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

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ABTRACT

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

Lawton-Brody Activities of Daily Living Scale and the Social Support Rate Scale were 14.15 and 39.54, respectively.

Future plans: The data provide for the purpose of identification of the causality of various aging related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. 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.

Keywords: Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease, Mental health

Strengths and limitations of this study

1. The Shenzhen Aging Related Disorder Cohort is a community-dwelling aging related disorder cohort with comprehensive 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.
2. The ways to identify the disease morbidity and mortality through questionnaire investigation, and searching National Electronic Disease Surveillance System and National Mortality Surveillance System guarantee the integrity and validity of outcomes of interest in our cohort.
3. There are limitations of our cohort. First, all participants are adults aged 60 years or older. Second, the medical histories of the participants in our cohort were self-reported. Third, parts of the participants took part in the body components analysis at baseline.

INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017,[1] and it is forecasted that the life expectancy will keep increasing until 2040.[2] 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.[3] For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,[4] the cancer incidence increased by 28% from 2006 and 2016,[5] and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.[6,7] In 2017, aging related diseases accounted for 51.3% of the global burden of diseases among adults.[8]

Compared with developed countries, developing counties 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.[9,10] 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.[11] Besides cardiovascular diseases, cancer and diabetes,[12-15] 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.[16,17] 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.[18] The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,[19] and that of Alzheimer's disease was estimated to have quadrupled from 6 to 28 million between 2011 and 2015.[20] However, to date, there are no known effective treatments for most aging related disorders, especially for neurological diseases, it is therefore urgent to identify the risk factors, particularly those modifiable ones to facilitate the early intervention and prevention of the onset of aging related disorders.

Shenzhen, a major city in Guangdong province, China, situates immediately north of Hongkong. As the first special economic zone and the birthplace of economic miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd most competitive financial center in the world in 2017. Along with the highest-speed urbanization, Shenzhen has attracted large internal migration across the country, and experienced dramatic socioeconomic changes and accelerated aging process during the past decades. Given the population diversity, rapid urbanization, high-speed aging process as well as adequate medical and health resources in Shenzhen city, a dynamic, prospective cohort study, the Shenzhen Aging Related Disorder Cohort, has been designed to provide evidence for addressing opportunities regarding aging related disorders as an aging-oriented research model for areas with most rapid urbanization and socioeconomic structure changes in developing countries.

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

1) determine the prevalence of aging related disorders, including neurological disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases,

diabetes mellitus, neoplasms, injuries and other non-communicable diseases in Shenzhen;

2) estimate the disease burden of aging related disorders, especially from neurological and mental disorders in Shenzhen;

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

4) assess the effects of environmental factors, lifestyle, and genetic factors on the initiation and progression of aging related disorders, especially for neurological and mental disorders;

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

6) generate health intervention and management strategies for aging related disorders, especially for neurological and mental disorders.

COHORT DESCRIPTION

The participants of the cohort

The Shenzhen Aging Related Disorder Cohort was established between 2017 and 2018 in 51 community recover centers in Luohu district of Shenzhen city, Guangdong province, China (Figure 1). A multistage cluster sampling was applied to recruit the participants older than 60 years. People with severe physical disabilities or mental disorders were not included. In the first stage, a district (Luohu district) in Shenzhen city was randomly sampled. In the second stage, 51 community recover centers in the selected district were randomly sampled. In the final stage, all permanent residents older than 60 years and without severe physical or mental disorders (16843) in the

selected community recover centers were invited to participate in the study. Approximately 56% (n=9411) agreed and provided signed informed consent. All participants were asked to bring their unique national identity cards for questionnaire investigation and physical examination in local health centers or hospitals. Considering the annual increase of 4000 adults aged 60 years or older in above mentioned community recover centers from 2016 to 2018, the cohort will be expanded by recruiting 2000 new entrants every year until 2028. 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-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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 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
Assessments of neurological function and activities of daily living	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[21] 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 [≥ 24 points and < 24 points].[22] The validity and reliability of the Chinese MMSE have been verified previously[18]. 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.[23,24] 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.[25] The Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven component scores, was applied to assess the sleep quality of all participants.[26] The participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality. The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of the social support, namely subjective support (emotional support, four items), objective support (tangible support, three items) and availability support (three items). Higher SSRS scores represent a better social support. The validity and reliability of SSRS have been verified previously.[27]

Clinic analysis of blood and urine

After at least 8 hours of overnight fasting, venous blood samples from each participant were separately collected into the EDTA anticoagulant tubes (a 2 ml and a 5 ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature to separate plasma and serum. The serum samples were used for biochemical analyses,

including fasting blood glucose, blood lipid [total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)], hepatic function [(total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)], kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers [carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)] and Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used for blood routine test, including the total number of white blood cell (WBC), the differential white blood cell counts (lymphocyte, monocyte, granulocytes, eosinophils and basophils), red blood cell counts (RBC), hemoglobin contents and blood platelet parameters [platelet count, mean platelet volume (MPV), platelet distribution width (PDW), blood platelet quantity (PLT), platelet volume ratio and platelet large cell ratio (P-LCR)]. The EDTA-anticoagulated whole blood (0.3 ml) and plasma specimens (1 ml) were used for DNA and RNA extraction, and testing of glycated hemoglobin A1c (HbA1c) and homocysteine (HCY), respectively.

Additionally, the early spot morning urine sample (8 ml) from each participant was collected for urine routine examination (including urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC and urine latent blood), urine concentrations of 24 kinds of 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), and urinary concentrations

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

Parameters of clinical measurements and imaging

Each participant took part in the physical examination conducted by trained physicians in the district hospital. The inspection-palpation-percussion-auscultation (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity, oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The measurements of baseline anthropometric indices for each participant were performed on the day of physical examination. Standing height, weight and waist were measured with the subjects in light clothing and without shoes by ultrasonic weighing apparatus (HNH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300, OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the right arm supported at heart-level. Statistical analysis was based on the average of the two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray, abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas, urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate B-type ultrasound inspection (only for males) and bone mineral density scan were then conducted. Out of 9411 participants, 3292 took part in the body composition measurements. The visceral fat and fluid imbalances in each segment of the body and the phase angle for cellular indicator of cell integrity were measured by bioelectrical

impedance analysis using an Inbody 770 body composition analyser (Biospace, Seoul, Korea). The body segments were analysed, including elementary body composition [body weight, body mass index (BMI), protein mass and minerals mass], total body water (TBW) analysis [intracellular water, extracellular water (ECW) and ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb circumferences as well as waist-to-hip ratio, visceral fat area and visceral fat level) and basal metabolic rate, etc.

The instruments used for the physical examination and the body composition measurements are listed as Supplemental Table 1.

The follow-up procedure

Follow-up will be conducted every 5 years to update exposure data and outcomes since 2019. The questionnaire survey, physical examination, the body composition measures, and neurological function and mental health assessments will be re-conducted during the follow-up. Blood and urine specimens will be collected according to the design procedures at baseline. The incidence of non-communicable chronic diseases, including neurological and mental disorders, hypertension, dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging related diseases will be annually verified through medical records review and the National Electronic Disease Surveillance in China.

All death cases will be verified by Chinese Cause of Death Registration System in Shenzhen Center for Disease Control and Prevention. The diagnosis of

aforementioned conditions and the causes of death will be classified according to the 10th 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,

wheat, vegetable, fruit, and meat were 1.98, 0.79, 1.62, 0.95 and 1.00 times/day, and those of coarse grain, fish, egg, milk, bean and pickle were 5.08, 3.12, 5.51, 3.52, 2.31 and 1.10 times/week, respectively (Table 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^{2*}	*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 x^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^{2*}	*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 (82.63)		
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 (77.71)		
No	1749 (18.58)	581 (14.45)	1168 (21.63)		
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 (25.05)		
No	5760 (61.20)	1912 (47.54)	3848 (71.40)		
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 (94.41)		
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 x^2 test were used for the comparison between continuous variables and for the categorical variables, respectively.

Table 4 and Table 5 presents the baseline levels of biochemical traits of the participants in the Shenzhen Aging Related Disorder Cohort. The average values of TCHO, TG, HDL-C, LDL-C and fasting blood glucose were 5.50, 1.64, 1.54, 3.13 and 6.17 mmol/l, respectively. The mean concentrations of total bilirubin, albumin, ALT, AST, blood urea nitrogen, creatinine and uric acid were 15.55 μmol/l, 44.55 g/l, 21.93 U/l, 22.07 U/l, 5.78 mmol/l, 80.03 μmol/l and 373.79 μmol/l. 0.20%, 0.07% and 0.09% of the participants presented positive reactions for EBV, CEA and AFP tests, respectively. The rates of positive/suspected positive urine glucose, bilirubin, acetone bodies, protein, bilinogen, nitrite and occult blood were 40.98%, 1.41%, 0.92%, 14.17%, 1.52%, 2.67% and 26.86%, respectively.

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^{2*}	*P*
Blood routine					
WBC (**n=9377**, × 10^9/l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.56	13.48	<0.0001
RBC (**n=9377**, × 10^{12}/l, mean±SD)	4.60±0.50	4.80±0.51	4.45±0.47	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**, × 10^9/l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
Lipid levels					
TCHO (**n=9376**, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.05	-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±0.85	-12.65	<0.0001
Fasting blood glucose (**n=9366**, mmol/l, mean±SD)	6.17±1.78	6.22±1.84	6.13±1.73	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±5.56	23.25	<0.0001
Hepatic function					
Total protein (**n=9378**, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.12	-8.42	<0.0001
Total bilirubin (**n=9378**, μmol/l, mean±SD)	15.55±5.06	16.34±5.60	14.97±4.63	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
Kidney function					
Blood urea nitrogen (**n=9369**, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.45	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 x^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^{2*}	*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 (3.28)		
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 x^2 test were used for the comparison between continuous variables and the categorical variables, respectively.

**Fisher exact test was used.

The mean values of BMI, SBP, DBP and pulse rate were 24.39 kg/m^2, 138.47 mmHg, 77.35 mmHg and 75.32 times/minute, respectively. There were 46.19%, 77.47%, 60.09%, 29.49% and 83.37% of participants presented abnormality during the examination of electrocardiogram, chest X-ray, color doppler ultrasound of liver/gallbladder/spleen/pancreas, color doppler ultrasound of urinary system and bone density scan, respectively. The average values of waist hip ratio, basal metabolic rate, total body water, body fat mass, percentage of body fat, fat free mass, skeletal muscle, body protein and body minerals were 0.88, 1281.47 kcal, 31.10 L, 19.98 kg, 31.94%, 42.20 kg, 22.87 kg, 8.24 kg and 2.85 kg, respectively, among 3292 participants who took the examination of body components (Table 6).

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

Variables	Total	Male	Female	t/x^{2*}	*P*
BMI (**n=9263**, kg/m^2, 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 (2.54)		
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)		

Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		
Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio (**n=3292**, mean±SD)	0.88±0.05	0.89±0.06	0.88±0.04	7.14	<0.0001
Basal metabolic rate (**n=3292**, kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water (**n=3292**, k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water (**n=3292**, L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water (**n=3292**, L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass (**n=3292**, kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.74	-10.25	<0.0001
Percentage of body fat (**n=3292**, %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.65	-40.37	<0.0001
Fat free mass (**n=3292**, Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.94	68.92	<0.0001
Skeletal muscle (**n=3292**, Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.36	69.67	<0.0001
SLM (**n=3292**, Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.74	69.54	<0.0001
Body protein (**n=3292**, kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.78	69.62	<0.0001
Body minerals (**n=3292**, kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.27	55.68	<0.0001
InBody score (**n=3292**, mean±SD)	69.05±4.92	68.15±5.16	69.67±4.65	-8.50	<0.0001

BMI, body mass index; SD, standard deviation.

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

**Uncertainty was caused by unsatisfied examination conditions.

Table 7 shows the prevalence of main non-communicable chronic diseases. 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 ADL and SSRS were 14.15 and 39.54, respectively.

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

Variables	Total	Male	Female	t/x^{2*}	*P*
Overweight/Obesity[a] (**n=9307**, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	5.96	0.01
Hypertension[b] (**n=9374**, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus[c] (**n=9340**, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	10.39	0.001
Dyslipidemia[d] (**n=9377**, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	239.42	<0.0001
Chronic bronchitis[e] (**n=9354**, %)	136 (1.45)	71 (1.78)	65 (1.21)	5.09	0.02
COPD[e] (**n=9357**, %)	18 (0.19)	12 (0.30)	6 (0.11)	4.23	0.04
Asthma[e] (**n=9356**, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis[e] (**n=9315**, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina[e] (**n=9311**, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction[e] (**n=9312**, %)	51 (0.55)	35 (0.88)	16 (0.30)	14.07	0.0002
Coronary heart disease[e] (**n=9315**, %)	530 (5.69)	239 (6.01)	291 (5.45)	1.33	0.25
Stroke[e] (**n=9309**, %)	102 (1.10)	57 (1.43)	45 (0.84)	7.30	0.007
Cancer[e] (**n=9303**, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis[e] (**n=9311**, %)	47 (0.50)	24 (0.60)	23 (0.43)	1.35	0.24
Arthritis[e] (**n=9308**, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine[e] (**n=9311**, %)	58 (0.62)	16 (0.40)	42 (0.79)	5.47	0.02
Nephritis[e] (**n=9312**, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease[e] (**n=9309**, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease[e] (**n=9309**, %)	21 (0.23)	13 (0.33)	8 (0.15)	3.17	0.08
Brain injury[e] (**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[f] (**n=9243**, %)	303 (3.28)	111 (2.81)	192 (3.63)	3.67	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	-4.75	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 x^2 test were used for the comparison between continuous variables and the categorical variables,respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.
[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.
[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.
[d] Dyslipidemia was defined as TCHO ≥5.2 mmol/L, or TG ≥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.
[e] The disease was defined as self-reported disease.
[f] 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 cites 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

were self-reported. But the link between our cohort and disease surveillance system in Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and reliability of the information. Third, only 3292 participants took part in the body components analysis at baseline. However, the selection bias tends to be small since the baseline characteristics are comparable between individuals with and without body component data (Supplemental Table 2). Forth, recruitment of 9411 participants at baseline makes our sample size relatively smaller compared with other cohorts in the world. However, according to the study design, an annual 2000 new participants will be recruited to enlarge the cohort until 2028, which will ensure the statistical power for most association studies in the future.

Collaboration

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. [JJLIUSZCDC@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.

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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 participanted in the study design, collected data, drafted the manuscript and performed the descriptive data analysis. LN, ZG, YL, WC, WL, LW, JZ, JY, XH, TL, EG, ZL, KH, YH, CY and QZ participanted in data collection, helped drafted the manuscript and reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, TL, EG, FY and XY constructed the data base and JY and JL were responsible for data management. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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.

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. [JJLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

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Figure legends

Figure 1 Location of Shenzhen in China

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

Figure 3 The flow diagram of the cohort design

Figure 4 The birthplace distribution of the studied individuals

Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

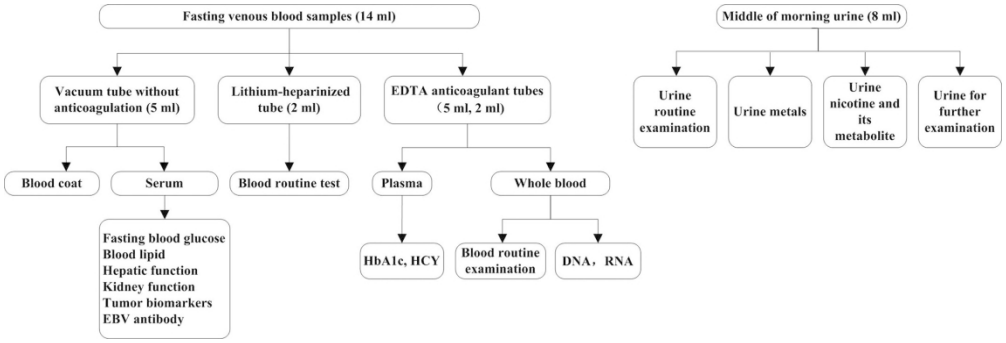

Figure 2 The flow diagram of collecting and separation blood and urine specimen

180x60mm (300 x 300 DPI)

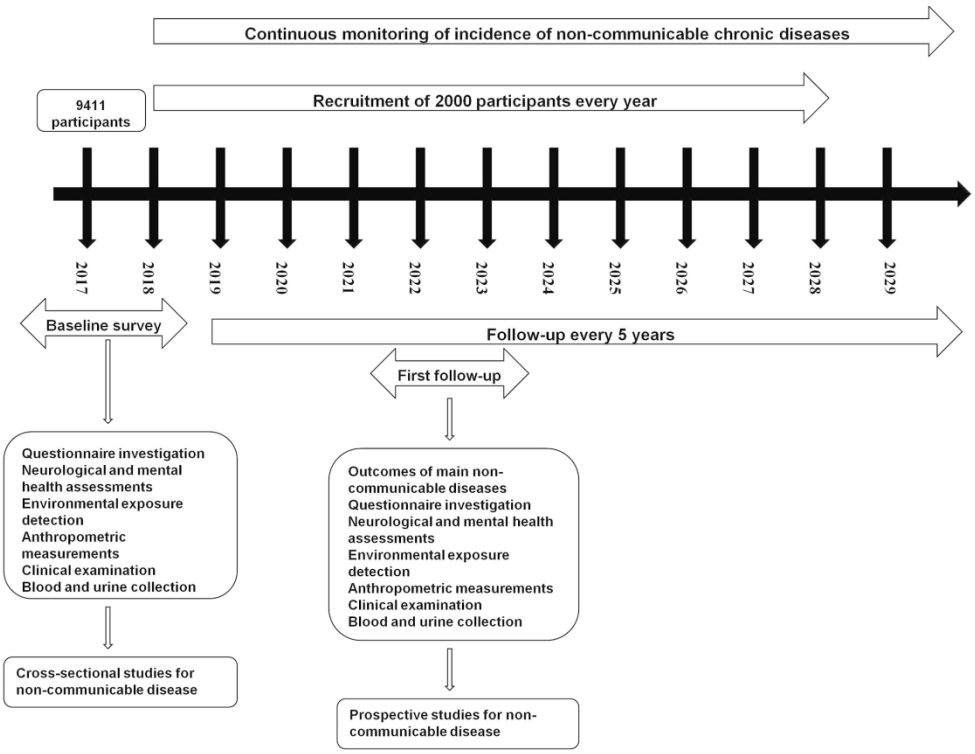

Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

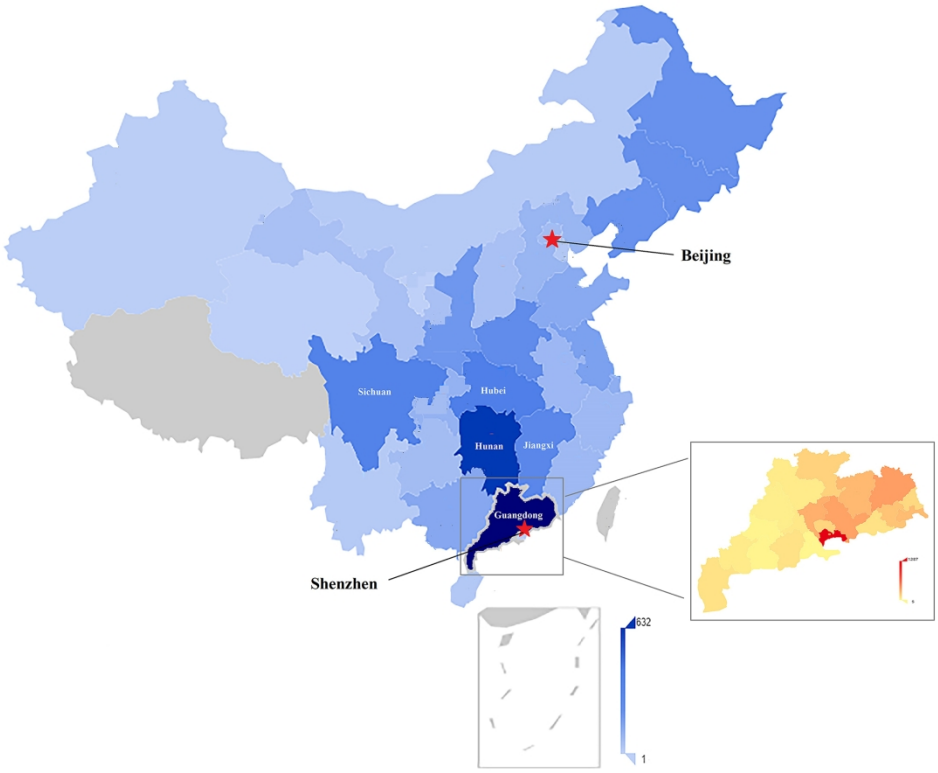

Figure 4 The birthplace distribution of the studied individuals

180x147mm (300 x 300 DPI)

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

Body water	Inbody 770, InBody Co., Ltd, Seoul, Korea
Body protein	Inbody 770, InBody Co., Ltd, Seoul, Korea
Body minerals	Inbody 770, InBody Co., Ltd, Seoul, Korea
Body muscle	Inbody 770, InBody Co., Ltd, Seoul, Korea
Skeletal muscle mass	Inbody 770, InBody Co., Ltd, Seoul, Korea
Body fat	Inbody 770, InBody Co., Ltd, Seoul, Korea
Body cell count	Inbody 770, InBody Co., Ltd, Seoul, Korea
Basal metabolic rata	Inbody 770, InBody Co., Ltd, Seoul, Korea
Waist circumference	Inbody 770, InBody Co., Ltd, Seoul, Korea
Hip circumference	Inbody 770, InBody Co., Ltd, Seoul, Korea
Bio-electrical impedance	Inbody 770, InBody Co., Ltd, Seoul, Korea
Urine metals	NEXION 300X PerkinElmer Inc., USA
Urine nicotine and its metabolite	Agilent 6890N-5973 GC-MS system, Agilent Technologies Inc., Santa Clara, CA, USA

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^{2*}	*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[a] (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02

Hypertension[b] (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
Diabetes mellitus[c] (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
Hyperlipidemia[d] (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
Chronic bronchitis[e] (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
COPD[e] (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
Asthma[e] (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
Tuberculosis[e] (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
Angina[e] (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
Myocardial infarction[e] (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
Coronary heart disease[e] (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
Stroke[e] (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
Cancer[e] (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
Chronic hepatitis[e] (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
Arthritis[e] (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
Migraine[e] (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
Nephritis[e] (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
Alzheimer's disease[e] (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
Parkinson's disease[e] (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
Brain injury[e] (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[f] (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 ± SD)	39.88 ± 7.68	39.36 ± 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 x^2 test wer used for the comparison between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.

[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

[d] Dyslipidemia was defined as TCHO ≥5.2 mmol/L, or TG ≥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.

[e] The disease was defined as self-reported disease.

[f] Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

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

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Primary Subject Heading:	Epidemiology
Secondary Subject Heading:	Public health
Keywords:	Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease

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

Li Liu[1†], Wei Liu[2†], Lulin Nie[2], Zhiwei Guo[3], Yi Luo[3], Weihong Chen[4], Weimin Liu[4], Feiqi Zhu[5], Lu Wang[6], Jiafei Zhang[6], Xian Wang[6], Tian Li[6], Erwei Gao[6], Li Zhou[2], Kaiwu He[2], Yidan Huang[6], Chunjie Yuan[6], Qingqing Zhu[6], Fang Ye[6], Xingchen Yu[1], Jing Yuan[6*], Jianjun Liu[2*]

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ABTRACT

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

depression status (3.28%). The mean scores for the Lawton-Brody Activities of Daily Living Scale and the Social Support Rate Scale were 14.15 and 39.54, respectively.

Future plans: The data collection is expected to be ended at the end of 2030. The data provide for the purpose of identification of the causality of aging related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. 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.

Keywords: Cohort study, Aging related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease, Mental health

Strengths and limitations of this study

1. The Shenzhen Aging Related Disorder Cohort is a community-dwelling cohort with the comprehensive collections of epidemiological data, clinical examinations, environmental exposures, body components and biological samples in elderly Chinese population, which would facilitate the identification of the causality of various aging related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors.

2. Several ways will be applied to identify the morbidities and mortalities of aging-related diseases during the follow-up through questionnaire investigation, physical examinations, and searching the National Electronic Disease Surveillance

System as well as the National Mortality Surveillance System, which guarantee the integrity and validity of the health outcomes of interest in our cohort.

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

4. The medical histories of the participants in the current cohort were mainly self-reported, which might cause biased estimation between disease histories and aging-related disorders.

5. Only a subsample (34.98%) of the participants at baseline took part in the measurement of body components.

INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017,[1] and it is forecasted that the life expectancy will keep increasing until 2040.[2] 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.[3] For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,[4] the cancer incidence increased by 28% from 2006 and 2016,[5] and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.[6,7] In 2017, aging related diseases accounted for 51.3% of the global burden of diseases among adults.[8]

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.[9] Besides cardiovascular diseases, cancer and diabetes,[10-13] 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.[14,15] 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.[16] The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,[17] and that of Alzheimer's disease was estimated to have quadrupled from 6 to 28

million between 2011 and 2015.[18] However, to date, there are no known effective treatments for most aging related disorders, especially for neurological diseases, it is therefore urgent to identify the risk factors, particularly those modifiable ones to facilitate the early intervention and prevention of the onset of aging related disorders.

Shenzhen, a major city in Guangdong province, China, situates immediately north of Hongkong. As the first special economic zone and the birthplace of economic miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd most competitive financial center in the world in 2017. Along with the highest-speed urbanization, Shenzhen has attracted large internal migration across the country, and experienced dramatic socioeconomic changes and accelerated aging process during the past decades. According to the 2015 Shenzhen Statistics, people aged 60 years or older accounted for 6.6% of total permanent resident population, and the estimated annual growth rate is approximate 6.5% during the period 2016-2020, which means that Shenzhen would step into aging society around 2020, and the elderly population of Shenzhen will show an explosive growth thereafter. Given the population diversity, rapid urbanization, high-speed aging process as well as adequate medical and health resources in Shenzhen city, a dynamic, prospective cohort study, the Shenzhen Aging Related Disorder Cohort, has been designed to provide evidence for addressing opportunities regarding aging related disorders as an aging-oriented research model for areas with most rapid urbanization and socioeconomic structure changes in developing countries.

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

1) determine the prevalence of aging related disorders, including neurological disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases, diabetes mellitus, neoplasms, injuries and other non-communicable diseases in Shenzhen;

2) detect the incidences of major mental and neurological disorders, including mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;

3) estimate the disease burden of aging related disorders, especially from neurological and mental disorders in Shenzhen;

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

5) assess the effects of environmental factors, lifestyle, and genetic factors on the initiation and progression of aging related disorders, especially for neurological and mental disorders;

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

7) generate health intervention and management strategies for aging related disorders, especially for neurological and mental disorders.

COHORT DESCRIPTION

The participants of the cohort

The Shenzhen Aging Related Disorder Cohort was established between 2017 and 2018 based on participants from 51 community health service centers in Luohu district of Shenzhen city, Guangdong province, China (Figure 1). The community health service center is the basic health administration unit located in each

community, which is responsible for disease prevention, health care, promoting recovery in each stage of health-illness process, health education, family planning and medical treatment of all the population in the area under it's jurisdiction. Firstly, among 11 districts of Shenzhen city, Luohu district was selected considering its representative to Shenzhen city in terms of socioeconomic structure and population size (Supplementary Table 1). Secondly, all 51 community health service centers in Luohu district were included. Individuals with severe physical disabilities or mental disorders which could affect daily activities or language communication were excluded through checking the medical insurance for urban residents and the National Electronic Disease Surveillance System considering that they could not response well to the questionnaire investigation, clinical examination and further follow-ups. Then, all registered permanent elderly residents aged at least 60 years old and without severe physical or mental disorders (n=16843) of the selected community health service centers were invited to participate in the study. Approximately 56% (n=9411) agreed and provided signed informed consent, but 44% of the local residents refused the invitation due to unwillingness to spent time on the epidemiological investigation or less attraction for them or they had finished the physical examination in early 2017. All participants were asked to bring their unique national identity cards for questionnaire investigation and physical examination in local health centers or hospitals. Considering the annual increase of 4000 adults aged 60 years or older in above mentioned community health service centers from 2016 to 2018, the cohort will be expanded by recruiting 2000 new entrants from the same community health

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-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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 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
Assessments of neurological function and activities of daily living	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[19] 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 [≥24 points and <24 points].[20] The validity and reliability of the Chinese MMSE have been verified previously[16]. 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.[21,22] 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.[23] The Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven component scores, was applied to assess the sleep quality of all participants.[24] The participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality. The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of the social support, namely subjective support (emotional support, four items), objective support (tangible support, three items) and availability support (three items). Higher SSRS scores represent a better social support. The validity and reliability of SSRS have been verified previously.[25]

Clinic analysis of blood and urine

After at least 8 hours of overnight fasting, venous blood samples from each participant were separately collected into the EDTA anticoagulant tubes (a 2 ml and a 5 ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature to separate plasma and serum. The serum samples were used for biochemical analyses, including fasting blood glucose, blood lipid, hepatic function, kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers and Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used for blood routine test, including the total number of white blood cell (WBC), red blood cell counts (RBC), hemoglobin contents and blood platelet counts. The detailed biochemical indexes of blood are listed in Supplemental Table 2. The EDTA-anticoagulated whole blood (0.3

ml) and plasma specimens (1 ml) were used for DNA and RNA extraction, and testing of glycated hemoglobin A1c (HbA1c) and homocysteine (HCY), respectively.

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

Parameters of clinical measurements and imaging

Each participant took part in the physical examination conducted by trained physicians in the district hospital. The inspection-palpation-percussion-auscultation (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity, oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The measurements of baseline anthropometric indices for each participant were performed on the day of physical examination. Standing height, weight and waist were measured with the subjects in light clothing and without shoes by ultrasonic weighing apparatus (HNH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300, OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the right arm supported at heart-level. Statistical analysis was based on the average of the two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray, abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas,

urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate B-type ultrasound inspection (only for males) and bone mineral density scan were then conducted. Out of 9411 participants, 3292 took part in the body composition measurements. The visceral fat and fluid imbalances in each segment of the body and the phase angle for cellular indicator of cell integrity were measured by bioelectrical impedance analysis using an Inbody 570 body composition analyser (Biospace, Seoul, Korea). The body segments were analysed, including elementary body composition [body weight, body mass index (BMI), protein mass and minerals mass], total body water (TBW) analysis [intracellular water, extracellular water (ECW) and ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb circumferences as well as waist-to-hip ratio, visceral fat area and visceral fat level) and basal metabolic rate, etc.

The instruments used for the physical examination and the body composition measurements are listed as Supplemental Table 3.

The follow-up procedure

Follow-up will be conducted every 5 years to update exposures and outcomes by the staffs in the community health service centers, who have established good relationship with the elderly during daily disease prevention, treatment and recovery to reduce the potential impact of losses to follow up on the validity of the study result. An annual health education on aging-related disorders will be provided by Shenzhen Center for Disease Control and Prevention, and the daily medical consultation will be provided

by the community health service centers for the participants to assure the retention of the participants. The questionnaire survey, physical examination, the body composition measures, and neurological function and mental health assessments will be re-conducted during the follow-up. Blood and urine specimens will be collected according to the design procedures at baseline. The incidence of non-communicable chronic diseases, including neurological and mental disorders, hypertension, dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging related diseases will be annually verified through searching the IDs of participants of the cohort, which were collected during the baseline questionnaire interviews in the medical insurance for urban residents, the National Electronic Disease Surveillance system and the National Mortality Surveillance System. The disease reports will be abstracted manually. For those presenting significant decline of cognition in MMSE but without diagnosis of mental or neurological disorders from the medical insurance for urban residents or the National Electronic Disease Surveillance System, the clinical diagnosis of mental disorders will be further performed by an expert panel from Shenzhen Luohu Hospital Group.

All death cases will be verified by Chinese Cause of Death Registration System in Shenzhen Center for Disease Control and Prevention. The diagnosis of aforementioned conditions and the causes of death will be classified according to the 10th version of the International Statistical Classification of Diseases (ICD-10). The flow diagram of the cohort design is presented as Figure 3. The anticipated rate of attrition is no more than 15% until the end of 2030.

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^{2*}	*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 x^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^{2*}	*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 (82.63)		
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 (77.71)		
No	1749 (18.58)	581 (14.45)	1168 (21.63)		
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 (25.05)		
No	5760 (61.20)	1912 (47.54)	3848 (71.40)		
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 (94.41)		
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 x^2 test were used for the comparison between continuous variables and for the categorical variables, respectively.

The baseline levels of biochemical traits of the participants in the Shenzhen Aging Related Disorder Cohort were detected, including blood routine, lipid levels, blood glucose, homocysteine, hepatic function, kidney function, tumor biomarkers, Epstein-Barr Virus (EBV) antibody and urine routine. The detailed items are provided as Supplemental Table 2. With the Exception of aspartate aminotransferase (AST), EB Virus status, carcino-embryonic antigen (CEA), alpha fetoprotein (AFP) and urine bilirubin, all other biochemical traits presented significant difference between males and females (all P <0.05, Tables 4 and 5).

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^{2*}	*P*
Blood routine					
WBC (**n=9377**, × 10^9/l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.56	13.48	<0.0001
RBC (**n=9377**, × 10^{12}/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±0.97	59.52	<0.0001
Platelet count (**n=9377**, × 10^9/l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
Lipid levels					
TCHO (**n=9376**, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.05	-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±0.37	-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±0.86	-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±1.73	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±5.96	23.25	<0.0001
Hepatic function					
Total protein (**n=9378**, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.12	-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 (3.76)	8.14	0.004
Kidney function					
Blood urea nitrogen (**n=9369**, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.48	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 x^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^{2*}	*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 (3.28)		
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 x^2 test were used for the comparison between continuous variables and the categorical variables, respectively.

**Fisher exact test was used.

Table 6 presents the baseline levels of clinical measurement parameters of participants in the Shenzhen Aging Related Disorder Cohort, including blood pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary system, color doppler ultrasound of prostate, bone mineral density. Owing to the relatively long waiting time, less interest and attention for their body components, only 34.98% (3292 of 9411) of the participants completed the measurements of body component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total body water, intracellular water, extracellular water, body fat mass, percentage of body fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody score. All clinical parameters presented significant difference between men and women (all P <0.05). With the exception of age, sex, the prevalence of overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as the other characteristics were comparable between individuals with and without body component data at baseline (Supplemental Table 4).

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

Variables	Total	Male	Female	t/x^{2*}	*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 (2.52)		
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)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio (**n=3292**, mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate (**n=3292**, kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water (**n=3292**, k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water (**n=3292**, L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water (**n=3292**, L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass (**n=3292**, kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.74	-10.25	<0.0001
Percentage of body fat (**n=3292**, %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.65	-40.37	<0.0001
Fat free mass (**n=3292**, Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.94	68.92	<0.0001
Skeletal muscle (**n=3292**, Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM (**n=3292**, Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.74	69.54	<0.0001
Body protein (**n=3292**, kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.78	69.62	<0.0001
Body minerals (**n=3292**, kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.29	55.68	<0.0001
InBody score (**n=3292**, mean±SD)	69.05±4.92	68.15±5.16	69.67±4.65	-8.50	<0.0001

SD, standard deviation.

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

**Uncertainty was caused by unsatisfied examination conditions.

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/x^{2*}	*P*
Overweight/Obesity[a] (**n=9307**, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	5.96	0.01
Hypertension[b] (**n=9374**, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus[c] (**n=9340**, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	10.39	0.001
Dyslipidemia[d] (**n=9377**, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	239.42	<0.0001
Chronic bronchitis[e] (**n=9354**, %)	136 (1.45)	71 (1.78)	65 (1.21)	5.09	0.02
COPD[e] (**n=9357**, %)	18 (0.19)	12 (0.30)	6 (0.11)	4.23	0.04
Asthma[e] (**n=9356**, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis[e] (**n=9315**, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina[e] (**n=9311**, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction[e] (**n=9312**, %)	51 (0.55)	35 (0.88)	16 (0.30)	14.07	0.0002
Coronary heart disease[e] (**n=9315**, %)	530 (5.69)	239 (6.01)	291 (5.45)	1.33	0.25
Stroke[e] (**n=9309**, %)	102 (1.10)	57 (1.43)	45 (0.84)	7.30	0.007
Cancer[e] (**n=9303**, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis[e] (**n=9311**, %)	47 (0.50)	24 (0.60)	23 (0.43)	1.35	0.24
Arthritis[e] (**n=9308**, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine[e] (**n=9311**, %)	58 (0.62)	16 (0.40)	42 (0.79)	5.47	0.02
Nephritis[e] (**n=9312**, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease[e] (**n=9309**, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease[e] (**n=9309**, %)	21 (0.23)	13 (0.33)	8 (0.15)	3.17	0.08
Brain injury[e] (**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[f] (**n=9243**, %)	303 (3.28)	111 (2.81)	192 (3.63)	3.67	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	-4.75	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 x^2 test were used for the comparison between continuous variables and the categorical variables,respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.
[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.
[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.
[d] Dyslipidemia was defined as TCHO ≥5.18 mmol/L, or TG ≥1.7 mmol/L, or HDL-C <1.0 mmol/L, or LDL-C ≥3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.
[e] The disease was defined as self-reported disease.
[f] 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 cites 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[26], the China Health and Retirement Longitudinal Study[27] and Chinese Longitudinal Healthy Longevity Survey[28], the Shenzhen Aging related disorder cohort might help to provide more epidemiological evidence for the causes of neurological and mental disorders through

wide exploration of the environmental exposures, such as lifestyle, metals, metabolite of tobacco and pesticide.

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 were self-reported. But the link between our cohort and disease surveillance system in Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and reliability of the information. Third, only 3292 participants took part in the body components analysis at baseline. However, the selection bias tends to be small since most baseline characteristics are comparable between individuals with and without body component data (Supplemental Table 4). Forth, recruitment of 9411 participants at baseline makes our sample size relatively smaller compared with other cohorts in the world. However, according to the study design, an annual 2000 new participants will be recruited to enlarge the cohort until 2028, which will ensure the statistical power for most association studies in the future.

Collaboration

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 from employees of a recognized academic institution, health service organization or charitable research organization with experience in medical research with the clear statement of their research interest, analysis proposal, data protection measures and corporation mechanisms. However, specific ideas and proposals for

potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JJLIUSZCDC@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.

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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 participanted in the study design, collected data, drafted the manuscript and performed the

descriptive data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XH, TL, EG, ZL, KH, YH, CY and QZ participated in data collection, helped drafted the manuscript and reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, FZ, TL, EG, FY and XY constructed the data base and JY and JL were responsible for data management. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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. [JJLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

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Figure legends

Figure 1 Location of Shenzhen in China

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

Figure 3 The flow diagram of the cohort design

Figure 4 The birthplace distribution of the studied individuals

Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

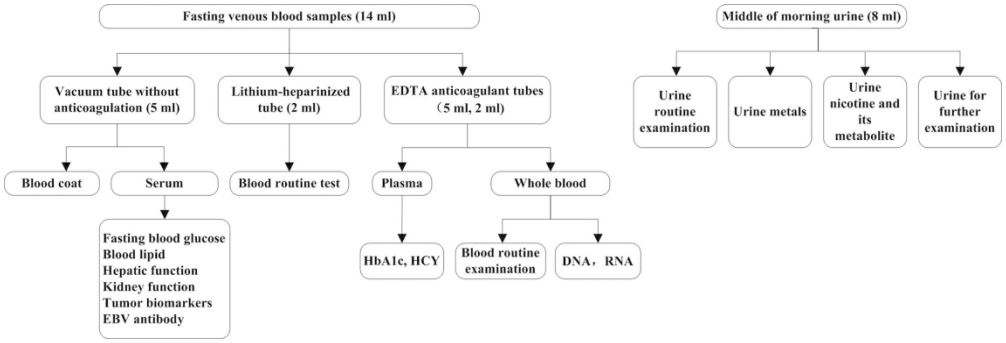

Figure 2 The flow diagram of collecting and separation blood and urine specimen

180x60mm (300 x 300 DPI)

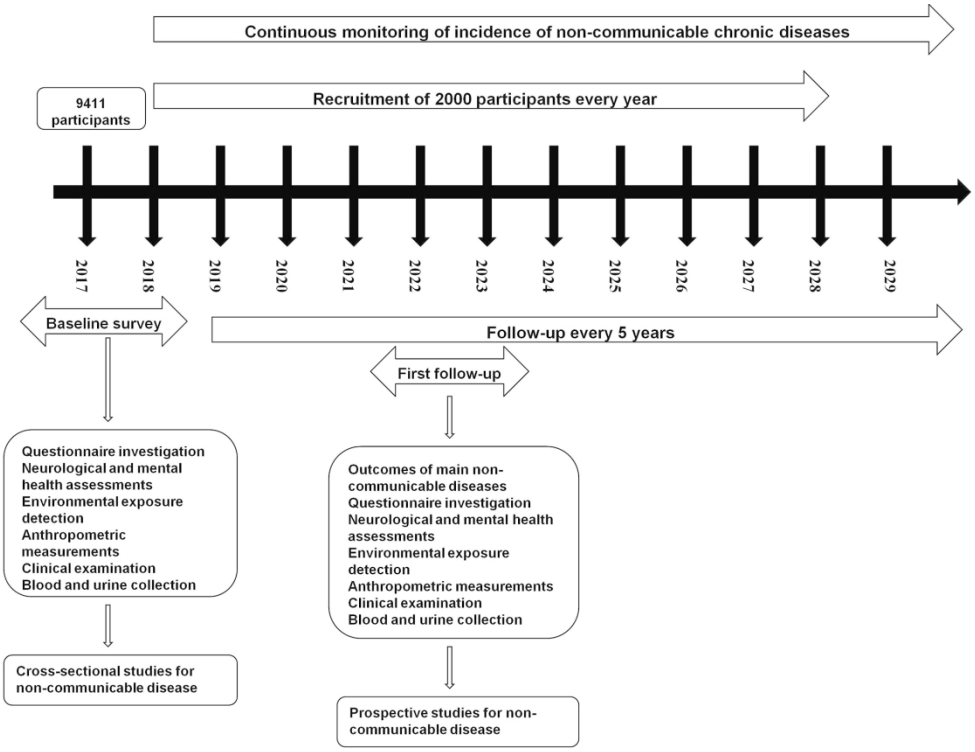

Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

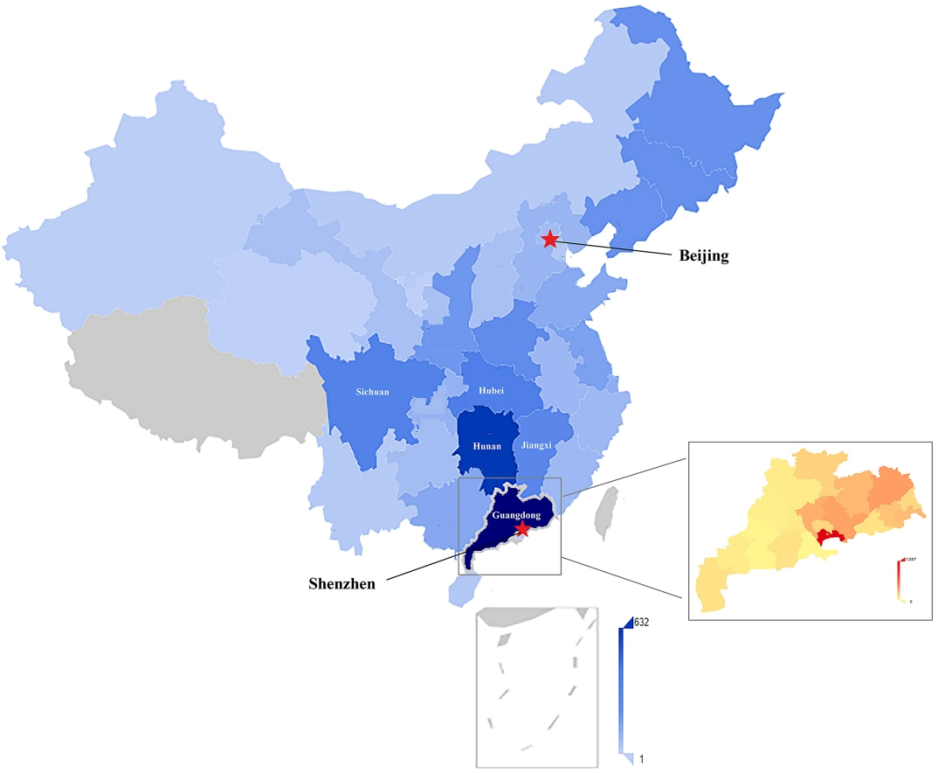

Figure 4 The birthplace distribution of the studied individuals

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

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

Categories	Measurements
Blood routine	white blood cell counts (WBC), red blood cell counts (RBC), hemoglobin contents, platelet counts
Lipid levels	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
Blood glucose	fasting plasma glucose, glycated hemoglobin
Homocysteine	
Hepatic function	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
Kidney function	creatinine, uric acid and urea nitrogen
Tumor biomarkers	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
Epstein-Barr Virus (EBV) antibody	
Urine routine	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent 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 metabolites	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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

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
Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
Basal metabolic rata	Inbody 570, InBody Co., Ltd, Seoul, Korea
Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
Urine metals	NEXION 300X PerkinElmer Inc., USA
Urine nicotine and its metabolite	1200 series/ 6410 Triple Quad LC/MS Agilent Technologies Inc., California, USA

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^{2*}	*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[a] (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02
Hypertension[b] (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
Diabetes mellitus[c] (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
Hyperlipidemia[d] (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
Chronic bronchitis[e] (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
COPD[e] (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
Asthma[e] (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
Tuberculosis[e] (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
Angina[e] (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
Myocardial infarction[e] (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
Coronary heart disease[e] (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
Stroke[e] (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
Cancer[e] (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
Chronic hepatitis[e] (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
Arthritis[e] (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
Migraine[e] (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
Nephritis[e] (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
Alzheimer's disease[e] (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
Parkinson's disease[e] (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
Brain injury[e] (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[f] (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 ± SD)	39.88 ± 7.68	39.36 ± 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 x^2 test wer used for the comparison between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.

[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

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

[e] The disease was defined as self-reported disease.

[f] Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

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

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

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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

scores for the Lawton-Brody Activities of Daily Living Scale and the Social Support Rate Scale were 14.15 and 39.54, respectively.

Future plans: 2000 new entrants from Luohu district will be recruited every year until 2028. The data collection is expected to be ended at the end of 2030. The data will be used to assess the causality of aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. The data sets generated and/or analyzed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request.

Keywords: Cohort study, Aging-related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease, Mental health

Strengths and limitations of this study

1. The Shenzhen Aging-Related Disorder Cohort is a community-dwelling cohort with the comprehensive collections of epidemiological data, clinical examinations, environmental exposures, body components and biological samples in elderly Chinese population, which would be used to analyze the causality of various aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors.

2. Several ways will be applied to identify the morbidities and mortalities of aging-related diseases during the follow-up through questionnaire investigation,

physical examinations, and searching the National Electronic Disease Surveillance System as well as the National Mortality Surveillance System, which guarantee the integrity and validity of the health outcomes of interest in our cohort.

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

4. The medical histories of the participants in the current cohort were mainly self-reported, which might cause biased estimation between disease histories and aging-related disorders.

5. Only a subsample (34.98%) of the participants at baseline took part in the measurement of body components.

INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017.[1] It is forecasted that the life expectancy will keep increasing until 2040.[2] 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.[3] For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,[4] the cancer incidence increased by 28% from 2006 and 2016,[5] and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.[6,7] In 2017, aging-related diseases accounted for 51.3% of the global burden of diseases among adults.[8]

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.[9] Besides cardiovascular diseases, cancer and diabetes,[10-13] 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.[14,15] 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.[16] The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,[17] and that of Alzheimer's disease was estimated to have quadrupled between 2011 and

2015, from 6 to 28 million.[18] However, to date, there are no known effective treatments for most aging-related disorders, especially for neurological diseases, it is therefore urgent to identify the risk factors, particularly modifiable ones for facilitating early intervention and prevention of the onset of aging-related disorders.

Shenzhen, a major city in Guangdong province, China, situates immediately north of Hongkong. As the first special economic zone and the birthplace of economic miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd most competitive financial center in the world in 2017. Along with the highest-speed urbanization, Shenzhen has attracted large internal migration across the country, and experienced dramatic socioeconomic changes and accelerated aging process during the past decades. Given the population diversity, rapid urbanization, high-speed aging process as well as adequate medical and health resources in Shenzhen city, a dynamic, prospective cohort study, the Shenzhen Aging-Related Disorder Cohort, was designed to provide evidence for addressing opportunities regarding aging-related disorders as an aging-oriented research model for areas with most rapid urbanization and socioeconomic structure changes in developing countries.

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

1) determine the prevalence of aging-related disorders, including neurological disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases, diabetes mellitus, neoplasms, injuries and other non-communicable diseases in Shenzhen;

2) detect the incidences of major mental and neurological disorders, including

mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;

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

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

5) assess the effects of environmental factors, lifestyle, and genetic factors on the initiation and progression of aging-related disorders, especially for neurological and mental disorders;

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

7) generate health intervention and management strategies for aging-related disorders, especially for neurological and mental disorders.

COHORT DESCRIPTION

The participants of the cohort

The Shenzhen Aging-Related Disorder Cohort was established between 2017 and 2018 based on participants from 51 community health service centers in Luohu district of Shenzhen city, Guangdong province, China (Figure 1). The community health service center is the basic health administration unit located in each community, which is responsible for disease prevention, health care, promoting recovery in each stage of health-illness process, health education, family planning and medical treatment of all the population in the area under its jurisdiction. Firstly, among 11 districts of Shenzhen city, Luohu district was selected considering its similarity with Shenzhen city in terms of socioeconomic structure (Supplemental

Table 1). Secondly, all 51 community health service centers in Luohu district were included, which managed 24402 household registered permanent elderly residents older than 60 years. Individuals with severe physical disabilities or mental disorders which could affect daily activities or language communication were excluded through checking the medical insurance for urban residents and the National Electronic Disease Surveillance System considering that they could not response well to the questionnaire investigation, clinical examination and further follow-ups. Then, all household registered permanent elderly residents aged at least 60 years old and without severe physical or mental disorders (n=16843) of the selected community health service centers were invited to participate in the study. Approximately 56% (n=9411) agreed and provided signed informed consent, but 44% of the local residents refused the invitation due to unwillingness to spent time on the epidemiological investigation or less attraction for them or they had finished the physical examination in early 2017. Although the age distribution of our cohort was comparable with that of Shenzhen city, the current cohort had higher proportion of females (Supplemental Table 2). All participants were asked to bring their unique national identity cards for questionnaire investigation and physical examination in local health centers or hospitals. Considering the annual increase of 4000 adults aged 60 years or older in above mentioned community health service centers between 2016 and 2018, the cohort will be expanded by recruiting 2000 new entrants from the same community health 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 (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

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 lipoproteincholesterol, 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-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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 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
Assessments of neurological function and activities of daily living	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[19] 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 [≥24 points and <24 points].[20] The validity and reliability of the Chinese MMSE have been verified previously[16]. 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.[21,22] 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.[23] The

Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven component scores, was applied to assess the sleep quality of all participants.[24] The participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality. The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of the social support, namely subjective support (emotional support, four items), objective support (tangible support, three items) and availability support (three items). Higher SSRS scores represent a better social support. The validity and reliability of SSRS have been verified previously.[25]

Clinic analysis of blood and urine

After at least 8 hours of overnight fasting, venous blood samples from each participant were separately collected into the EDTA anticoagulant tubes (one 2-ml and one 5-ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature to separate plasma and serum. The serum samples were used for biochemical analyses, including fasting blood glucose, blood lipid, hepatic function, kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers and Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used for blood routine test, including the total number of white blood cell (WBC), red blood cell counts (RBC), hemoglobin contents and blood platelet counts. The detailed biochemical indexes of blood are listed in Supplemental Table 3. The EDTA-anticoagulated whole blood (0.3 ml) and plasma specimens (1 ml) were used for DNA and RNA extractions, and analysis of glycated hemoglobin A1c (HbA1c)

and homocysteine (HCY), respectively.

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

Parameters of clinical measurements and imaging

Each participant took part in the physical examination conducted by trained physicians in the district hospital. The inspection-palpation-percussion-auscultation (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity, oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The measurements of baseline anthropometric indices for each participant were performed on the day of physical examination. Standing height, weight and waist were measured with the subjects in light clothing and without shoes by ultrasonic weighing apparatus (HNH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300, OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the right arm supported at heart-level. Statistical analysis was based on the average of the two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray, abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas, urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate

B-type ultrasound inspection (only for males) and bone mineral density scan were then conducted. Out of 9411 participants, 3292 took part in the body composition measurements. The visceral fat and fluid imbalances in each segment of the body and the phase angle for cellular indicator of cell integrity were measured by bioelectrical impedance analysis using an Inbody 570 body composition analyzer (Biospace, Seoul, Korea). The body segments were analyzed, including elementary body composition [body weight, body mass index (BMI), protein mass and minerals mass], total body water (TBW) analysis [intracellular water, extracellular water (ECW) and ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb circumferences, waist-to-hip ratio, visceral fat area and visceral fat level) and basal metabolic rate.

The instruments used for the physical examination and the body composition measurements are listed as Supplemental Table 4.

The follow-up procedure

Follow-up will be conducted every 5 years to update exposures and outcomes by the staffs in the community health service centers, who have established good relationship with the elderly during daily disease prevention, treatment and recovery to reduce the potential impact of losses to follow up on the validity of the study result. An annual health education on aging-related disorders will be provided by Shenzhen Center for Disease Control and Prevention, and the daily medical consultation will be provided by the community health service centers for the participants to assure the retention of

the participants. The questionnaire survey, physical examination, the body composition measures, and neurological function and mental health assessments will be re-conducted during the follow-up. Blood and urine specimens will be collected according to the design procedures at baseline. The incidence of non-communicable chronic diseases, including neurological and mental disorders, hypertension, dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging-related diseases will be annually verified through searching the IDs of participants of the cohort, which were collected during the baseline questionnaire interviews in the medical insurance for urban residents, the National Electronic Disease Surveillance system and the National Mortality Surveillance System. The disease reports will be extracted manually. For those presenting low MMSE score (less than 24 points) at baseline or significant decline of cognition in MMSE but without diagnosis of mental or neurological disorders from the medical insurance for urban residents or the National Electronic Disease Surveillance System, the clinical diagnosis of mental disorders will be further performed by an expert panel from Shenzhen Luohu Hospital Group.

All death cases will be verified by Chinese Cause of Death Registration System in Shenzhen Center for Disease Control and Prevention. The diagnosis of aforementioned conditions and the causes of death will be classified according to the 10th version of the International Statistical Classification of Diseases (ICD-10). The flow diagram of the cohort design is presented as Figure 3. The anticipated rate of attrition is no more than 15% until the end of 2030.

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^{2*}	*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 x^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^{2*}	*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 (82.63)		
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 (77.71)		
No	1749 (18.58)	581 (14.45)	1168 (21.63)		
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 (25.05)		
No	5760 (61.20)	1912 (47.54)	3848 (71.40)		
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 (94.41)		
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 x^2 test were used for the comparisons between continuous variables and for the categorical variables, respectively.

The baseline levels of of participants in the Shenzhen Aging-Related Disorder Cohort were detected, including blood routine, lipid levels, blood glucose, homocysteine, hepatic function, kidney function, tumor biomarkers, Epstein-Barr Virus (EBV) antibody and urine routine. The detailed items are provided as Supplemental Table 3. With the exception of the parameters (including aspartate aminotransferase (AST), EB Virus status, carcino-embryonic antigen (CEA), alpha fetoprotein (AFP) and urine bilirubin), other indices presented significant difference between both sexes (all $P<0.05$, Tables 4 and 5).

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

Variables	Total	Male	Female	t/x^{2*}	*P*
Blood routine					
WBC (**n=9377**, × 10^9/l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.56	13.48	<0.0001
RBC (**n=9377**, × 10^{12}/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±0.97	59.52	<0.0001
Platelet count (**n=9377**, × 10^9/l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
Lipid levels					
TCHO (**n=9376**, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.05	-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±0.37	-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±0.86	-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±1.73	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±5.96	23.25	<0.0001
Hepatic function					
Total protein (**n=9378**, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.12	-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 (3.76)	8.14	0.004
Kidney function					
Blood urea nitrogen (**n=9369**, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.48	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 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 x^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^{2*}	*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 (3.28)		
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 x^2 test were used for the comparisons between continuous variables and the categorical variables, respectively.

**Fisher exact test was used.

Table 6 presents the baseline levels of clinical measurement parameters of participants in the Shenzhen Aging-Related Disorder Cohort, including blood pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary system, color doppler ultrasound of prostate, bone mineral density. Owing to the relatively long waiting time, less interest and attention for their body components, only 34.98% (3292 of 9411) of the participants completed the measurements of body component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total body water, intracellular water, extracellular water, body fat mass, percentage of body fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody score. All clinical parameters presented significant difference between men and women (all $P<0.05$). With the exception of age, sex, the prevalence of overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as the other characteristics were comparable between individuals with and without body component data at baseline (Supplemental Table 5).

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

Variables	Total	Male	Female	t/x^{2*}	*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 (2.52)		
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)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio (**n=3292**, mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate (**n=3292**, kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water (**n=3292**, k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water (**n=3292**, L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water (**n=3292**, L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass(**n=3292**,kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.74	-10.25	<0.0001
Percentage of body fat (**n=3292**, %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.65	-40.37	<0.0001
Fat free mass(**n=3292**,Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.94	68.92	<0.0001
Skeletal muscle(**n=3292**,Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM(**n=3292**,Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.74	69.54	<0.0001
Body protein(**n=3292**,kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.78	69.62	<0.0001
Body minerals(**n=3292**,kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.29	55.68	<0.0001
InBody score(**n=3292**, mean±SD)	69.05±4.92	68.15±5.16	69.67±4.65	-8.50	<0.0001

SD, standard deviation.

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

**Uncertainty was caused by unsatisfied examination conditions.

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/x^{2*}	*P*
Overweight/Obesity[a] (**n=9307**, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	5.96	0.01
Hypertension[b] (**n=9374**, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus[c] (**n=9340**, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	10.39	0.001
Dyslipidemia[d] (**n=9377**, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	239.42	<0.0001
Chronic bronchitis[e] (**n=9354**, %)	136 (1.45)	71 (1.78)	65 (1.21)	5.09	0.02
COPD[e] (**n=9357**, %)	18 (0.19)	12 (0.30)	6 (0.11)	4.23	0.04
Asthma[e] (**n=9356**, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis[e] (**n=9315**, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina[e] (**n=9311**, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction[e] (**n=9312**, %)	51 (0.55)	35 (0.88)	16 (0.30)	14.07	0.0002
Coronary heart disease[e] (**n=9315**, %)	530 (5.69)	239 (6.01)	291 (5.45)	1.33	0.25
Stroke[e] (**n=9309**, %)	102 (1.10)	57 (1.43)	45 (0.84)	7.30	0.007
Cancer[e] (**n=9303**, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis[e] (**n=9311**, %)	47 (0.50)	24 (0.60)	23 (0.43)	1.35	0.24
Arthritis[e] (**n=9308**, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine[e] (**n=9311**, %)	58 (0.62)	16 (0.40)	42 (0.79)	5.47	0.02
Nephritis[e] (**n=9312**, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease[e] (**n=9309**, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease[e] (**n=9309**, %)	21 (0.23)	13 (0.33)	8 (0.15)	3.17	0.08
Brain injury[e] (**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[f] (**n=9243**, %)	303 (3.28)	111 (2.81)	192 (3.63)	3.67	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	-4.75	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 x^2test were used for the comparisons between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.
[b]Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.
[c]Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.
[d]Dyslipidemia was defined as TCHO ≥5.18 mmol/L, or TG ≥1.7 mmol/L, or HDL-C <1.0 mmol/L, or LDL-C ≥3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.
[e]The disease was defined as self-reported disease.
[f]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 cites 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 except 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[26], the China Health and Retirement Longitudinal Study[27] and Chinese Longitudinal Healthy Longevity Survey[28], 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

environmental exposures, such as lifestyle, metals, metabolite of tobacco and pesticide.

However, there are some limitations of our cohort. First, although Luohu district is similar with Shenzhen city in socioeconomic structures among all 11 districts, there is inevitably some deviations, especially in age composition. However, the age structure in our cohort is comparable with that of the elderly in Shenzhen city. But our cohort has higher proportion of females, which may cause deviations of the demographic features for the whole study population. To reduce the potential bias, we presented all results by sex. Second, 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. Third, the medical histories of the participants in our cohort were self-reported. But the link between our cohort and disease surveillance system in Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and reliability of the information. Fourth, only 3292 participants took part in the body components analysis at baseline. However, the selection bias tends to be small since most baseline characteristics are comparable between individuals with and without body component data (Supplemental Table 5). Fifth, recruitment of 9411 participants at baseline makes our sample size relatively smaller compared with other cohorts in the world. However, according to the study design, an annual 2000 new participants will be recruited to enlarge the cohort until 2028, which will ensure the statistical power for most association studies in the future.

Collaboration

The datasets generated and/or analyzed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request from employees of a recognized academic institution, health service organization or charitable research organization with experience in medical research with the clear statement of their research interest, analysis proposal, data protection measures and corporation mechanisms. However, specific ideas and proposals for potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JJLIUSZCDC@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.

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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 descriptive data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XW, TL, EG, LZ, KH, YH, CY, QZ, FY and XY participated in data collection, helped drafted the manuscript and reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, FZ, TL, EG, FY and XY constructed the data base and JY and JL were responsible for data management. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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. [JJLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

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Figure legends

Figure 1 Location of Shenzhen in China

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

Figure 3 The flow diagram of the cohort design

Figure 4 The birthplace distribution of the studied individuals

Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

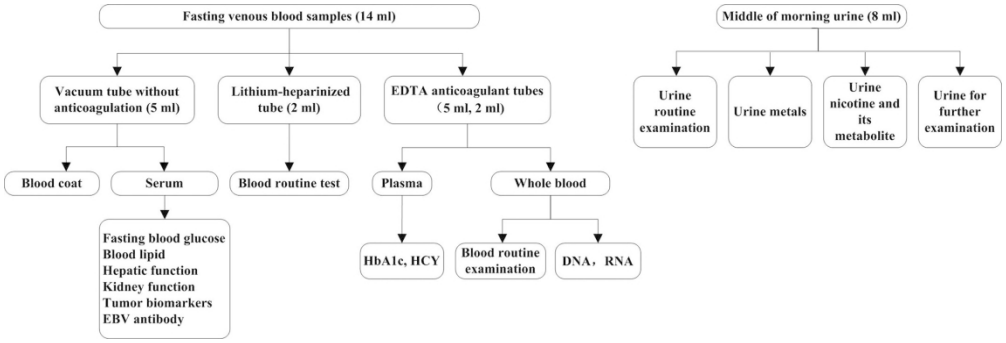

Figure 2 The flow diagram of collecting and separation blood and urine specimen

180x60mm (300 x 300 DPI)

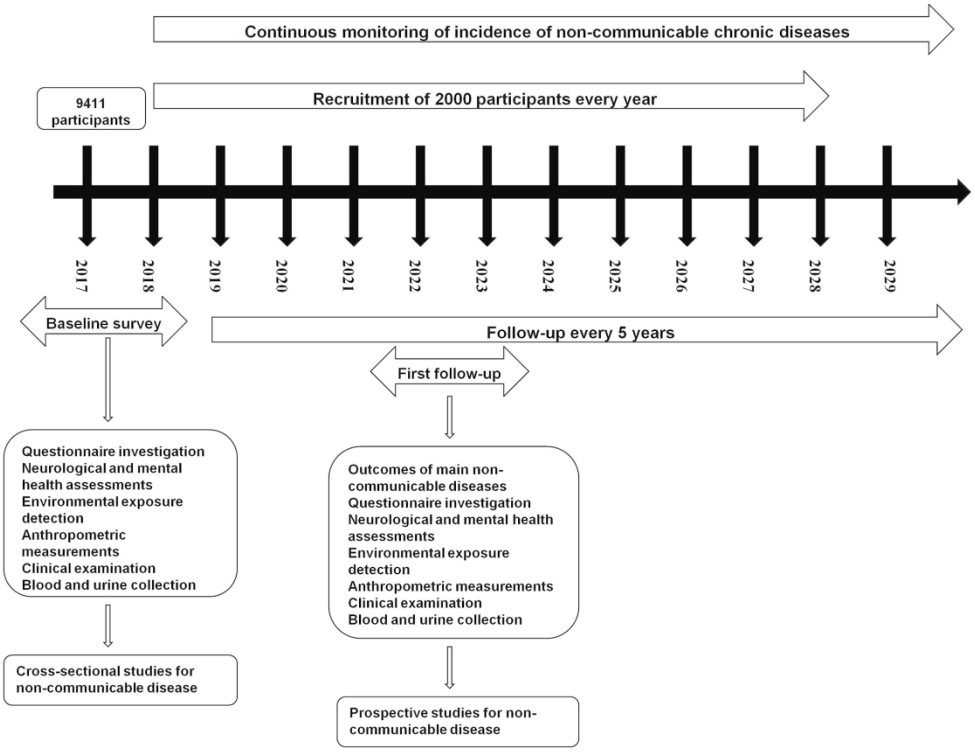

Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

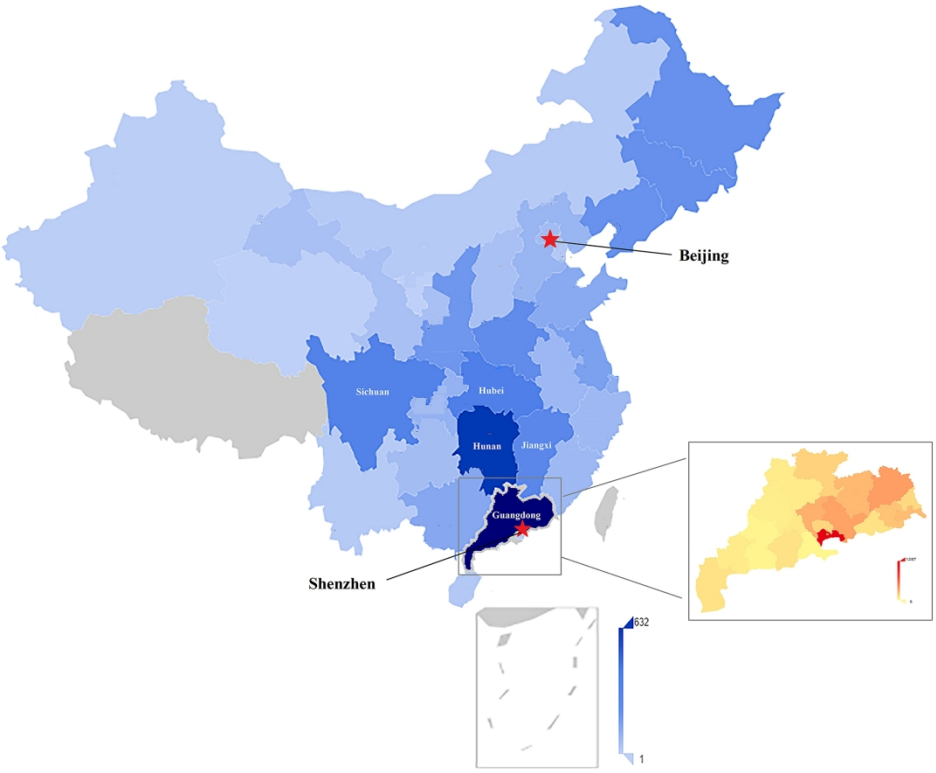

Figure 4 The birthplace distribution of the studied individuals

180x147mm (300 x 300 DPI)

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

	Luohu district ($n=103.99\times10^4$)	Shenzhen city ($n=1302.66\times10^4$)
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 biochemichal analysis of biosamples at baseline in the Shenzhen Aging-Related Disorder Cohort

Categories	Measurements
Blood routine	white blood cell counts (WBC), red blood cell counts (RBC), hemoglobin contents, platelet counts
Lipid levels	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
Blood glucose	fasting plasma glucose, glycated hemoglobin
Homocysteine	
Hepatic function	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
Kidney function	creatinine, uric acid and urea nitrogen
Tumor biomarkers	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
Epstein-Barr Virus (EBV) antibody	
Urine routine	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent 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 metabolites	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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

Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
Basal metabolic rata	Inbody 570, InBody Co., Ltd, Seoul, Korea
Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
Urine metals	NEXION 300X PerkinElmer Inc., USA
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^{2*}	*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[a] (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02

Hypertension[b] (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
Diabetes mellitus[c] (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
Hyperlipidemia[d] (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
Chronic bronchitis[e] (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
COPD[e] (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
Asthma[e] (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
Tuberculosis[e] (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
Angina[e] (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
Myocardial infarction[e] (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
Coronary heart disease[e] (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
Stroke[e] (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
Cancer[e] (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
Chronic hepatitis[e] (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
Arthritis[e] (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
Migraine[e] (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
Nephritis[e] (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
Alzheimer's disease[e] (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
Parkinson's disease[e] (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
Brain injury[e] (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[f] (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 ± SD)	39.88 ± 7.68	39.36 ± 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 x^2 test wer used for the comparisons between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.

[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

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

[e] The disease was defined as self-reported disease.

[f] Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.

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

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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

scores for the Lawton-Brody Activities of Daily Living Scale and the Social Support Rate Scale were 14.15 and 39.54, respectively.

Future plans: 2000 new entrants from Luohu district will be recruited every year until 2028. The data collection is expected to be ended at the end of 2030. The data will be used to assess the causality of aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors. The data sets generated and/or analyzed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request.

Keywords: Cohort study, Aging-related disorders, Lifestyle, Environmental exposure, Genetic susceptibility, Neurological disease, Mental health

Strengths and limitations of this study

1. The Shenzhen Aging-Related Disorder Cohort is a community-dwelling cohort with the comprehensive collections of epidemiological data, clinical examinations, environmental exposures, body components and biological samples in elderly Chinese population, which would be used to analyze the causality of various aging-related disorders, especially neurological and mental disorders through integrating environmental, genetic and lifestyle factors.

2. Several ways will be applied to identify the morbidities and mortalities of aging-related diseases during the follow-up through questionnaire investigation,

physical examinations, and searching the National Electronic Disease Surveillance System as well as the National Mortality Surveillance System, which guarantee the integrity and validity of the health outcomes of interest in our cohort.

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

4. The medical histories of the participants in the current cohort were mainly self-reported, which might cause biased estimation between disease histories and aging-related disorders.

5. Only a subsample (34.98%) of the participants at baseline took part in the measurement of body components.

INTRODUCTION

Globally, life expectancy at birth increased by 7.4 years from 1990 to 2017.[1] It is forecasted that the life expectancy will keep increasing until 2040.[2] 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.[3] For instance, the lifetime risk of stroke increased by 8.9% from 1990 to 2016,[4] the cancer incidence increased by 28% from 2006 and 2016,[5] and the number of dementia is forecasted to increase from 47.5 million in 2010 to 131.5 million by 2050.[6,7] In 2017, aging-related diseases accounted for 51.3% of the global burden of diseases among adults.[8]

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.[9] Besides cardiovascular diseases, cancer and diabetes,[10-13] 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.[14,15] 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.[16] The prevalence of Parkinson's disease increased by 116% in China from 1990 to 2016,[17] and that of Alzheimer's disease was estimated to have quadrupled between 2011 and

2015, from 6 to 28 million.[18] However, to date, there are no known effective treatments for most aging-related disorders, especially for neurological diseases, it is therefore urgent to identify the risk factors, particularly modifiable ones for facilitating early intervention and prevention of the onset of aging-related disorders.

Shenzhen, a major city in Guangdong province, China, situates immediately north of Hongkong. As the first special economic zone and the birthplace of economic miracle of China, Shenzhen grew from a small fishing village in 1980 to the 22nd most competitive financial center in the world in 2017. Along with the highest-speed urbanization, Shenzhen has attracted large internal migration across the country, and experienced dramatic socioeconomic changes and accelerated aging process during the past decades. Given the population diversity, rapid urbanization, high-speed aging process as well as adequate medical and health resources in Shenzhen city, a dynamic, prospective cohort study, the Shenzhen Aging-Related Disorder Cohort, was designed to provide evidence for addressing opportunities regarding aging-related disorders as an aging-oriented research model for areas with most rapid urbanization and socioeconomic structure changes in developing countries.

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

1) determine the prevalence of aging-related disorders, including neurological disorders, mental diseases, chronic respiratory diseases, cardiovascular diseases, diabetes mellitus, neoplasms, injuries and other non-communicable diseases in Shenzhen;

2) detect the incidences of major mental and neurological disorders, including

mild cognitive impairment, dementia, Alzheimer's disease and Parkinson's disease;

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

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

5) assess the effects of environmental factors, lifestyle, and genetic factors on the initiation and progression of aging-related disorders, especially for neurological and mental disorders;

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

7) generate health intervention and management strategies for aging-related disorders, especially for neurological and mental disorders.

COHORT DESCRIPTION

The participants of the cohort

The Shenzhen Aging-Related Disorder Cohort was established between 2017 and 2018 based on participants from 51 community health service centers in Luohu district of Shenzhen city, Guangdong province, China (Figure 1). The community health service center is the basic health administration unit located in each community, which is responsible for disease prevention, health care, promoting recovery in each stage of health-illness process, health education, family planning and medical treatment of all the population in the area under its jurisdiction. Firstly, among 11 districts of Shenzhen city, Luohu district was selected considering its similarity with Shenzhen city in terms of socioeconomic structure (Supplemental

Table 1). Secondly, all 51 community health service centers in Luohu district were included, which managed 24402 household registered permanent elderly residents older than 60 years. Individuals with severe physical disabilities or mental disorders which could affect daily activities or language communication were excluded through checking the medical insurance for urban residents and the National Electronic Disease Surveillance System considering that they could not response well to the questionnaire investigation, clinical examination and further follow-ups. Then, all household registered permanent elderly residents aged at least 60 years old and without severe physical or mental disorders (n=16843) of the selected community health service centers were invited to participate in the study. Approximately 56% (n=9411) agreed and provided signed informed consent, but 44% of the local residents refused the invitation due to unwillingness to spent time on the epidemiological investigation or less attraction for them or they had finished the physical examination in early 2017. Although the age distribution of our cohort was comparable with that of Shenzhen city, the current cohort had higher proportion of females when compared with the elderly permanent residents in Luohu district or Shenzhen city (Supplemental Table 2). All participants were asked to bring their unique national identity cards for questionnaire investigation and physical examination in local health centers or hospitals. Considering the annual increase of 4000 adults aged 60 years or older in above mentioned community health service centers between 2016 and 2018, the cohort will be expanded by recruiting 2000 new entrants from the same community health 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 (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
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 lipoproteincholesterol, 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-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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 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
Assessments of neurological function and activities of daily living	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[19] 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 [≥24 points and <24 points].[20] The validity and reliability of the Chinese MMSE have been verified previously[16]. 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.[21,22] 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.[23] The Pittsburgh sleep quality index (PSQI), a 24-item questionnaire comprising seven component scores, was applied to assess the sleep quality of all participants.[24] The participants with higher PSQI scores (ranging from 0 to 21) had worse sleep quality. The ten items of the Social Support Rate Scale (SSRS) reflect the three dimensions of the social support, namely subjective support (emotional support, four items), objective support (tangible support, three items) and availability support (three items). Higher SSRS scores represent a better social support. The validity and reliability of SSRS have been verified previously.[25]

Clinic analysis of blood and urine

After at least 8 hours of overnight fasting, venous blood samples from each participant were separately collected into the EDTA anticoagulant tubes (one 2-ml and one 5-ml), promoting coagulation tube (5 ml) and the lithium-heparinized tube (2 ml), and then the blood specimens were centrifuged at 3000 rpm for 5 min at room temperature to separate plasma and serum. The serum samples were used for biochemical analyses, including fasting blood glucose, blood lipid, hepatic function, kidney function (creatinine, uric acid and urea nitrogen), tumor biomarkers and Epstein-Barr Virus (EBV) antibody. The lithium-heparinized whole blood was used for blood routine test, including the total number of white blood cell (WBC), red blood cell counts (RBC), hemoglobin contents and blood platelet counts. The detailed biochemical indexes of blood are listed in Supplemental Table 3. The

EDTA-anticoagulated whole blood (0.3 ml) and plasma specimens (1 ml) were used for DNA and RNA extractions, and analysis of glycated hemoglobin A1c (HbA1c) and homocysteine (HCY), respectively.

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

Parameters of clinical measurements and imaging

Each participant took part in the physical examination conducted by trained physicians in the district hospital. The inspection-palpation-percussion-auscultation (IPPA) approach was used to find visual abnormalities in the eyes, ears, nasal cavity, oral cavity, thyroid, thorax, lung, heart, liver, spleen, skin and limbs. The measurements of baseline anthropometric indices for each participant were performed on the day of physical examination. Standing height, weight and waist were measured with the subjects in light clothing and without shoes by ultrasonic weighing apparatus (HNH-219, OMRON Healthcare Co., Ltd, Japan). Resting blood pressure and pulse rate were tested in duplicate using an electronic sphygmomanometers (HBP-1300, OMRON Healthcare Co., Ltd, Japan) with the participant in sitting position and the right arm supported at heart-level. Statistical analysis was based on the average of the two measures. Twelve-lead resting electrocardiogram (ECG), routine chest X-ray,

abdominal B-type ultrasound inspection of the liver, gall bladder, spleen or pancreas, urinary tract B-type ultrasound inspections of uterus, bladder and kidney, prostate B-type ultrasound inspection (only for males) and bone mineral density scan were then conducted. Out of 9411 participants, 3292 took part in the body composition measurements. The visceral fat and fluid imbalances in each segment of the body and the phase angle for cellular indicator of cell integrity were measured by bioelectrical impedance analysis using an Inbody 570 body composition analyzer (Biospace, Seoul, Korea). The body segments were analyzed, including elementary body composition [body weight, body mass index (BMI), protein mass and minerals mass], total body water (TBW) analysis [intracellular water, extracellular water (ECW) and ECW/TBW], segmental muscle and fat analysis [total skeletal muscle mass and total body fat percentage (BF%)], segmental lean mass analysis (neck, waist, hip and limb circumferences, waist-to-hip ratio, visceral fat area and visceral fat level) and basal metabolic rate.

The instruments used for the physical examination and the body composition measurements are listed as Supplemental Table 4.

The follow-up procedure

Follow-up will be conducted every 5 years to update exposures and outcomes by the staffs in the community health service centers, who have established good relationship with the elderly during daily disease prevention, treatment and recovery to reduce the potential impact of losses to follow up on the validity of the study result. An annual health education on aging-related disorders will be provided by Shenzhen Center for

Disease Control and Prevention, and the daily medical consultation will be provided by the community health service centers for the participants to assure the retention of the participants. The questionnaire survey, physical examination, the body composition measures, and neurological function and mental health assessments will be re-conducted during the follow-up. Blood and urine specimens will be collected according to the design procedures at baseline. The incidence of non-communicable chronic diseases, including neurological and mental disorders, hypertension, dyslipidemia, stroke, coronary heart disease, diabetes mellitus, cancer and other aging-related diseases will be annually verified through searching the IDs of participants of the cohort, which were collected during the baseline questionnaire interviews in the medical insurance for urban residents, the National Electronic Disease Surveillance system and the National Mortality Surveillance System. The disease reports will be extracted manually. For those presenting low MMSE score (less than 24 points) at baseline or significant decline of cognition in MMSE but without diagnosis of mental or neurological disorders from the medical insurance for urban residents or the National Electronic Disease Surveillance System, the clinical diagnosis of mental disorders will be further performed by an expert panel from Shenzhen Luohu Hospital Group.

All death cases will be verified by Chinese Cause of Death Registration System in Shenzhen Center for Disease Control and Prevention. The diagnosis of aforementioned conditions and the causes of death will be classified according to the 10th version of the International Statistical Classification of Diseases (ICD-10). The

flow diagram of the cohort design is presented as Figure 3. The anticipated rate of attrition is no more than 15% until the end of 2030.

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^{2*}	*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 x^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^{2*}	*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 (82.63)		
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 (77.71)		
No	1749 (18.58)	581 (14.45)	1168 (21.63)		
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 (25.05)		
No	5760 (61.20)	1912 (47.54)	3848 (71.40)		
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 (94.41)		
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 x^2 test were used for the comparisons between continuous variables and for the categorical variables, respectively.

The baseline levels of of participants in the Shenzhen Aging-Related Disorder Cohort were detected, including blood routine, lipid levels, blood glucose, homocysteine, hepatic function, kidney function, tumor biomarkers, Epstein-Barr Virus (EBV) antibody and urine routine. The detailed items are provided as Supplemental Table 3. With the exception of the parameters (including aspartate aminotransferase (AST), EB Virus status, carcino-embryonic antigen (CEA), alpha fetoprotein (AFP) and urine bilirubin), other indices presented significant difference between both sexes (all $P<0.05$, Tables 4 and 5).

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

Variables	Total	Male	Female	t/x^{2*}	*P*
Blood routine					
WBC (**n=9377**, × 10^9/l, mean±SD)	6.62±1.64	6.89±1.71	6.43±1.56	13.48	<0.0001
RBC (**n=9377**, × 10^{12}/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±0.97	59.52	<0.0001
Platelet count (**n=9377**, × 10^9/l, mean±SD)	230.16±58.14	219.75±54.62	237.9±59.47	-15.34	<0.0001
Lipid levels					
TCHO (**n=9376**, mmol/l, mean±SD)	5.50±1.09	5.20±1.05	5.72±1.05	-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±0.37	-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±0.86	-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±1.73	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±5.96	23.25	<0.0001
Hepatic function					
Total protein (**n=9378**, g/l, mean±SD)	73.93±4.08	73.52±4.00	74.23±4.12	-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 (3.76)	8.14	0.004
Kidney function					
Blood urea nitrogen (**n=9369**, mmol/l, mean±SD)	5.78±1.60	6.00±1.74	5.61±1.48	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 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 x^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^{2*}	*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 (3.28)		
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 x^2 test were used for the comparisons between continuous variables and the categorical variables, respectively.

**Fisher exact test was used.

Table 6 presents the baseline levels of clinical measurement parameters of participants in the Shenzhen Aging-Related Disorder Cohort, including blood pressure, pulse rate, examinations of electrocardiogram, chest X-ray, color doppler ultrasound of liver/ gallbladder/ spleen/ pancreas, color doppler ultrasound of urinary system, color doppler ultrasound of prostate, bone mineral density. Owing to the relatively long waiting time, less interest and attention for their body components, only 34.98% (3292 of 9411) of the participants completed the measurements of body component (Table 6), which comprised of waist hip ratio, basal metabolic rate, total body water, intracellular water, extracellular water, body fat mass, percentage of body fat, fat free mass, skeletal muscle, SLM, body protein, body minerals and InBody score. All clinical parameters presented significant difference between men and women (all $P<0.05$). With the exception of age, sex, the prevalence of overweight/obesity, hypertension and arthritis, ADL score and SSRS score as well as the other characteristics were comparable between individuals with and without body component data at baseline (Supplemental Table 5).

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

Variables	Total	Male	Female	t/x^{2*}	*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 (2.52)		
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)		
Osteopenia/osteoporosis	7846 (83.37)	2931 (72.87)	4915 (91.20)		

Missing	170 (1.81)	88 (2.19)	82 (1.52)		
Waist hip ratio (**n=3292**, mean±SD)	0.88±0.05	0.89±0.06	0.88±0.05	7.14	<0.0001
Basal metabolic rate (**n=3292**, kcal, mean±SD)	1281.47±158.83	1433.37±114.83	1178.89±85.16	68.94	<0.0001
Total body water (**n=3292**, k, mean±SD)	31.10±5.45	36.32±3.91	27.58±2.91	69.47	<0.0001
Intracellular water (**n=3292**, L, mean±SD)	19.07±3.39	22.32±2.43	16.87±1.81	69.68	<0.0001
Extracellular water (**n=3292**, L, mean±SD)	12.04±2.07	14.00±1.51	10.71±1.12	67.67	<0.0001
Body fat mass(**n=3292**,kg, mean±SD)	19.98±5.72	18.77±5.46	20.80±5.74	-10.25	<0.0001
Percentage of body fat (**n=3292**, %, mean±SD)	31.94±6.79	27.19±5.41	35.15±5.65	-40.37	<0.0001
Fat free mass(**n=3292**,Kg, mean±SD)	42.20±7.35	49.23±5.32	37.45±3.94	68.92	<0.0001
Skeletal muscle(**n=3292**,Kg, mean±SD)	22.87±4.23	27.12±3.18	20.00±2.46	69.67	<0.0001
SLM(**n=3292**,Kg, mean±SD)	39.85±7.00	46.56±5.03	35.31±3.74	69.54	<0.0001
Body protein(**n=3292**,kg, mean±SD)	8.24±1.47	9.64±1.05	7.29±0.78	69.62	<0.0001
Body minerals(**n=3292**,kg, mean±SD)	2.85±0.46	3.25±0.38	2.58±0.29	55.68	<0.0001
InBody score(**n=3292**, mean±SD)	69.05±4.92	68.15±5.16	69.67±4.65	-8.50	<0.0001

SD, standard deviation.

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

**Uncertainty was caused by unsatisfied examination conditions.

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/x^{2*}	*P*
Overweight/Obesity[a] (**n=9307**, %)	5061 (54.38)	2219 (55.84)	2842 (53.29)	5.96	0.01
Hypertension[b] (**n=9374**, %)	5476 (58.24)	2256 (56.32)	3220 (59.99)	12.72	0.0004
Diabetes mellitus[c] (**n=9340**, %)	2083 (22.30)	954 (23.91)	1129 (21.10)	10.39	0.001
Dyslipidemia[d] (**n=9377**, %)	7097 (75.69)	2711 (67.74)	4386 (81.60)	239.42	<0.0001
Chronic bronchitis[e] (**n=9354**, %)	136 (1.45)	71 (1.78)	65 (1.21)	5.09	0.02
COPD[e] (**n=9357**, %)	18 (0.19)	12 (0.30)	6 (0.11)	4.23	0.04
Asthma[e] (**n=9356**, %)	41 (0.44)	19 (0.48)	22 (0.41)	0.22	0.64
Tuberculosis[e] (**n=9315**, %)	38 (0.40)	16 (0.40)	22 (0.41)	0.007	0.93
Angina[e] (**n=9311**, %)	36 (0.39)	13 (0.33)	23 (0.43)	0.65	0.42
Myocardial infarction[e] (**n=9312**, %)	51 (0.55)	35 (0.88)	16 (0.30)	14.07	0.0002
Coronary heart disease[e] (**n=9315**, %)	530 (5.69)	239 (6.01)	291 (5.45)	1.33	0.25
Stroke[e] (**n=9309**, %)	102 (1.10)	57 (1.43)	45 (0.84)	7.30	0.007
Cancer[e] (**n=9303**, %)	203 (2.18)	53 (1.33)	150 (2.82)	23.45	<0.0001
Chronic hepatitis[e] (**n=9311**, %)	47 (0.50)	24 (0.60)	23 (0.43)	1.35	0.24
Arthritis[e] (**n=9308**, %)	469 (5.04)	118 (2.97)	351 (6.58)	62.28	<0.0001
Migraine[e] (**n=9311**, %)	58 (0.62)	16 (0.40)	42 (0.79)	5.47	0.02
Nephritis[e] (**n=9312**, %)	36 (0.39)	17 (0.43)	19 (0.36)	0.30	0.58
Alzheimer's disease[e] (**n=9309**, %)	17 (0.18)	9 (0.23)	8 (0.15)	0.73	0.39
Parkinson's disease[e] (**n=9309**, %)	21 (0.23)	13 (0.33)	8 (0.15)	3.17	0.08
Brain injury[e] (**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[f] (**n=9243**, %)	303 (3.28)	111 (2.81)	192 (3.63)	3.67	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	-4.75	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 x^2test were used for the comparisons between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.
[b]Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.
[c]Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.
[d]Dyslipidemia was defined as TCHO ≥5.18 mmol/L, or TG ≥1.7 mmol/L, or HDL-C <1.0 mmol/L, or LDL-C ≥3.37 mmol/L or self-reported hyperlipidemia diagnosis by a physician, or taking lipid-lowering drugs.
[e]The disease was defined as self-reported disease.
[f]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 cites 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 except 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[26], the China Health and Retirement Longitudinal Study[27] and Chinese Longitudinal Healthy Longevity Survey[28], 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

environmental exposures, such as lifestyle, metals, metabolite of tobacco and pesticide.

However, there are some limitations of our cohort. First, although Luohu district is similar with Shenzhen city in socioeconomic structures among all 11 districts, there is inevitably some deviations, especially in age composition. However, the age structure in our cohort is comparable with that of the elderly in Shenzhen city. But our cohort has higher proportion of females, which may cause deviations of the demographic features for the whole study population. To reduce the potential bias, we presented all results by sex. Second, 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. Third, the medical histories of the participants in our cohort were self-reported. But the link between our cohort and disease surveillance system in Shenzhen Center for Disease Control and Prevention will guarantee the accuracy and reliability of the information. Fourth, only 3292 participants took part in the body components analysis at baseline. However, the selection bias tends to be small since most baseline characteristics are comparable between individuals with and without body component data (Supplemental Table 5). Fifth, recruitment of 9411 participants at baseline makes our sample size relatively smaller compared with other cohorts in the world. However, according to the study design, an annual 2000 new participants will be recruited to enlarge the cohort until 2028, which will ensure the statistical power for most association studies in the future.

Collaboration

The datasets generated and/or analyzed during the current study are not publicly available at this stage, but are available from the corresponding author on reasonable request from employees of a recognized academic institution, health service organization or charitable research organization with experience in medical research with the clear statement of their research interest, analysis proposal, data protection measures and corporation mechanisms. However, specific ideas and proposals for potential collaborations would be welcomed and invited to contact the corresponding authors via e-mail to L.J. [JJLIUSZCDC@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.

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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 descriptive data analysis. LN, ZG, YL, FZ, WC, WL, LW, JZ, JY, XW, TL, EG, LZ, KH, YH, CY, QZ, FY and XY participated in data collection, helped drafted the manuscript and reviewed the manuscript for important intellectual content. LL, WL, LW, JZ, XW, FZ, TL, EG, FY and XY constructed the data base and JY and JL were responsible for data management. All authors read and approved the final manuscript.

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Competing interests

The authors declare that they have no competing interests.

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. [JJLIUSZCDC@163.com] and Y. J. [jyuan@tjh.tjmu.edu.cn].

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Figure legends

Figure 1 Location of Shenzhen in China

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

Figure 3 The flow diagram of the cohort design

Figure 4 The birthplace distribution of the studied individuals

Figure 1 Location of Shenzhen in China

114x120mm (300 x 300 DPI)

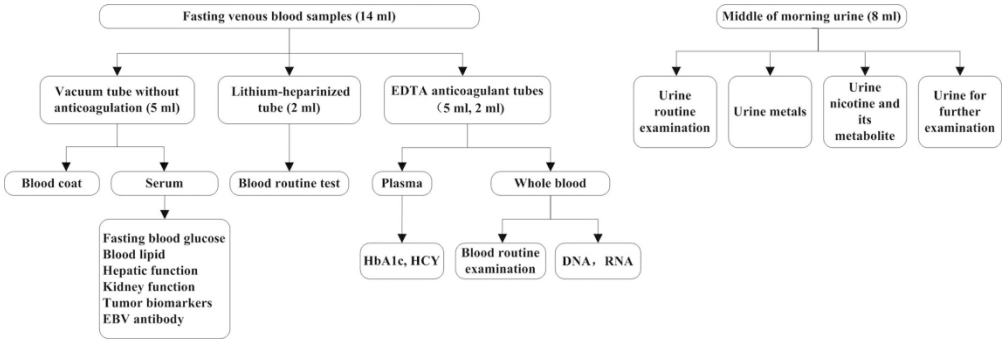

Figure 2 The flow diagram of collecting and separation blood and urine specimen

180x60mm (300 x 300 DPI)

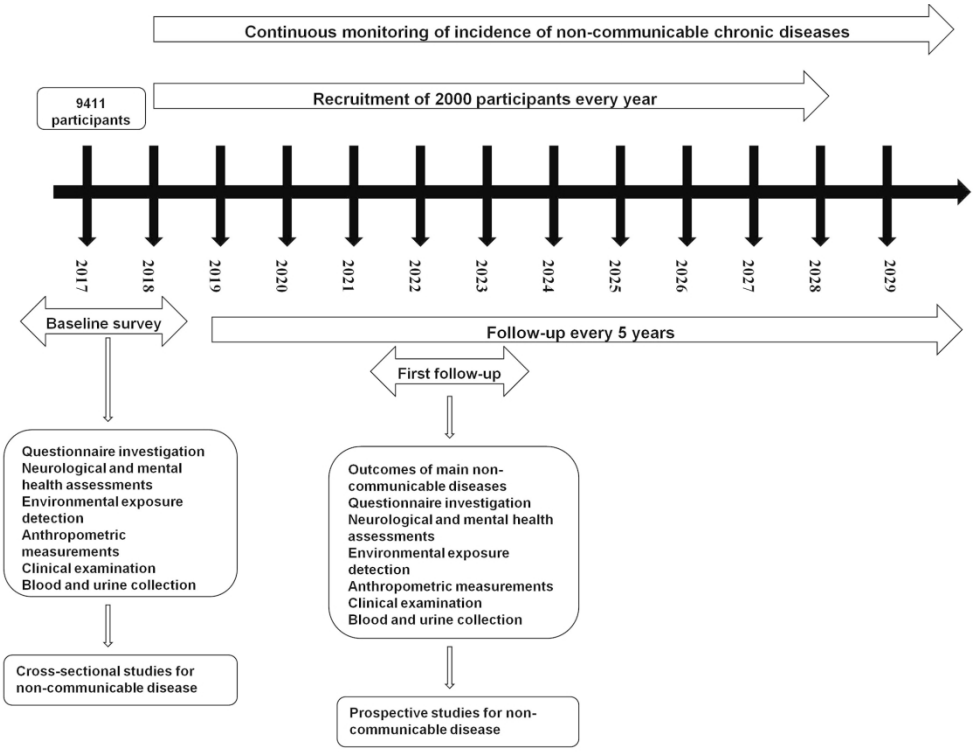

Figure 3 The flow diagram of the cohort design

180x134mm (300 x 300 DPI)

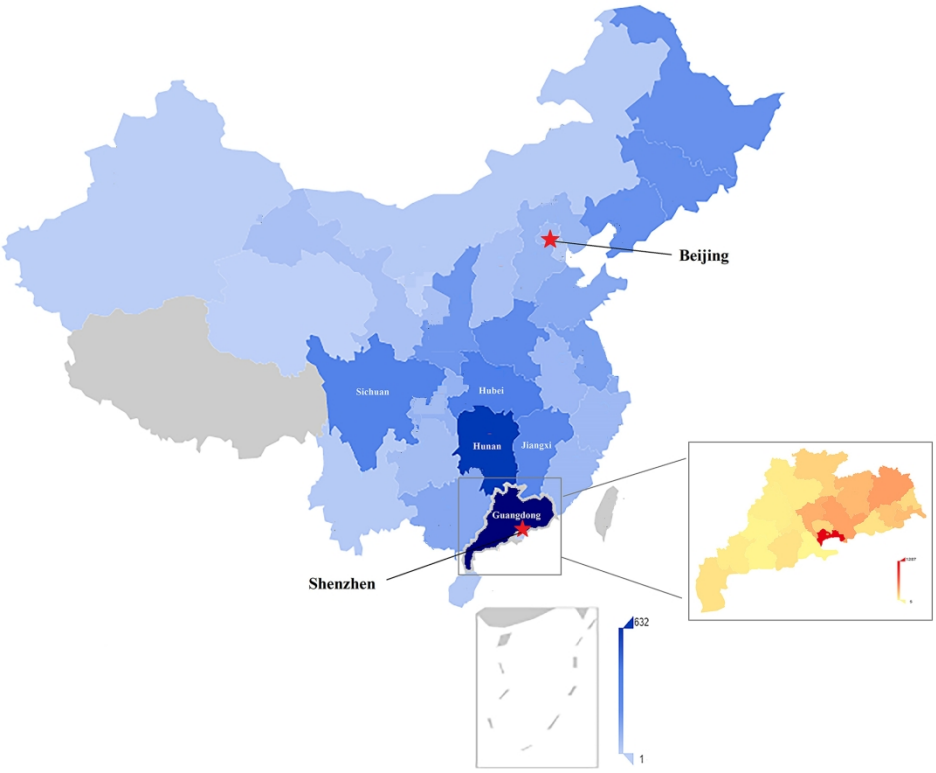

Figure 4 The birthplace distribution of the studied individuals

180x147mm (300 x 300 DPI)

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

	Luohu district ($n=103.99\times10^4$)	Shenzhen city ($n=1302.66\times10^4$)
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 biochemichal analysis of biosamples at baseline in the Shenzhen Aging-Related Disorder Cohort

Categories	Measurements
Blood routine	white blood cell counts (WBC), red blood cell counts (RBC), hemoglobin contents, platelet counts
Lipid levels	total cholesterol (TCHO), triglyceride (TG), low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C)
Blood glucose	fasting plasma glucose, glycated hemoglobin
Homocysteine	
Hepatic function	total protein, albumin, total bilirubin (TB), alanine aminotransferase (ALT) and aspartate aminotransferase (AST)
Kidney function	creatinine, uric acid and urea nitrogen
Tumor biomarkers	carcino-embryonic antigen (CEA) and alpha fetoprotein (AFP)
Epstein-Barr Virus (EBV) antibody	
Urine routine	urine glucose, urine bilirubin, urine ketone, urine specific gravity, pH, urine protein, urobilinogen qualitative, urine nitrite, urine WBC, urine latent 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 metabolites	nicotine, cotinine, trans-3'-hydroxy cotinine, nicotine-N-β-glucuronide, cotinine N-β-D-glucuronide, trans-3'-hydroxy cotinine O- β -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

Body water	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body protein	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body minerals	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body muscle	Inbody 570, InBody Co., Ltd, Seoul, Korea
Skeletal muscle mass	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body fat	Inbody 570, InBody Co., Ltd, Seoul, Korea
Body cell count	Inbody 570, InBody Co., Ltd, Seoul, Korea
Basal metabolic rata	Inbody 570, InBody Co., Ltd, Seoul, Korea
Waist circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Hip circumference	Inbody 570, InBody Co., Ltd, Seoul, Korea
Bio-electrical impedance	Inbody 570, InBody Co., Ltd, Seoul, Korea
Urine metals	NEXION 300X PerkinElmer Inc., USA
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^{2*}	*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[a] (n, %)	1836 (56.04)	3225 (53.47)	5.65	0.02

Hypertension[b] (n, %)	1846 (56.26)	3630 (59.58)	9.64	0.002
Diabetes mellitus[c] (n, %)	732 (22.44)	1351 (22.23)	0.06	0.81
Hyperlipidemia[d] (n, %)	2460 (75.07)	4637 (75.79)	1.04	0.31
Chronic bronchitis[e] (n, %)	46 (1.41)	90 (1.48)	0.08	0.78
COPD[e] (n, %)	4 (0.12)	14 (0.23)	1.29	0.26
Asthma[e] (n, %)	15 (0.46)	26 (0.43)	0.05	0.83
Tuberculosis[e] (n, %)	15 (0.46)	23 (0.38)	0.35	0.55
Angina[e] (n, %)	13 (0.40)	23 (0.38)	0.02	0.88
Myocardial infarction[e] (n, %)	13 (0.40)	38 (0.63)	2.00	0.16
Coronary heart disease[e] (n, %)	203 (6.24)	327 (5.39)	2.84	0.09
Stroke[e] (n, %)	30 (0.92)	72 (1.19)	1.36	0.24
Cancer[e] (n, %)	80 (2.47)	123 (2.03)	1.89	0.17
Chronic hepatitis[e] (n, %)	18 (0.55)	29 (0.48)	0.24	0.62
Arthritis[e] (n, %)	138 (4.25)	331 (5.46)	6.48	0.01
Migraine[e] (n, %)	20 (0.62)	38 (0.63)	0.004	0.95
Nephritis[e] (n, %)	9 (0.28)	27 (0.45)	1.56	0.21
Alzheimer's disease[e] (n, %)	6 (0.18)	11 (0.18)	0.001	0.97
Parkinson's disease[e] (n, %)	8 (0.25)	13 (0.21)	0.10	0.76
Brain injury[e] (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[f] (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 ± SD)	39.88 ± 7.68	39.36 ± 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 x^2 test wer used for the comparisons between continuous variables and the categorical variables, respectively.

[a] Overweight/Obesity was defined as BMI at least 24 kg/m^2.

[b] Hypertension was defined as diastolic blood pressure (DBP) ≥90mmHg and / or systolic blood pressure (SBP) ≥140mmHg, or self-reported hypertension diagnosed by a physician, or taking antihypertension drugs.

[c] Diabetes was defined as fasting blood glucose value ≥7.0 mmol/l or antidiabetic therapy, or self-reported diabetes diagnosed by a physician, or taking hypoglycemic agent or insulin.

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

[e] The disease was defined as self-reported disease.

[f] Depression was defined as having at least 16 scores in the Center for Epidemiologic Studies Depression Scale.