Consumption frequencies of major food groups and drinks, active and passive smoking status, alcohol intake, physical activity, sleep habits, and cooking habits
Medical histories	Histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease
	Use of health services and taking medicines in the past 2 weeks
Family histories of diseases	Family histories of hypertension, dyslipidemia, coronary heart disease, stroke, diabetes mellitus, cancers, chronic bronchitis, asthma, pulmonary tuberculosis, chronic hepatitis, nephritis, arthritis, osteoporosis, migraine, epilepsy, depression, Alzheimer's disease, and Parkinson's disease
Reproductive history (for women)	Histories of pregnancy and delivery, menopause status, and history of taking contraceptive pills
Clinic analysis of blood and urine	Blood routine examination, fasting plasma glucose, total cholesterol, triglycerides, low density lipoprotein cholesterol, high density lipoprotein cholesterol, alanine aminotransferase, glycated hemoglobin and homocysteine, creatinine, uric acid, urea nitrogen, tumor biomarkers, EB virus antibody, glycated hemoglobin A1c, homocysteine
	Urine glucose, urine bilirubin, urine acetone bodies, urine specific gravity, pH, urinary protein, urobilinogen, urine nitrite, urine white blood cell, urine occult blood
	Urine metals [lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead]
	Urine nicotine and its metabolite [nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl)butanoic Acid Dicyclohexylamine Salt]
Parameters of	Height, weight, blood pressure, electrocardiogram, chest



clinical measurements and imaging	X-ray, color doppler ultrasound of liver, gallbladder, spleen, pancreas, kidney, bladder, ureter and prostate (men only), bone mineral density
Assessments of neurological function and activities of daily living	Basal metabolic rate, body mass index, circumference of neck, chest, waist, hip, biceps and thigh, total body fat, percentage of body fat, visceral fat level, fat free mass, lean muscle mass, skeletal muscle, total body water, intracellular water, extracellular water, body protein, body minerals, body cell count, bio-electrical impedance Mini-Cog, Mini-mental State Examination (MMSE), Center for Epidemiologic Studies Depression Scale (CES-D), Activities of Daily Living Scale (ADLS), Social Support Rating Scale (SSRS), Pittsburgh Sleep Quality Index (PSQI)

### **Assessments of neurological function and activities of daily living**

Standardized scales were applied to estimate cognitive function, depression status, functional disability, social support and sleep quality. The Mini-Cog, a 5-point scale combining three-item recall and Clock Drawing Test<sup>19</sup> was used as preliminary screening instrument for mild cognitive impairment. For those who got 4 or less scores of Mini-Cog, further Chinese version of the Mini-mental State Examination (MMSE) was applied to classify them into two groups [ $\geq 24$  points and  $< 24$  points].<sup>20</sup> The validity and reliability of the Chinese MMSE have been verified previously<sup>16</sup>. The Center for Epidemiologic Studies Depression Scale (CES-D) was applied to estimate the depression status of each participant. To favor international comparisons, we used the cutoff of 16 or more out of a total of 60 points to define the prevalence of depression.<sup>21,22</sup> The Lawton-Brody Activities of Daily Living Scale (ADLS) combining basic (ability to toilet, feed, dress, groom, bathe and walk) and instrumental (ability to shop, prepare food, perform housekeeping, wash laundry, arrange transport, administer medication, use a telephone and manage finances) scales

1  
2  
3  
4 was used to assess functional disability of each participant. The participants with  
5  
6 higher ADLS scores (ranging from 14-64) exhibit worse independence.<sup>23</sup> The  
7  
8 Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven  
9  
10 component scores, was applied to assess the sleep quality of all participants.<sup>24</sup> The  
11  
12 participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality.  
13  
14 The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of  
15  
16 the social support, namely subjective support (emotional support, four items),  
17  
18 objective support (tangible support, three items) and availability support (three items).  
19  
20 Higher SSRS scores represent a better social support. The validity and reliability of  
21  
22 SSRS have been verified previously.<sup>25</sup>  
23  
24  
25  
26  
27  
28  
29

### 30 **Clinic analysis of blood and urine**

31  
32 After at least 8 hours of overnight fasting, venous blood samples from each  
33  
34 participant were separately collected into the EDTA anticoagulant tubes (one 2-ml  
35  
36 and one 5-ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2  
37  
38 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room  
39  
40 temperature to separate plasma and serum. The serum samples were used for  
41  
42 biochemical analyses, including fasting blood glucose, blood lipid, hepatic function,  
43  
44 kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers and  
45  
46 Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used  
47  
48 for blood routine test, including the total number of white blood cell (WBC), red  
49  
50 blood cell counts (RBC), hemoglobin contents and blood platelet counts. The detailed  
51  
52 biochemical indexes of blood are listed in Supplemental Table 3. The  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 EDTA-anticoagulated whole blood (0.3 ml) and plasma specimens (1 ml) were used  
5  
6 for DNA and RNA extractions, and analysis of glycated hemoglobin A1c (HbA1c)  
7  
8 and homocysteine (HCY), respectively.  
9

10  
11 Additionally, an early spot morning urine sample (8 ml) was collected from each  
12  
13 participant for urine routine examination, urinary concentrations of 24 metals as well  
14  
15 as nicotine and its 10 metabolites. The detailed biochemical indices of urine are listed  
16  
17 in Supplemental Table 3. The resting blood and urine specimens were stored at -80°C  
18  
19 and -20°C refrigerators, respectively. Flow diagram of collections and separations for  
20  
21 blood and urine samples is shown as Figure 2.  
22  
23  
24  
25

### 26 27 **Parameters of clinical measurements and imaging**

28  
29 Each participant took part in the physical examination conducted by trained  
30  
31 physicians in the district hospital. The inspection-palpation-percussion-auscultation  
32  
33 (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity,  
34  
35 oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The  
36  
37 measurements of baseline anthropometric indices for each participant were performed  
38  
39 on the day of physical examination. Standing height, weight and waist were measured  
40  
41 with the subjects in light clothing and without shoes by ultrasonic weighing apparatus  
42  
43 (HNN-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse  
44  
45 rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300,  
46  
47 OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the  
48  
49 right arm supported at heart-level. Statistical analysis was based on the average of the  
50  
51 two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray,  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4 abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas,  
5  
6 urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate  
7  
8  
9 B-type ultrasound inspection (only for males) and bone mineral density scan were  
10  
11 then conducted. Out of 9411 participants, 3292 took part in the body composition  
12  
13 measurements. The visceral fat and fluid imbalances in each segment of the body and  
14  
15 the phase angle for cellular indicator of cell integrity were measured by bioelectrical  
16  
17 impedance analysis using an Inbody 570 body composition analyzer (Biospace, Seoul,  
18  
19 Korea). The body segments were analyzed, including elementary body composition  
20  
21 [body weight, body mass index (BMI), protein mass and minerals mass], total body  
22  
23 water (TBW) analysis [intracellular water, extracellular water (ECW) and  
24  
25 ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total  
26  
27 body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb  
28  
29 circumferences, waist-to-hip ratio, visceral fat area and visceral fat level) and basal  
30  
31 metabolic rate.  
32  
33  
34  
35  
36  
37  
38  
39

40 The instruments used for the physical examination and the body composition  
41  
42 measurements are listed as Supplemental Table 4.  
43  
44

#### 45 **The follow-up procedure**

46  
47  
48 Follow-up will be conducted every 5 years to update exposures and outcomes by the  
49  
50 staffs in the community health service centers, who have established good relationship  
51  
52 with the elderly during daily disease prevention, treatment and recovery to reduce the  
53  
54 potential impact of losses to follow up on the validity of the study result. An annual  
55  
56 health education on aging-related disorders will be provided by Shenzhen Center for  
57  
58  
59  
60

1  
2  
3  
4 Disease Control and Prevention, and the daily medical consultation will be provided  
5  
6 by the community health service centers for the participants to assure the retention of  
7  
8 the participants. The questionnaire survey, physical examination, the body  
9  
10 composition measures, and neurological function and mental health assessments will  
11  
12 be re-conducted during the follow-up. Blood and urine specimens will be collected  
13  
14 according to the design procedures at baseline. The incidence of non-communicable  
15  
16 chronic diseases, including neurological and mental disorders, hypertension,  
17  
18 dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other  
19  
20 aging-related diseases will be annually verified through searching the IDs of  
21  
22 participants of the cohort, which were collected during the baseline questionnaire  
23  
24 interviews in the medical insurance for urban residents, the National Electronic  
25  
26 Disease Surveillance system and the National Mortality Surveillance System. The  
27  
28 disease reports will be extracted manually. For those presenting low MMSE score  
29  
30 (less than 24 points) at baseline or significant decline of cognition in MMSE but  
31  
32 without diagnosis of mental or neurological disorders from the medical insurance for  
33  
34 urban residents or the National Electronic Disease Surveillance System, the clinical  
35  
36 diagnosis of mental disorders will be further performed by an expert panel from  
37  
38 Shenzhen Luohu Hospital Group.  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49

50 All death cases will be verified by Chinese Cause of Death Registration System  
51  
52 in Shenzhen Center for Disease Control and Prevention. The diagnosis of  
53  
54 aforementioned conditions and the causes of death will be classified according to the  
55  
56 10<sup>th</sup> version of the International Statistical Classification of Diseases (ICD-10). The  
57  
58  
59  
60

1  
2  
3  
4 flow diagram of the cohort design is presented as Figure 3. The anticipated rate of  
5  
6 attrition is no more than 15% until the end of 2030.  
7  
8

### 9 **Patient and public involvement**

10  
11 Participants were not involved in the development of study design or conduct.

12  
13  
14 However, each participant received a health report of their examinations and tests.  
15  
16  
17

## 18 **FINDINGS TO DATE**

19  
20 A total of 9411 people were recruited into the Shenzhen Aging-Related Disorder  
21  
22 Cohort. The participants were from 33 provinces, municipalities directly under the  
23  
24 Central Government and autonomous regions of China (except for Tibet Autonomous  
25  
26 Region). Among them, 48.65% of the cohort participants were from the outside areas  
27  
28 of Guangdong province (Shenzhen city, a city of Guangdong) (Figure 4). The age of  
29  
30 participants ranged from 60 to 92 years at baseline. Among all participants, 42.74 %  
31  
32 were males. The distributions of race, education levels, marital status, and exposures  
33  
34 to occupational hazards and kitchen fumes are shown in Table 2. The baseline  
35  
36 lifestyle and diet habits of participants are presented in Table 3. The significant  
37  
38 differences in the demographics and lifestyle between males and females were  
39  
40 observed. Males were more likely to have higher education level, possess the habits of  
41  
42 smoking, drinking, taking afternoon nap, and drinking tea, be physically active, and  
43  
44 have worse sleep quality (all  $P<0.05$ ) (Tables 2 and 3).  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 2 Baseline characteristics of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4022)	Female (n=5389)	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.73±5.41	68.38±5.59	67.24±5.23	10.12	<0.0001
Age groups (years, n, %)				89.80	<0.0001
60 - 64	3142 (33.39)	1167 (29.02)	1975 (36.65)		
65 - 69	3274 (34.79)	1399 (34.78)	1875 (34.79)		
70 - 74	1818 (19.32)	848 (21.08)	970 (18.00)		
≥75	1177 (12.51)	608 (15.12)	569 (10.56)		
Race (n, %)				6.88	0.03
Han Chinese	8577 (91.14)	3684 (91.60)	4893 (90.80)		
Other ethnic groups	57 (0.61)	15 (0.37)	42 (0.78)		
Missing	777 (8.26)	323 (8.03)	454 (8.42)		
Migration time to Shenzhen (n, %)				65.89	<0.0001
<1950	1450 (15.41)	554 (13.77)	896 (16.63)		
1950-	404 (4.29)	174 (4.33)	230 (4.27)		
1970-	3735 (39.69)	1722 (42.81)	2013 (37.35)		
1990-	2661 (28.28)	1022 (25.41)	1639 (30.41)		
2010-	729 (7.75)	365 (9.08)	364 (6.75)		
Missing	432 (4.59)	185 (4.60)	247 (4.58)		
Education level (n, %)				571.31	<0.0001
Primary school or illiteracy	1637 (17.39)	390 (9.70)	1247 (23.14)		
Middle school	2564 (27.24)	934 (23.22)	1630 (30.25)		
High school	3143 (33.40)	1450 (36.05)	1693 (31.42)		
University or college or higher	1977 (21.01)	1210 (30.08)	767 (14.23)		
Missing	90 (0.96)	38 (0.94)	52 (0.96)		
Marital status (n, %)				419.31	<0.0001
Single	37(0.39)	13(0.32)	24(0.45)		
Married	8045 (85.49)	3762 (93.54)	4283 (79.48)		
Widowed	1023 (10.87)	147 (3.65)	876 (16.26)		

Divorced	119 (1.26)	26 (0.65)	93 (1.73)		
Cohabited	2 (0.02)	0	2 (0.04)		
Remarried	9 (0.10)	7 (0.17)	2 (0.04)		
Missing	176 (1.87)	67 (1.67)	109 (2.02)		
Family yearly income (yuan, n, %)				32.87	<0.0001
<40,000	306 (3.25)	87 (2.16)	219 (4.06)		
40,000 -	857 (9.11)	339 (8.43)	518 (9.61)		
80,000 -	1401 (14.89)	626 (15.56)	775 (14.38)		
120,000 -	1951 (20.73)	852 (21.18)	1099 (20.39)		
≥160,000	4114 (43.71)	1787 (44.43)	2327 (43.18)		
Missing	782 (8.31)	331 (8.23)	451 (8.37)		
Exposure to occupational hazards**				127.85	<0.0001
Yes	1563 (16.61)	834 (20.74)	729 (13.53)		
No	5361 (56.97)	2309 (57.41)	3052 (56.63)		
Missing	2487 (26.43)	879 (21.85)	1608 (29.84)		
Exposure to kitchen fumes (n, %)				1104.43	<0.0001
Yes	6284 (66.77)	1943 (48.31)	4341 (80.55)		
No	2975 (31.61)	2017 (50.15)	958 (17.78)		
Missing	152 (1.62)	62 (1.54)	90 (1.67)		
Menolipsis (n=5233, %)		-	5230 (99.94)		
Parturition (n=5233, times)		-	2.02±1.04		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and categorical variables, respectively.

\*\*Occupational hazards included high temperature, noise, radiation, metal, dust, organic solvent, and farm chemical.



**Table 3 Baseline lifestyle and diet habits of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total (n=9411)	Male (n=4041)	Female (n=5370)	t/x <sup>2</sup> *	P
Smoking status (n, %)				2994.95	<0.0001
Never smoker	7449 (79.15)	2129 (52.93)	5320 (98.72)		
Former smoker	974 (10.35)	961 (23.89)	13 (0.24)		
Current smoker	926 (9.84)	904 (22.48)	22 (0.41)		
Missing	62 (0.66)	28 (0.70)	34 (0.63)		
Passive smoker (n, %)				419.58	<0.0001
Yes	1054 (11.20)	144 (3.58)	910 (16.89)		
No	8282 (88.00)	3830 (95.23)	4452 (82.61)		
Missing	75 (0.80)	48 (1.19)	27 (0.50)		
Drinking status (n, %)				1383.99	<0.0001
Never drinker	7998 (84.99)	2794 (69.47)	5204 (96.57)		
Former drinker	247 (2.62)	227 (5.64)	20 (0.37)		
Current drinker	1104 (11.73)	976 (24.27)	128 (2.38)		
Missing	62 (0.66)	25 (0.62)	37 (0.69)		
Afternoon nap (n, %)				30.79	<0.0001
Yes	7020 (74.59)	3116 (77.47)	3904 (72.44)		
No	2301 (24.45)	871 (21.66)	1430 (26.54)		
Missing	90 (0.96)	35 (0.87)	55 (1.02)		
Sleep duration at night (n=9185, hours/day, mean±SD)	7.45±1.11	7.49±1.13	7.43±1.10	2.34	0.02
Pittsburgh Sleep Quality Index (n=7772, mean±SD)	4.20±2.61	3.84±2.41	4.46±2.72	-10.50	<0.0001
Physical activity (n, %)				80.11	<0.0001
Yes	7588 (80.63)	3411 (84.81)	4177 (77.41)		
No	1749 (18.58)	581 (14.45)	1168 (21.98)		
Missing	74 (0.79)	30 (0.75)	44 (0.82)		
Rice (n=9259, times/day, mean±SD)	1.98±0.65	2.00±0.65	1.96±0.65	3.04	0.002
Wheat (n=9224, times/day, mean±SD)	0.79±0.57	0.78±0.57	0.80±0.57	-2.24	0.03
Coarse grain (n=9241, times/week, mean±SD)	5.08±3.28	4.88±3.35	5.22±3.22	-4.80	<0.0001

Vegetables (n=9267, times/day, mean±SD)	1.62±0.71	1.60±0.72	1.63±0.71	-1.81	0.07
Fruit (n=9256, times/day, mean±SD)	0.95±0.50	0.92±0.51	0.97±0.50	-4.68	<0.0001
Meat (n=9258, times/day, mean±SD)	1.00±0.60	1.03±0.61	0.98±0.60	4.17	<0.0001
Fish (n=9240, times/week, mean±SD)	3.12±3.33	3.22±3.41	3.04±3.27	2.53	0.01
Shrimp/shell (n=9204, times/week, mean±SD)	1.20±3.04	1.29±3.14	1.12±2.95	2.59	0.009
Egg (n=9263, times/week, mean±SD)	5.51±2.64	5.52±2.65	5.50±2.63	0.39	0.70
Milk (n=9256, times/week, mean±SD)	3.52±3.23	3.34±3.19	3.66±3.25	-4.68	<0.0001
Bean (n=9225, times/week, mean±SD)	2.31±2.52	2.36±2.60	2.27±2.46	1.69	0.09
Pickle (n=9267, times/week, mean±SD)	1.10±2.20	1.08±2.14	1.11±2.25	-0.63	0.53
Processed meat (n=9266, times/week, mean±SD)	0.25±1.01	0.24±0.94	0.26±1.06	-0.93	0.35
Green tea (n, %)				612.93	<0.0001
Yes	3348 (35.58)	1999 (49.70)	1349 (25.63)		
No	5760 (61.20)	1912 (47.54)	3848 (71.49)		
Missing	303 (3.22)	111 (2.76)	192 (3.56)		
Black tea (n, %)				253.99	<0.0001
Yes	1741 (18.50)	1040 (25.88)	700 (12.99)		
No	7331 (77.90)	2847 (70.79)	4484 (83.21)		
Missing	339 (3.60)	134 (3.33)	205 (3.80)		
Coffee (n, %)				3.21	0.20
Yes	144 (1.53)	72 (1.79)	72 (1.34)		
No	8872 (94.27)	3784 (94.08)	5088 (94.43)		
Missing	395 (4.20)	166 (4.13)	229 (4.25)		
Juice (n, %)				0.40	0.82
Yes	47 (0.50)	18 (0.45)	29 (0.54)		
No	8970 (95.31)	3837 (95.40)	5133 (95.25)		
Missing	394 (4.19)	167 (4.15)	227 (4.21)		

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and for the categorical variables, respectively.

1  
2  
3  
4 The baseline levels of of participants in the Shenzhen Aging-Related Disorder  
5  
6 Cohort were detected, including blood routine, lipid levels, blood glucose,  
7  
8 homocysteine, hepatic function, kidney function, tumor biomarkers, Epstein-Barr  
9  
10 Virus (EBV) antibody and urine routine. The detailed items are provided as  
11  
12 Supplemental Table 3. With the exception of the parameters (including aspartate  
13  
14 aminotransferase (AST), EB Virus status, carcino-embryonic antigen (CEA), alpha  
15  
16 fetoprotein (AFP) and urine bilirubin), other indices presented significant difference  
17  
18 between both sexes (all  $P < 0.05$ , Tables 4 and 5).  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**Table 4 Baseline levels of blood biochemical traits of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
<b>Blood routine</b>					
WBC (n=9377, × 10 <sup>9</sup> /l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.50	13.48	<0.0001
RBC (n=9377, × 10 <sup>12</sup> /l, mean±SD)	4.60±0.50	4.80±0.51	4.45±0.49	35.59	<0.0001
Hemoglobin (n=9377, g/dl, mean±SD)	13.74±1.27	14.52±1.20	13.15±0.97	59.52	<0.0001
Platelet count (n=9377, × 10 <sup>9</sup> /l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
<b>Lipid levels</b>					
TCHO (n=9376, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.00	-23.50	<0.0001
TCHO ≥5.18 mmol/L (n, %)	5732 (61.13)	2019 (50.67)	3703 (68.93)	321.83	<0.0001
TG (n=9376, mmol/l, mean±SD)	1.64±1.08	1.56±1.08	1.70±1.07	-6.24	<0.0001
TG ≥1.7 mmol/L (n, %)	3232 (34.47)	1226 (30.62)	2006 (37.34)	45.90	<0.0001
HDL-C (n=9376, mmol/l, mean±SD)	1.54±0.37	1.44±0.34	1.63±0.33	-25.85	<0.0001
HDL-C <1.0 mmol/L (n, %)	349 (3.72)	256 (6.39)	93 (1.73)	139.16	<0.0001
LDL-C (n=9376, mmol/l, mean±SD)	3.13±0.85	3.00±0.83	3.22±0.80	-12.65	<0.0001
LDL-C ≥3.37 mmol/L (n, %)	3633 (38.63)	1296 (32.37)	2326 (43.30)	115.62	<0.0001
Fasting blood glucose (n=9366, mmol/l, mean±SD)	6.17±1.78	6.22±1.84	6.13±1.70	2.59	0.01
Fasting blood glucose value ≥7.0 mmol/l (%)	1561 (16.67)	716 (17.90)	845 (15.75)	7.59	0.006
HbA1c (n=6487, %, mean±SD)	6.27±1.06	6.31±1.14	6.24±0.99	2.32	0.02
HCY (n=6488, μmol/l, mean±SD)	15.14±6.75	17.42±7.52	13.47±5.66	23.25	<0.0001
<b>Hepatic function</b>					
Total protein (n=9378, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.02	-8.42	<0.0001
Abnormal total protein (n, %)	33 (0.35)	9 (0.22)	24 (0.26)	3.23	0.07
Total bilirubin (n=9378, μmol/l, mean±SD)	15.55±5.06	16.34±5.60	14.97±4.63	12.71	<0.0001
Abnormal total bilirubin (n, %)	3036 (32.37)	1562 (38.99)	1474 (27.44)	139.90	<0.0001
Albumin (n=9378, g/l, mean±SD)	44.55±2.06	44.68±2.09	44.46±2.03	5.05	<0.0001
Abnormal albumin (n, %)	77 (0.82)	41 (1.02)	36 (0.67)	3.50	0.06
ALT (n=9378, U/l, mean±SD)	21.93±19.53	22.70±14.29	21.35±22.65	3.52	0.0004
Abnormal ALT (n, %)	619 (6.60)	283 (7.06)	336 (6.25)	2.44	0.12

AST (n=9378, U/l, mean±SD)	22.07±12.27	21.88±9.22	22.21±14.12	-1.38	0.17
Abnormal AST (n, %)	310 (3.31)	108 (2.70)	202 (3.72)	8.14	0.004
<b>Kidney function</b>					
Blood urea nitrogen (n=9369, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.46	11.769	<0.0001
Creatinine (n=9369, µmol/l, mean±SD)	80.03±24.11	93.36±26.30	70.10±16.37	49.30	<0.0001
Uric acid (n=9369, µmol/l, mean±SD)	373.79±90.64	408.49±88.68	347.93±83.14	33.58	<0.0001
EB Virus (n, %)				0.60	0.74
Negative	9354 (99.39)	3997 (99.38)	5357 (99.41)		
Positive	19 (0.20)	7 (0.17)	12 (0.22)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		
CEA (n, %)					0.68**
Negative	9367 (99.53)	4001 (99.48)	5366 (99.57)		
Positive	7 (0.07)	4 (0.10)	3 (0.06)		
Missing	37 (0.39)	17 (0.42)	20 (0.37)		
AFP (n, %)				0.94	0.62
Negative	9364 (99.50)	3999 (99.43)	5365 (99.55)		
Positive	9 (0.09)	5 (0.12)	4 (0.07)		
Missing	38 (0.40)	18 (0.45)	20 (0.37)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoprotein cholesterol; LDL-C, low density lipoprotein cholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

**Table 5 Baseline levels of urine indices of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Urine glucose (n, %)				76.90	<0.0001
Negative	8862 (94.17)	3696 (91.89)	5166 (95.86)		
Positive/suspected positive	469 (4.98)	292 (7.26)	177 (3.22)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine bilirubin (n, %)				2.08	0.35
Negative	9198 (97.74)	3923 (97.54)	5275 (97.88)		
Positive/suspected positive	133 (1.41)	65 (1.62)	68 (1.26)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine acetone bodies (n, %)				5.55	0.06
Negative	9244 (98.23)	3940 (97.96)	5304 (98.42)		
Positive/suspected positive	87 (0.92)	48 (1.19)	39 (0.72)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine specific gravity (n=9331, mean±SD)	1.02±0.01	1.02±0.01	1.02±0.01	3.28	0.001
Urinary protein (n, %)				18.46	<0.0001
Negative	7997 (84.98)	3346 (83.19)	4651 (86.31)		
Positive/suspected positive	1334 (14.17)	643 (15.91)	691 (12.87)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urobilinogen (n, %)				33.40	<0.0001
Negative	9186 (97.61)	3891 (96.74)	5295 (98.26)		
Positive/suspected positive	143 (1.52)	95 (2.36)	48 (0.89)		
Missing	82 (0.87)	36 (0.90)	46 (0.85)		
Urine nitrite (n, %)				116.02	<0.0001
Negative	9080 (96.48)	3964 (98.56)	5116 (94.93)		
Positive/suspected positive	251 (2.67)	24 (0.60)	225 (4.21)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine white blood cell (n, %)				874.22	<0.0001
Negative	7406 (78.70)	3737 (92.91)	3669 (68.08)		

Positive/suspected positive	1925 (20.45)	251 (6.24)	1674 (31.06)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		
Urine occult blood (n, %)				263.04	<0.0001
Negative	6803 (72.29)	3252 (80.86)	3551 (65.89)		
Positive/suspected positive	2528 (26.86)	736 (18.30)	1792 (33.25)		
Missing	80 (0.85)	34 (0.85)	46 (0.85)		

AFP, alpha fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen; HbA1c, glycated hemoglobin; HCY, homocysteine; HDL-C, high density lipoproteincholesterol; LDL-C, low density lipoproteincholesterol; RBC, red blood cell count; SD, standard deviation; SUA, serum uric acid; TCHO, total cholesterol; TG, triglycerides; WBC, white blood cell count.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Fisher exact test was used.

1  
2  
3  
4 Table 6 presents the baseline levels of clinical measurement parameters of  
5  
6 participants in the Shenzhen Aging-Related Disorder Cohort, including blood  
7  
8 pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler  
9  
10 ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary  
11  
12 system, color doppler ultrasound of prostate, bone mineral density. Owing to the  
13  
14 relatively long waiting time, less interest and attention for their body components,  
15  
16 only 34.98% (3292 of 9411) of the participants completed the measurements of body  
17  
18 component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total  
19  
20 body water, intracellular water, extracellular water, body fat mass, percentage of body  
21  
22 fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody  
23  
24 score. All clinical parameters presented significant difference between men and  
25  
26 women (all  $P<0.05$ ). With the exception of age, sex, the prevalence of  
27  
28 overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as  
29  
30 the other characteristics were comparable between individuals with and without body  
31  
32 component data at baseline (Supplemental Table 5).  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



**Table 6 Baseline levels of clinical measurement parameters of participants in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t/x <sup>2</sup> *	P
Blood pressure (mmHg, mean±SD)					
Systolic blood pressure (n=9330)	138.47±19.42	137.19±18.74	139.43±19.96	-5.37	<0.0001
Diastolic blood pressure (n=9330)	77.35±10.72	79.23±10.69	75.93±10.52	14.82	<0.0001
Pulse rate (n=6681, times/min)	75.32±11.39	74.61±11.58	75.85±11.21	-4.43	<0.0001
Electrocardiogram(n, %)				7.40	0.02
Normal	4995 (53.08)	2073 (51.54)	2922 (54.22)		
Abnormal	4347 (46.19)	1915 (47.61)	2432 (45.13)		
Missing	69 (0.73)	34 (0.85)	35 (0.65)		
Chest X-ray				5.46	0.07
Normal	1911 (20.31)	813 (20.21)	1098 (20.37)		
Abnormal	7291 (77.47)	3136 (77.97)	4155 (77.10)		
Missing	209 (2.22)	73 (1.82)	136 (2.53)		
Color doppler ultrasound of liver/ gallbladder/ spleen/				17.02	0.007
Normal	3678 (39.08)	1559 (38.76)	2119 (39.32)		
Abnormal	5655 (60.09)	2416 (60.07)	3239 (60.10)		
Uncertainty/Missing**	78 (0.83)	47 (1.17)	31 (0.58)		
Color doppler ultrasound of urinary system (n, %)				267.05	<0.0001
Normal	6026 (64.03)	2305 (57.31)	3721 (69.05)		
Abnormal	2775 (29.49)	1533 (38.12)	1242 (23.05)		
Uncertainty/Missing**	610 (6.48)	184 (4.57)	426 (7.90)		
Color doppler ultrasound of prostate (n=4022, %)					
Normal		1139 (28.32)	-		
Abnormal		2770 (68.87)	-		
Uncertainty/Missing**		113 (2.81)	-		
Bone mineral density (n, %)				583.26	<0.0001
Normal	1395 (14.82)	1003 (24.94)	392 (7.29)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio ( <b>n=3292</b> , mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate ( <b>n=3292</b> , kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water ( <b>n=3292</b> , k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water ( <b>n=3292</b> , L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water ( <b>n=3292</b> , L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass( <b>n=3292</b> ,kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.44	-10.25	<0.0001
Percentage of body fat ( <b>n=3292</b> , %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.55	-40.37	<0.0001
Fat free mass( <b>n=3292</b> ,Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.84	68.92	<0.0001
Skeletal muscle( <b>n=3292</b> ,Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM( <b>n=3292</b> ,Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.44	69.54	<0.0001
Body protein( <b>n=3292</b> ,kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.77	69.62	<0.0001
Body minerals( <b>n=3292</b> ,kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.27	55.68	<0.0001
InBody score( <b>n=3292</b> , mean±SD)	69.05±4.92	68.15±5.16	69.67±4.75	-8.50	<0.0001

SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

\*\*Uncertainty was caused by unsatisfied examination conditions.

1  
2  
3 Table 7 shows the prevalences of main non-communicable chronic diseases,  
4 including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia,  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

Table 7 shows the prevalences of main non-communicable chronic diseases, including overweight/obesity, hypertension, diabetes mellitus, dyslipidemia, chronic bronchitis, COPD, Asthma, tuberculosis, angina, myocardial infarction, coronary heart disease, stroke, cancer, arthritis, Chronic hepatitis, arthritis, migraine, nephritis, Alzheimer's disease, Parkinson's disease and brain injury. The assessments of mental health based on Mini-mental State Examination (MMSE) and Center for Epidemiologic Studies Depression Scale (CES-D), activities based on Activities of Daily Living Scale (ADLS), and social support based on Social Support Rating Scale (SSRS) were also provided in Table 7. Except for asthma, tuberculosis, angina, coronary heart disease, chronic hepatitis, nephritis, Alzheimer's disease, brain injury, MMSE score, depression status and ADL as well as other health related outcomes presented significant difference between males and females (all  $P < 0.05$ ).

**Table 7 The prevalence of the common non-communicable disorders in the Shenzhen Aging-Related Disorder Cohort**

Variables	Total	Male	Female	t <sup>2</sup> *	P
Overweight/Obesity <sup>a</sup> (n=9307, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	1.96	0.01
Hypertension <sup>b</sup> (n=9374, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus <sup>c</sup> (n=9340, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	20.39	0.001
Dyslipidemia <sup>d</sup> (n=9377, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	229.42	<0.0001
Chronic bronchitis <sup>e</sup> (n=9354, %)	136 (1.45)	71 (1.78)	65 (1.21)	0.09	0.02
COPD <sup>e</sup> (n=9357, %)	18 (0.19)	12 (0.30)	6 (0.11)	0.23	0.04
Asthma <sup>e</sup> (n=9356, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis <sup>e</sup> (n=9315, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina <sup>e</sup> (n=9311, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction <sup>e</sup> (n=9312, %)	51 (0.55)	35 (0.88)	16 (0.30)	1.07	0.0002
Coronary heart disease <sup>e</sup> (n=9315, %)	530 (5.69)	239 (6.01)	291 (5.45)	0.33	0.25
Stroke <sup>e</sup> (n=9309, %)	102 (1.10)	57 (1.43)	45 (0.84)	0.30	0.007
Cancer <sup>e</sup> (n=9303, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis <sup>e</sup> (n=9311, %)	47 (0.50)	24 (0.60)	23 (0.43)	0.35	0.24
Arthritis <sup>e</sup> (n=9308, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine <sup>e</sup> (n=9311, %)	58 (0.62)	16 (0.40)	42 (0.79)	0.47	0.02
Nephritis <sup>e</sup> (n=9312, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease <sup>e</sup> (n=9309, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease <sup>e</sup> (n=9309, %)	21 (0.23)	13 (0.33)	8 (0.15)	0.23	0.08
Brain injury <sup>e</sup> (n=9267, %)	533 (5.75)	227 (5.74)	306 (5.76)	0.001	0.97
MMSE score < 24 (n=8678, %)	468 (5.39)	205 (5.42)	263 (5.37)	0.01	0.92
Depression status <sup>f</sup> (n=9243, %)	303 (3.28)	111 (2.81)	192 (3.63)	0.67	0.06
ADL (n=9240, scores, mean±SD)	14.15±1.58	14.16±1.73	14.14±1.44	0.78	0.43
SSRS (n=8117, score, mean±SD)	39.54±7.89	39.17±7.90	39.83±7.88	0.75	0.0002

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

1  
2  
3  
4  
5 <sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

6 <sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq 90$  mmHg and / or systolic blood pressure (SBP)  $\geq 140$  mmHg, or self-reported  
7 hypertension diagnosed by a physician, or taking antihypertension drugs.

8 <sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq 7.0$  mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or  
9 taking hypoglycemic agent or insulin.

10 <sup>d</sup> Dyslipidemia was defined as TCHO  $\geq 5.18$  mmol/L, or TG  $\geq 1.7$  mmol/L, or HDL-C  $< 1.0$  mmol/L, or LDL-C  $\geq 3.37$  mmol/L or self-reported  
11 hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

12 <sup>e</sup> The disease was defined as self-reported disease.

13 <sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46

### Strengths and limitations

This is the community-dwelling aging-related disorder cohort with main focus on neurological and mental disorders. We comprehensively collected epidemiological data, clinical examination, environmental exposures, body components and biological samples in Chinese population, which will facilitate the identification of the causality of various aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. As an epitome of the areas with the rapid economic development and growth of immigrant population, Shenzhen reflects the aging process of population in cities with rapid economic development in China. The setting up of our cohort is able to provide more epidemiological evidence for the prevention and control of aging-related diseases in China, especially in those areas with upcoming booming economy. With the exception of routine follow-up by questionnaires, the incidence of aging-related diseases, especially neurological and mental disorders will be annually verified from the National Electronic Disease Surveillance System and National Mortality Surveillance System in Shenzhen Center for Disease Control and Prevention, which guarantees the integrity and validity of outcomes of interest in our cohort. Comprehensive measurement of internal exposures is another strength of our cohort. A total of 24 metals as well as nicotine and its metabolites in urine samples have been detected for all participants at baseline. Chronic risk assessment of exposure to environmental pollutants will be extended to pesticides in 2020. Compared with the previous cohorts, including China Kadoorie biobank<sup>26</sup>, the China Health and Retirement Longitudinal Study<sup>27</sup> and Chinese Longitudinal Healthy Longevity Survey<sup>28</sup>, the Shenzhen Aging-related disorder cohort might help to provide more epidemiological evidence for the causality of neurological and mental disorders through wide exploration of the

1  
2  
3 environmental exposures, such as lifestyle, metals, metabolite of tobacco and  
4 pesticide.  
5  
6

7  
8 However, there are some limitations of our cohort. First, although Luohu district  
9 is similar with Shenzhen city in socioeconomic structures among all 11 districts, there  
10 is inevitably some deviations, especially in age composition. However, the age  
11 structure in our cohort is comparable with that of the elderly in Shenzhen city. But our  
12 cohort has higher proportion of females, which may cause deviations of the  
13 demographic features for the whole study population. To reduce the potential bias, we  
14 presented all results by sex. Second, all participants are adults aged 60 years or older,  
15 then we could not have information on their early-life exposures. However, the high  
16 incidence of aging-related disorders in older adults in the context of rapid  
17 epidemiological transition will provide us with sufficient power for further analysis.  
18 Third, the medical histories of the participants in our cohort were self-reported. But  
19 the link between our cohort and disease surveillance system in Shenzhen Center for  
20 Disease Control and Prevention will guarantee the accuracy and reliability of the  
21 information. Fourth, only 3292 participants took part in the body components analysis  
22 at baseline. However, the selection bias tends to be small since most baseline  
23 characteristics are comparable between individuals with and without body component  
24 data (Supplemental Table 5). Fifth, recruitment of 9411 participants at baseline makes  
25 our sample size relatively smaller compared with other cohorts in the world. However,  
26 according to the study design, an annual 2000 new participants will be recruited to  
27 enlarge the cohort until 2028, which will ensure the statistical power for most  
28 association studies in the future.  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57

## 58 **Collaboration**

59  
60

1  
2  
3 The datasets generated and/or analyzed during the current study are not publicly  
4 available at this stage, but are available from the corresponding author on reasonable  
5 request from employees of a recognized academic institution, health service  
6 organization or charitable research organization with experience in medical research  
7 with the clear statement of their research interest, analysis proposal, data protection  
8 measures and corporation mechanisms. However, specific ideas and proposals for  
9 potential collaborations would be welcomed and invited to contact the corresponding  
10 authors via e-mail to L.J. [JLIUSZCDC@163.com] and Y. J.  
11 [jyuan@tjh.tjmu.edu.cn].  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25

## 26 **Abbreviations**

27  
28 MMSE, Mini-mental State Examination; CES-D, Center for Epidemiologic Studies  
29 Depression Scale; ADLS, Lawton-Brody Activities of Daily Living Scale; PSQI,  
30 Pittsburgh sleep quality index; SSRS, Social Support Rate Scale; TCHO, total  
31 cholesterol; TG, triglyceride; LDL-C, low density lipoprotein cholesterol; HDL-C,  
32 high density lipoprotein cholesterol; TB, total bilirubin; ALT, alanine  
33 aminotransferase; AST, aspartate aminotransferase; CEA, carcino-embryonic antigen;  
34 AFP, alpha fetoprotein; EBV, Epstein-Barr Virus; WBC, white blood cell; RBC, red  
35 blood cell counts; MPV, mean platelet volume; PDW, platelet distribution width; PLT,  
36 blood platelet quantity; P-LCR, platelet volume ratio and platelet large cell ratio;  
37 HbA1c, glycated hemoglobin A1c; HCY, homocysteine; IPPA,  
38 inspection-palpation-percussion-auscultation; ECG, electrocardiogram; BMI, body  
39 mass index; TBW, total body water; ECW, extracellular water.  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

## **Acknowledgments**



1  
2  
3 The study has received great support from Shenzhen center for disease control and  
4 prevention, Shenzhen Luohu Hospital for Traditional Chinese Medicine, and  
5 Shenzhen Luohu Center for Disease Control and Prevention. The manuscript has been  
6 edited for language by a native English Speaker Dr. Bin He. The contributions of all  
7 the working staffs and participants are greatly acknowledged.  
8  
9  
10  
11  
12  
13  
14  
15  
16

## 17 **Contributors**

18  
19  
20 JY and JL conceived of the study, participated in its design, coordinated the study and  
21 reviewed the manuscript for important intellectual content. LL and WL participated in  
22 the study design, collected data, drafted the manuscript and performed the descriptive  
23 data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XW, TL, EG, LZ, KH, YH,  
24 CY, QZ, FY and XY participated in data collection, helped drafted the manuscript and  
25 reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, FZ,  
26 TL, EG, FY and XY constructed the data base and JY and JL were responsible for  
27 data management. All authors read and approved the final manuscript.  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40

## 41 **Funding**

42  
43 This project is supported by Sanming Project of Medicine in Shenzhen  
44 [SZSM201611090], and Shenzhen Basic Research Plan for Medical Health  
45 [SZGW2018004, SZXJ2017013]. The funders have no role in the study design, data  
46 collection, analysis and interpretation as well as manuscript preparation and  
47 submission.  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57

## 58 **Competing interests**

1  
2  
3 The authors declare that they have no competing interests.  
4  
5  
6  
7

### 8 **Patient consent for publication** 9

10 Not required.  
11  
12  
13

### 14 **Ethics approval** 15

16 All participants agreed to join in the cohort and provide informed written consent. The  
17  
18 study has been approved by the Review Board of Shenzhen Center for Disease  
19  
20 Control and Prevention (approval numbers: R2017001 and R2018020).  
21  
22  
23  
24  
25  
26  
27

### 28 **Provenance and peer review** 29

30 Not commissioned; externally peer review.  
31  
32  
33  
34

### 35 **Data sharing statement** 36

37 The datasets generated and/or analysed during the current study are not publicly  
38  
39 available at this stage, but are available from the corresponding author on reasonable  
40  
41 request. However, specific ideas and proposals for potential collaborations would be  
42  
43 welcomed and invited to contact the corresponding authors via e-mail to L.J.  
44  
45 [JLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

**REFERENCES**

1. GBD 2017 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018;392:1859-922.
2. Foreman KJ, Marquez N, Dolgert A, et al. Forecasting life expectancy, years of life lost, and all-cause and cause-specific mortality for 250 causes of death: reference and alternative scenarios for 2016-40 for 195 countries and territories. *Lancet* 2018;392:2052-90.
3. GBD 2016 Disease and Injury Incidence and Prevalence Collaborators. Global, regional, and national incidence, prevalence, and years lived with disability for 328 diseases and injuries for 195 countries, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet* 2017;390:1211-59.
4. GBD 2016 Lifetime Risk of Stroke Collaborators, Feigin VL, Nguyen G, Cercy K, et al. Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016. *N Engl J Med* 2018;379:2429-37.
5. Global Burden of Disease Cancer Collaboration, Fitzmaurice C, Akinyemiju TF, Alam T, et al. Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-Years for 29 Cancer Groups, 1990 to 2016: A Systematic Analysis for the Global Burden of Disease Study. *JAMA Oncol* 2018;4:1553-68.
6. Wimo A, Jonsson L, Bond J, et al. The worldwide economic impact of

- dementia 2010. *Alzheimers Dement*2013;9:1-11 e13.
7. Alzheimer's Disease International. World Alzheimer report 2015: the global impact of dementia. <https://www.alz.co.uk/research/world-report-2015>. Accessed 1 June 2016.
  8. Chang AY, Skirbekk VF, Tyrovolas S, et al. Measuring population ageing: an analysis of the Global Burden of Disease Study 2017. *Lancet Public Health*2019;4:e159-e167.
  9. He X, Song M, Qu J, et al. Basic and translational aging research in China: present and future. *Protein Cell*2019;10:476-84.
  10. Liu S, Li Y, Zeng X, et al. Burden of Cardiovascular Diseases in China, 1990-2016: Findings From the 2016 Global Burden of Disease Study. *JAMA Cardiol*2019; doi: 10.1001/jamacardio.2019.0295.
  11. Zhou M, Wang H, Zhu J, et al. Cause-specific mortality for 240 causes in China during 1990-2013: a systematic subnational analysis for the Global Burden of Disease Study 2013. *Lancet* 2016;387:251-72.
  12. Liu M, Liu SW, Wang LJ, et al. Burden of diabetes, hyperglycaemia in China from to 2016: Findings from the 1990 to 2016, global burden of disease study. *Diabetes Metab*2019;45:286-93.
  13. Yang JJ, Yu D, Wen W, et al. Association of Diabetes With All-Cause and Cause-Specific Mortality in Asia: A Pooled Analysis of More Than 1 Million Participants. *JAMA Netw Open*2019;2:e192696.
  14. Stein DJ, He Y, Phillips A, et al. Global mental health and neuroscience: potential synergies. *Lancet Psychiatry*2015;2:178-85.
  15. Ji Y, Shi Z, Zhang Y, et al. Prevalence of dementia and main subtypes in rural northern China. *Dement Geriatr Cogn Disord*2015;39:294-302.

16. Zeng Y, Feng Q, Hesketh T, et al. Survival, disabilities in activities of daily living, and physical and cognitive functioning among the oldest-old in China: a cohort study. *Lancet* 2017;389:1619-29.
17. GBD 2016 Parkinson's Disease Collaborators. Global, regional, and national burden of Parkinson's disease, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet Neurol* 2018;17:939-53.
18. Keogh-Brown MR, Jensen HT, Arrighi HM, et al. The Impact of Alzheimer's Disease on the Chinese Economy. *EBioMedicine* 2015 22;4:184-90.
19. Borson S, Scanlan JM, Chen P, et al. The Mini-Cog as a screen for dementia: validation in a population-based sample. *J Am Geriatr Soc* 2003;51:1451-4.
20. Lv X, Li W, Ma Y, et al. Cognitive decline and mortality among community-dwelling Chinese older people. *BMC Med* 2019;17:63.
21. Pequignot R, Dufouil C, Peres K, et al. Depression Increases the Risk of Death Independently From Vascular Events in Elderly Individuals: The Three-City Study. *J Am Geriatr Soc* 2019;67:546-52.
22. Jeurig HW, Hoogendijk EO, Comijs HC, et al. The tide has turned: incidence of depression declined in community living young-old adults over one decade. *Epidemiol Psychiatr Sci* 2019:1-8.
23. O'Caomh R, Gao Y, Svendrovski A, et al. Effect of Visit-to-Visit Blood Pressure Variability on Cognitive and Functional Decline in Mild to Moderate Alzheimer's Disease. *J Alzheimers Dis* 2019;68:1499-510.
24. Curtis BJ, Williams PG, Anderson JS. Objective cognitive functioning in self-reported habitual short sleepers not reporting daytime dysfunction: examination of impulsivity via delay discounting. *Sleep* 2018;41.
25. Xiao S. Theoretical foundation and research and application of Social Support

1  
2  
3 Rating Scale. *J Clin Psychiatry* 1994;4:98-100.  
4

- 5  
6 26. Chen Z, Chen J, Collins R, et al. China Kadoorie Biobank of 0.5 million people:  
7  
8 survey methods, baseline characteristics and long-term follow-up. *Int J*  
9  
10 *Epidemiol* 2011;40:1652-66.  
11  
12 27. Zhao Y, Hu Y, Smith JP, et al. Cohort profile: the China Health and Retirement  
13  
14 Longitudinal Study (CHARLS). *Int J Epidemiol* 2014;43:61-8.  
15  
16 28. Shi Z, Zhang T, Byles J, et al. Food Habits, Lifestyle Factors and Mortality among  
17  
18 Oldest Old Chinese: The Chinese Longitudinal Healthy Longevity Survey  
19  
20 (CLHLS). *Nutrients* 2015;7:7562-79.  
21  
22  
23  
24  
25

## 26 **Figure legends**

27

28  
29 Figure 1 Location of Shenzhen in China

30  
31 Figure 2 The flow diagram of collecting and separation blood and urine specimen

32  
33 Figure 3 The flow diagram of the cohort design

34  
35 Figure 4 The birthplace distribution of the studied individuals  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60



Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

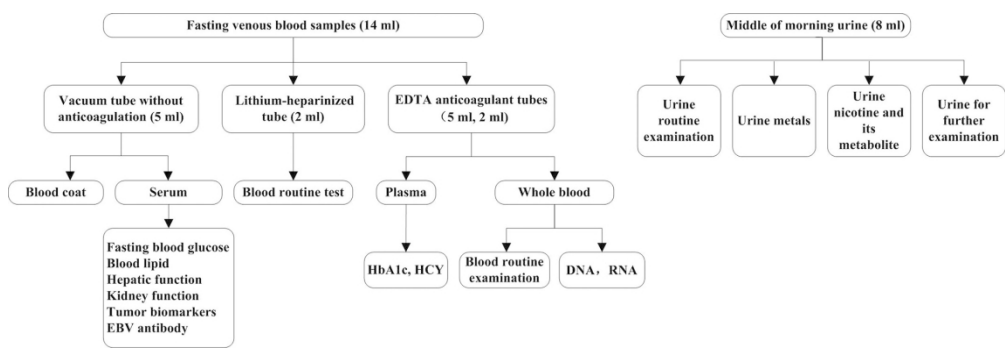


Figure 2 The flow diagram of collecting and separation blood and urine specimen  
180x60mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2019-034317 on 21 June 2020. Downloaded from <http://bmjopen.bmj.com/> on April 23, 2024 by guest. Protected by copyright.



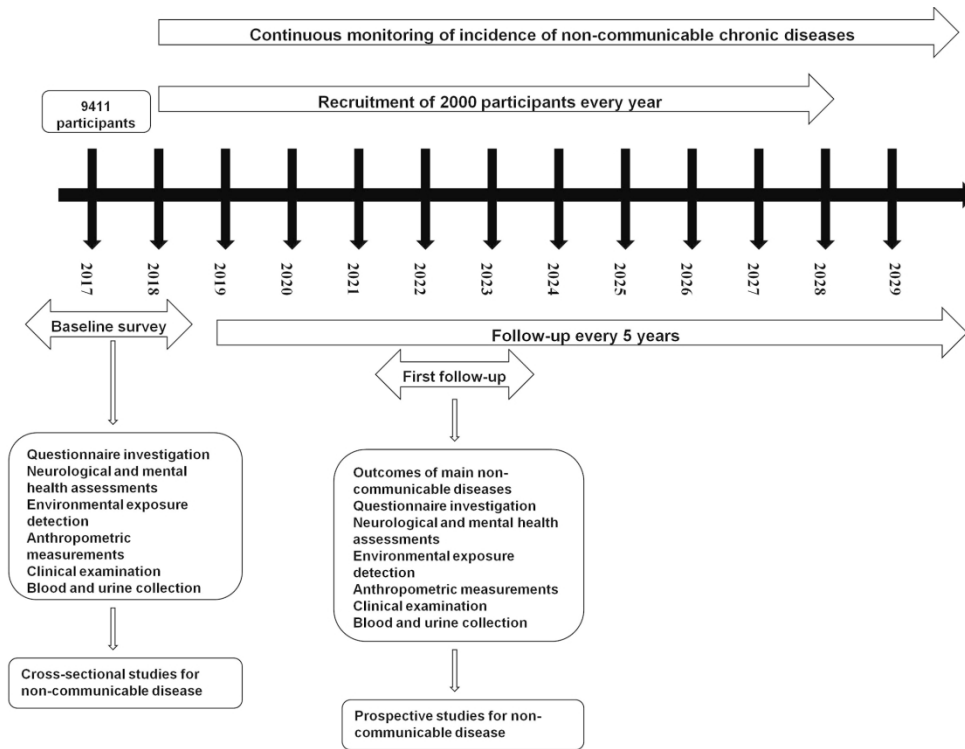


Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60

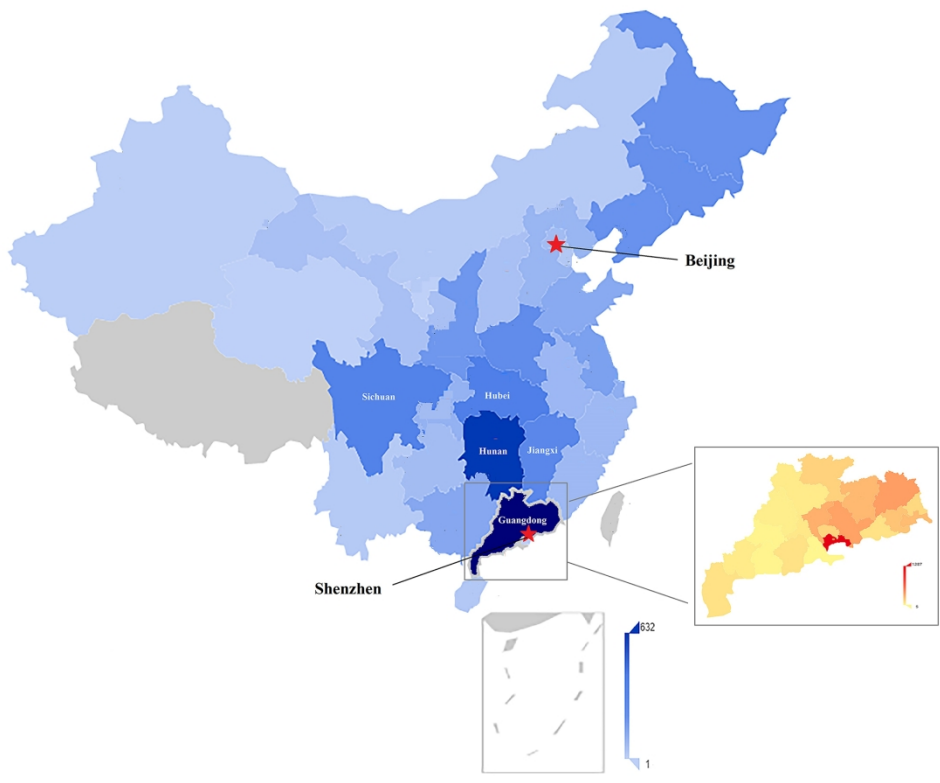


Figure 4 The birthplace distribution of the studied individuals

180x147mm (300 x 300 DPI)

**Supplemental Table 1 Socioeconomic structures of all permanent residents of Luohu district and Shenzhen city in 2018**

	Luohu district (n=103.99×10 <sup>4</sup> )	Shenzhen city (n=1302.66×10 <sup>4</sup> )
Sex (n, %)		
male	559,952 (53.85)	7,250,711 (55.66)
female	479,948 (46.15)	5,775,877 (44.34)
Age (years, (n, %))		
0-14	139,625 (13.43)	1,569,745 (13.03)
15-59	826,107 (79.44)	10,878,040 (83.51)
60-	74,168 (7.13)	578,803 (4.44)
Education level (n, %)		
Illiteracy	8735 (0.84)	96,379 (0.74)
Primary school	111,477 (10.72)	1,217,936 (9.34)
High school	814,554 (78.33)	10,612,306 (81.47)
University	105,134 (10.11)	1,099,967 (8.44)
Annual per capita disposable income (RMB)	60,595	57,543
Total assets (100 million RMB)	4702	47120

Data on the demographics of the permanent residents were presented.

**Supplemental Table 2. Comparisons of the distributions of age and sex among elderly permanent residents in Shenzhen city, Luohu district and our cohort**

	Shenzhen Aging- Related Disorder cohort	Luohu district	Shenzhen city
Sex (n, %)			
male	4022 (42.73)	37,492 (50.55)	290,001 (50.10)
female	5389 (57.26)	36,676 (49.45)	288,802 (49.90)
Age (years, (n, %))			
60-69	6416 (68.18)	48,937 (65.98)	394,769 (68.20)
≥70	2995 (31.82)	25,231 (34.02)	184,034 (31.80)

**Supplemental Table 3 The list of biochemical analysis of biosamples at baseline in the Shenzhen Aging-Related Disorder Cohort**

Categories	Measurements
<b>Blood routine</b>	white blood cell counts (WBC), red blood cell counts (RBC), hemoglobin contents, platelet counts
<b>Lipid levels</b>	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
<b>Blood glucose</b>	fasting plasma glucose, glycated hemoglobin
<b>Homocysteine</b>	
<b>Hepatic function</b>	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
<b>Kidney function</b>	creatinine, uric acid and urea nitrogen
<b>Tumor biomarkers</b>	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
<b>Epstein-Barr Virus (EBV) antibody</b>	
<b>Urine routine</b>	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent blood
<b>Urine metals</b>	lithium, beryllium, aluminum, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, arsenic, selenium, rubidium, strontium, molybdenum, cadmium, indium, tin, antimony, barium, thallium, lead
<b>Urine nicotine and its metabolites</b>	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N- $\beta$ -glucuronide, cotinine N- $\beta$ -D-glucuronide, trans-3'-hydroxy cotinine O- $\beta$ -D-glucuronide, (R,S)-nornicotine, (R,S)-norcotinine, (1'S,2'S)-nicotine-1'-oxide, (S)-cotinine N-Oxide, rac 4-Hydroxy-4-(3-pyridyl) butanoic Acid Dicyclohexylamine Salt

**Supplemental Table 4 Summary of the instruments messages for clinical indicators analysis at baseline**

Items	Equipment used
Standing height	HNH-219, OMRON Healthcare Co., Ltd, Japan
Body weight	HNH-219, OMRON Healthcare Co., Ltd, Japan
Resting blood pressure	HBP-1300, OMRON Healthcare Co., Ltd, Japan
12-lead electrocardiography	ECG-1350c, Nihon Kohden Corporation, Japan
Chest X-ray	Optimus, Royal Dutch Philips Electronics Ltd., Netherlands
Abdominal B-type ultrasound inspection	Affiniti50, Royal Dutch Philips Electronics Ltd., Netherlands
	EPIQ5, Royal Dutch Philips Electronics Ltd., Netherlands
	S25, SonoScape Medical Corp., Guangdong, China
Fasting plasma glucose	7600-010, Hitachi, Ltd., Tokyo, Japan
Glycated hemoglobin	Premier Hb9210, Trinity Biotech Plc., Bray, Ireland
Homocysteine	AU5800, Beckman Coulter, Inc., California, USA
Blood lipids	7600-010, Hitachi, Ltd., Tokyo, Japan
Hepatic function	7600-010, Hitachi, Ltd., Tokyo, Japan
Renal function	7600-010, Hitachi, Ltd., Tokyo, Japan
Blood routine	XT-1800I, SYSMEX Corporation, Japan
EB virus	Uranus AE100, Aikang Medtech Co., Ltd, China
Tumor biomarkers	Uranus AE100, Aikang Medtech Co., Ltd, China
Urine routine	URIT-500B, URIT Medical Electronic Group Co., China
Bone mineral density	MetriScan, Miles Medical Inc., California, USA
	BMD-1000D, Hongyang Medical Apparatus Co., Ltd, China

---

1		
2		
3		
4	Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
5	Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
6	Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
7	Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
8	Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
9		
10	Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
11	Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
12	Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
13	Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
14	Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
15	Basal metabolic rate	Inbody 570, InBody Co., Ltd, Seoul, Korea
16	Basal metabolic rate	Inbody 570, InBody Co., Ltd, Seoul, Korea
17	Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
18	Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
19	Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
20	Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
21	Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
22	Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
23	Urine metals	NEXION 300X PerkinElmer Inc., USA
24	Urine nicotine and its metabolite	1200 series/ 6410 Triple Quad LC/MS Agilent Technologies Inc., California, USA

---

**Supplemental Table 5 Comparisons between the individuals with and without body component data at baseline**

Variables	Participants with body component (n=3292 )	Participants without body component (n=6119 )	t/x <sup>2</sup> *	P
Age (years, mean±SD)	67.54±5.25	67.83±5.50	2.56	0.01
Male (n, %)	1327 (40.31)	2695 (44.04)	12.19	0.0005
Han Chinese (n, %)	2954 (99.29)	5623 (99.36)	0.14	0.70
Education level (n, %)			4.01	0.26
Primary school or illiteracy	547 (16.79)	1090 (17.97)		
Middle school	913 (28.03)	1651 (27.23)		
High school	1081 (33.19)	2062 (34.00)		
University or college or higher	716 (21.98)	1261 (20.79)		
Marital status (n, %)			7.74	0.10
Single	14 (0.43)	32 (0.53)		
Married	2825 (87.60)	5220 (86.86)		
Widowed	336 (10.42)	687 (11.43)		
Divorced	48 (1.49)	71 (1.18)		
Cohabited	2 (0.06)	0		
Ever smoker (n, %)	643 (19.64)	1257 (20.69)	1.45	0.23
Passive smoker (n, %)	380 (11.63)	674 (11.11)	0.57	0.45
Ever drinker (n, %)	485 (14.82)	866 (14.25)	0.55	0.46
Pittsburgh Sleep Quality Index (n, mean ± SD)	4.33 ± 2.60	4.12 ± 2.61	-3.41	0.0006
Physical active (n, %)	2664 (81.24)	4924 (81.28)	0.002	0.97
Overweight/Obesity <sup>a</sup> (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02

Hypertension <sup>b</sup> (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
Diabetes mellitus <sup>c</sup> (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
Hyperlipidemia <sup>d</sup> (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
Chronic bronchitis <sup>e</sup> (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
COPD <sup>e</sup> (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
Asthma <sup>e</sup> (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
Tuberculosis <sup>e</sup> (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
Angina <sup>e</sup> (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
Myocardial infarction <sup>e</sup> (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
Coronary heart disease <sup>e</sup> (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
Stroke <sup>e</sup> (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
Cancer <sup>e</sup> (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
Chronic hepatitis <sup>e</sup> (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
Arthritis <sup>e</sup> (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
Migraine <sup>e</sup> (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
Nephritis <sup>e</sup> (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
Alzheimer's disease <sup>e</sup> (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
Parkinson's disease <sup>e</sup> (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
Brain injury <sup>e</sup> (n, %)	193 (5.96)	340 (5.64)	0.40	0.53
MMSE score < 24 (n, %)	167 (5.48)	301 (5.35)	0.07	0.79
Depression status <sup>f</sup> (n, %)	126 (3.87)	177 (2.95)	5.63	0.02
ADL (n, scores, mean ± SD)	14.09 ± 1.23	14.18 ± 1.73	2.82	0.005



SSRS (n, score, mean $\pm$ SD)	39.88 $\pm$ 7.68	39.36 $\pm$ 8.00	-2.88	0.004
--------------------------------	------------------	------------------	-------	-------

ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; MMSE, Mini-mental State Examination; SSRS, Social support rate scale; SD, standard deviation.

\*Student's t-test and Pearson  $\chi^2$  test were used for the comparisons between continuous variables and the categorical variables, respectively.

<sup>a</sup> Overweight/Obesity was defined as BMI at least 24 kg/m<sup>2</sup>.

<sup>b</sup> Hypertension was defined as diastolic blood pressure (DBP)  $\geq$ 90mmHg and / or systolic blood pressure (SBP)  $\geq$ 140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

<sup>c</sup> Diabetes was defined as fasting blood glucose value  $\geq$ 7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

<sup>d</sup> Dyslipidemia was defined as TCHO  $\geq$ 5.18 mmol/L, or TG  $\geq$ 1.7 mmol/L, or HDL-C  $<$ 1.0 mmol/L, or LDL-C  $\geq$ 3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.

<sup>e</sup> The disease was defined as self-reported disease.

<sup>f</sup> Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.