

Study design, participation and characteristics of The Danish General Suburban Population Study

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ABSTRACT

INTRODUCTION: The aim of this article was to describe the study design, participants and baseline characteristics of The Danish General Suburban Population Study (GESUS) and to compare suburban participants with age- and gender-matched urban participants from the Copenhagen General Population Study (CGPS).

MATERIAL AND METHODS: Data from questionnaire, health examination, biochemical measurements and public registers were collected.

RESULTS: In GESUS the overall participation rate was 49.3% (response n = 10,621 of total n = 21,557). Among people aged 40-79 years, the participation rate was 53.9% (8,797/16,310). Participants were more frequently women, had a higher median age, a higher frequency of marriage/registered partnerships, but had a lower frequency of comorbidities and death in the follow-up period (January 2010-May 2011 (diseases)/June 2011 (death) than the non-participants. GESUS has sufficient power to study effects of rare and common exposures or genetic variants on the occurrence of common multifactorial diseases. Compared with an age- and gender-matched urban population (n = 10,618, CGPS), participants in GESUS (n = 10,618) were less physically active, smoked less and ingested less alcohol, had higher anthropometric measures, less undiagnosed hypertension but more undiagnosed diabetes, had a lower frequency of elevated total cholesterol and low-density lipoprotein cholesterol but higher frequency of decreased high-density lipoprotein cholesterol and elevated triglycerides.

CONCLUSION: In GESUS, participants had a better health profile than non-participants, and participants in GESUS had a different cardiovascular risk profile than participants in the CGPS.

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TRIAL REGISTRATION: not relevant.

The Danish General Suburban Population Study (GESUS) is a study of the general suburban population living in Naestved Municipality (70 km south of Copenhagen). The aim of GESUS is to facilitate epidemiologic and genetic research by using information from questionnaires,

health examinations, biochemical measurements, genetic variants and public registers to analyze the occurrence of co-morbidities (e.g. diabetes, cardiovascular disease, pulmonary disease and cancer) and mortality.

The aim of this article is to describe the study design, participants and baseline characteristics of GESUS and to compare the suburban participants with urban participants from the Copenhagen General Population Study (CGPS).

MATERIAL AND METHODS

Study population

GESUS was initiated in January 2010 with ongoing enrollment and is a cross-sectional study of the adult Danish suburban general population in Naestved Municipality (70 km south of Copenhagen; including postal codes 4160, 4171, 4250, 4262, 4684, 4700, 4733, and 4736). The criteria for invitation are Danish citizenship and a Danish Civil Registration number (CPR, a unique identification number assigned at birth to all Danes) indicating Danish residence. All persons aged 30+ and a random 25% selection of the population aged 20-30 years are invited by mail in numerical order starting with citizens born on the 1st in every month and continuing. If individuals have not responded within three weeks of their scheduled attendance period, a reminder is sent with a new scheduled period. A completed paper-questionnaire is a prerequisite for attending the health examination. For this study, we included participants and non-participants from 11 Jan 2010 to 31 July 2011.

The study was approved by the appropriate institutional review boards and ethical committees (SJ-113, SJ-114, SJ-147, SJ-278), and it was reported to the Danish Data Protection Agency. Written informed consent was obtained from all participants. The investigation conforms to the principles of the Declaration of Helsinki.

Self-administered questionnaire

The questionnaire was similar to the ones used for the Copenhagen City Heart Study (CCHS) and the CGPS [1], but it also included questions about skin and allergies [2-4], health-related information, well-being and depression [5, 6]. The questionnaire was tested in a pilot-study on 60 volunteers and finally validated by the Danish Unit of Patient Conceived Quality, Institute of Public Health.

ORIGINAL ARTICLE

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The Danish General Suburban Population Study (GESUS) is a study of the general, adult suburban population living in Naestved Municipality (70 km south of Copenhagen). The objective of the study is to identify risk factors in citizens and to compile a research database and biobank based on the general population in Region Zealand.



Health examination

The health examination was carried out by trained health professionals at the Department of Clinical Biochemistry, Naestved University Hospital, Denmark, on weekdays 3.30 PM-9.00 PM.

After five minutes of rest, two consecutive digital measurements of blood pressure were performed on the left upper arm (apparatus type A&D UA-787, A&D Medical, Tokyo, Japan) [7], and the blood pressure of the second measurement was registered.

Using a tape measure, waist circumference (WC) (cm) was measured at the lowest rib and hip circumference (HC) (cm) at the widest part of the hip. Height (cm)

was measured without shoes, using a stadiometer. Body composition (weight (kg), body fat, muscle mass, body water) was measured on a Bio Impedance Analysis (BIA) (TANITA MC-180MA; Tanita Corporation, Tokyo, Japan). However, participants with a pacemaker and pregnant women were weighed on an ordinary digital weight scale (Tanita WB-110 MA); 1 kg was subtracted to account for clothes.

Lung function and pulse-oximetry were measured by a hand-held Spirometer (MicroLoop, Micro Medical Ltd, Kent, UK) and considered valid if the "ATS/ERS quality criterion" by the American Thoracic Society (ATS) and the European Respiratory Society (ERS) was met [8].

A resting 12-lead electrocardiography (ECG) at 150 Hz (Mac-5500, GE Healthcare, Milwaukee, WI) was recorded and digital (MUSE/Interval Editor software (GE Healthcare, Milwaukee, WI) and paper versions (25 mm/sec.) filed. ECGs were coded according to the automatic ECG analysis programme (Marquette 12 SL revision E, GE Healthcare) and manually according to the Minnesota Coding System by two health examiners [9].

Distal blood pressure for the measurement of ankle-brachial index (ABI) was measured by standard Doppler technique using Dopplex mini (Huntleigh) and a manometer. ABI was the highest ankle pressure divided by the highest arm pressure after bilateral arm and ankle pressures [10].

Arterial stiffness, vascular tone and endothelial function were tested using Pulse Trace PCA2 (Micro Medical Ltd, Kent, UK) [11] which is a photoplethysmographic device placed at the finger-tip and like pulse-oximetry using peripheral waveform analysis.

The eye examination (the Danish Rural Eye Study (DRES)) included a structured interview, best corrected visual activity (Nidek Auto Refractor 360-A) followed by an EDTRS chart when vision was < 20/25, testing of colour vision (Ishihara), testing for strabismus (Hirsnberg) and retinal photos of both eyes.

Body mass index (BMI) was calculated as kg/m² and waist-hip-ratio (WHR) was calculated by WC/HC. Elevated WHR or WC was considered present in women with a WHR > 0.85 or a WC > 88 cm and men with a WHR > 0.90 or a WC > 102 cm [12].

SUPPLEMENTARY TABLE 1

Sample preservative, volume, and measurements.

Type of sample	Volume collected (ml)	Measurements	Type of analyzer
Sodium-citrate	4.5	INR, APTT, D-dimer	STA-R (Stago)
Lithium-heparin (PST)	3.5	Chemistry ^a	Cobas-6000 (Roche)
Clot activator (SST)	4.0	Biobank-serum	
Clot activator (SST)	3.5	Thyroid peroxidase antibody	Kryptor (Brahms)
EDTA	2.9	Biobank plasma and buffy coat	–
EDTA	2.0	Haematology ^b	Sysmex XE-5000
EDTA	2.0	HbA ^{1c}	TOSOH
Flouride-citrate	3.0	Glucose	Cobas-6000 (Roche)

EDTA = ethylenediaminetetraacetic acid

INR = international normalized ratio

PST = plasma separation tube

SST = serum separation tube

a) Iron, transferrin, ferritin, total triiodothyronine (TT3), free thyroxine (FT4), thyroid stimulating hormone (TSH), sodium, potassium, alkaline phosphatase, alanine amino transferase, bilirubin, creatinine, total cholesterol, low-density lipoprotein cholesterol (calculated), high-density lipoprotein cholesterol, triglyceride, albumin, high-sensitivity C-reactive-protein, estimated glomerular filtration rate (eGFR; calculated), very-low-density lipoprotein (VLDL; calculated).

b) White blood cell (WBC); basophil (PASO); immature granulocyte (IG); nucleated red blood cell (NRBC); reticulocyte (RET); reticulocyte haemoglobin content (Ret-He); immature reticulocyte fraction (IRF); low, medium, and high reticulocyte fraction LRF/MRF/HRF; platelet (PLT) (volume fraction); optical platelet count (PLT-O); immature platelet fraction (IPF); platelet volume fraction (PCT); platelet volume difference (PDW) (max-min); red blood cell (RBC); haemoglobin (HGB); haematocrit (HCT); mean corpuscular volume (MCV); mean corpuscular haemoglobin (MCH); mean corpuscular haemoglobin concentration (MCHC); red blood cell distribution (RDW); mean platelet volume (MPV); neutrophil (NEUT); lymphocyte (LYMPH); monocyte (MONO); eosinophil (EO).

Sample collection, blood analyses and storage conditions

Fresh blood samples (50 ml) were drawn in the non-fasting state. Venosafe plastic tubes (Terumo, Leuven, Belgium) were used and 25 ml of blood were spun and kept overnight at 4 °C until biochemical analysis the next morning (**Supplementary Table 1**). Assays were followed up daily for precision and several times annually for accuracy with a Scandinavian quality control programme. A total of 25 ml ethylenediaminetetraacetic acid (EDTA)

whole blood and serum were kept overnight at 4°C for aliquoting the next morning into 2 × 2 ml serum, 2 × 2 ml buffy coat, and 4 × 2 ml plasma and then stored at -80°C for future research purposes. The duplicates were located in two geographically distant biobanks. DNA was extracted (2ml buffy coat yielded approximately 100 micrograms/participant) at KBioscience Laboratory (Hoddesdon, UK) and then stored at -80°C at KBioscience and at Naestved University Hospital, Denmark. Spot urine samples (10 ml) were collected in Urine Monovette and spun and aliquoted on the examination day into a 1.2 ml tube and a 10 ml tube and temporarily stored at -80°C until transfer of samples to The Laboratory for Clinical Pharmacology (University Hospital Copenhagen, Denmark) and stored at -80°C.

Low-density lipoprotein cholesterol (LDL-C) was calculated from the Friedewald equation if triglycerides (TG) was < 5 mmol/l [13]. TC ≥ 5 mmol/l, LDL-C ≥ 3 mmol/l, TG ≥ 2 mmol/L and high-density lipoprotein cholesterol (HDL-C) ≤ 1 mmol/l were indicative of high risk of cardiovascular disease [14]. Levels of blood glucose and HbA_{1c} were considered elevated and indicative of diabetes if glucose ≥ 11 mol/l or HbA_{1c} ≥ 48 mmol/mol.

Register-based data

The study included register-based data as follows: The Danish Cancer Registry (World Health Organization (WHO) International Classification of Diseases, Seventh Revision (ICD-7) and Tenth Revision (ICD-10) codes) [1]; the national Danish Patient Registry with diagnoses of ischaemic heart disease (ICD8: 410-414, ICD10: I20-I25), cerebrovascular disease (ICD8: 430-438, ICD10: I60-I68, G45), and diabetes (Type 1 diabetes (ICD8: 249, ICD10: E10) and Type 2 or other or unspecified diabetes (ICD8:250, ICD10: E11, E13, E14)); the national Danish Causes of Death Registry, the Danish Civil Registration System (marital status and mortality). Follow-up (Jan 2010-May 2011 (diseases)/June 2011 (death) was 100%.

Comparison population

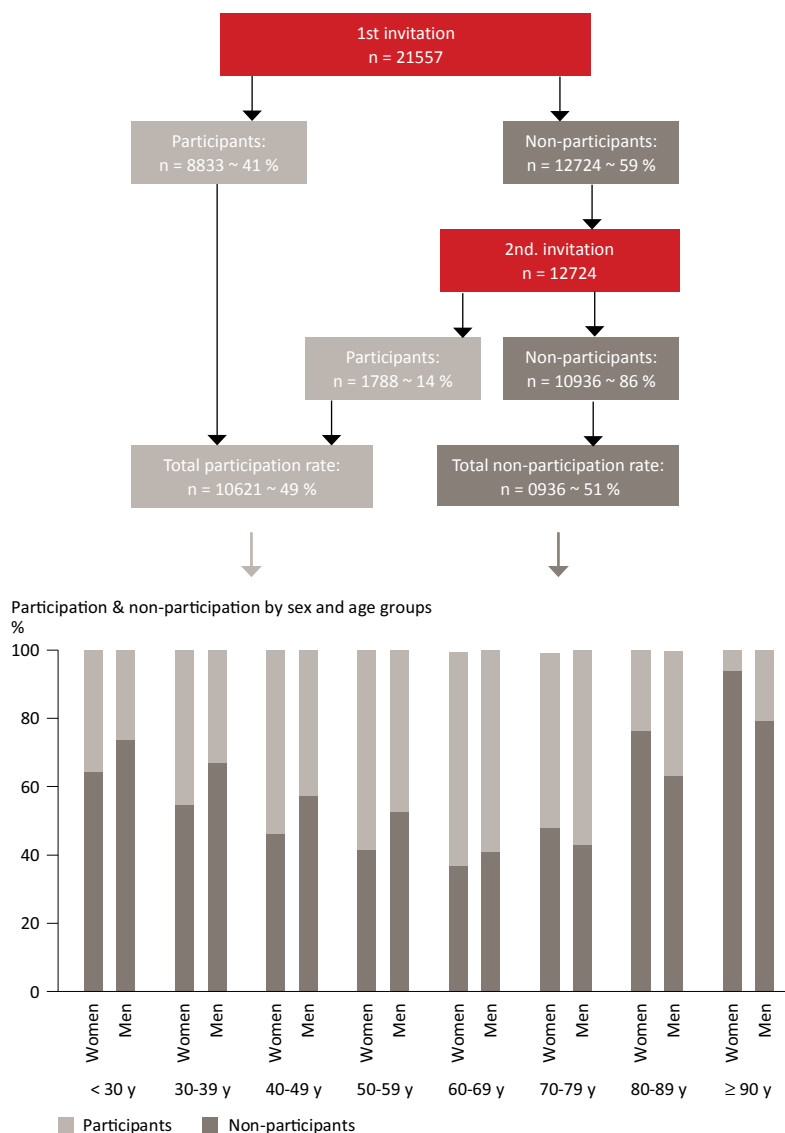
The CGPS [1] has recruited participants randomly from the general population of Copenhagen, Denmark since 2003. It has a response rate of 49.3% (response n = 10,621 of total n = 21,557). We included age- and gender-matched participants (n = 10,618) for comparison with GESUS on baseline characteristics. The differences in number (10,621 versus 10,618) are due to lack of match for three participants in GESUS.

Identification and correction of errors

Data from GESUS were checked for serious errors and inconsistencies. Questionnaires were checked for missing data points on the day of attendance. Participants

FIGURE 1

Participation and non-participation in the General Suburban Population Study.



were rejected at the health examination until the questionnaire had been completed. With use of the mass verification function in ReadSoft, numbers for each questionnaire were visually inspected and if any discrepancies occurred, the original questionnaire was inspected and scanning errors corrected. All variables were checked for errors by category and range (minimum and maximum values).

A complete list of data errors and inconsistencies was produced for the whole study containing before- and after-values of the identified outliers. Other information available in the questionnaire was examined in order to judge the likelihood of the data in question being correct (internal validity). If a strong indication of se-

TABLE 1

Results for participants vs. non-participants in the General Suburban Population Study using register-based data

		Participants			Non-participants			p-value ^a
		n	%	median (IQR)	n	%	median (IQR)	
Total		10,621	49.0		10,936	51.0		
Sex	Women	5,817	54.8		5,363	49.0		
	Men	4,804	45.2		5,573	51.0		< 0.0005
Age	Years	10,621		56.0 (45-66)	10,936		52.0 (41-66)	< 0.00005
Age groups	< 30 years	171	1.6		389	3.6		
	30-39 years	1,328	12.5		2,098	19.2		
	40-49 years	2,232	21.0		2,425	22.2		
	50-59 years	2,384	22.5		2,107	19.3		
	60-69 years	2,832	26.7		1,824	16.7		
	70-79 years	1,349	12.7		1,157	10.6		
	80-89 years	309	2.9		756	6.9		
	≥ 90 years	16	0.2		180	1.7		< 0.0005
Residence ^b	Suburban	6,918	65.1		6,782	62.0		
	Rural	3,702	34.9		4,154	38.0		< 0.0005
Marital status	Unmarried	1,294	12.2		2,393	22.4		
	Married/registered partnership	7,243	68.5		5,656	53.0		
	Divorced/terminated partnership	1,223	11.6		1,513	14.2		
	Widow/widower/surviving partner	818	7.7		1,106	10.4		< 0.0005
Co-morbidity ^c	No	7,793	73.40		7,872	72.0		
	Yes	2,824	26.6		3,064	28.0		0.019
Cancer	No	9,341	88.0		9,739	89.1		
	Yes	1,280	12.1		1,197	11.0		0.011
IHD	No	9,881	93.1		10,072	92.1		
	Yes	736	6.9		864	7.9		0.007
AMI	No	10,357	97.6		10,575	96.7		
	Yes	260	2.5		361	3.3		< 0.0005
DM (all types)	No	10,318	97.2		10,339	94.5		
	Yes	299	2.8		597	5.5		< 0.0005
CVD	No	10,242	96.5		10,306	94.2		
	Yes	375	3.5		630	5.8		< 0.0005
Hypertension	No	9,563	90.1		9,678	88.5		
	Yes	1,054	9.9		1,258	11.5		< 0.0005
Death	No	10,589	99.7		10,795	98.7		
	Yes	28	0.3		141	1.3		< 0.0005

AMI = acute myocardial infarction; CVD = cerebrovascular disease; DM = diabetes mellitus; IHD = ischemic heart disease; IQR = Interquartile range.

a) χ^2 for categorized variables, Mann-Whitney for continuous variables.

b) Residence: Urban: Address in Naestved city. Rural: Address outside Naestved city, in Naestved Municipality.

c) Comorbidity: Yes: one or more of the following diseases: Cancer, IHD, AMI, DM, CVD or hypertension. No: none of the diseases.

rious error was present, the error was corrected provided the information needed was available or participants were contacted by telephone in order to retrieve the correct answer. In case of lack of response to the telephone call, the data inconsistencies were recoded to missing values. Biochemical and other health measurements were examined by range, and only extreme outliers incompatible with life (e.g. pulse < 10) were corrected or recoded as missing values. These errors were mostly due to the manual recording of data on the rare occasion of electronic database inaccessibility.

Statistics

STATA 11.0 was used. Pearson's χ^2 - and the Mann-Whitney-U tests were used for categorical and continuous

variables, respectively. The level of significance was $p < 0.05$. The total numbers in the analyses vary slightly according to availability of data for each covariate. Power was calculated using NCSS-Pass.

Trial registration: not relevant.

RESULTS

Characteristics of participants versus non-participants

The participation rate was 49.3% with 10,621 participants and 10,936 non-participants (Figure 1). Among people aged 40-79 years, the participation rate was 53.9% (57.0% among women and 50.6% among men) (Figure 1). The participation rates were higher among women than among men, except for people aged 80+



TABLE 2

		GESUS			CGPS			p-value ^a
		n	%	median (IQR)	n	%	median (IQR)	
Total	Number	10,618			10,618			
Sex	Women	5,814	54.8		5,814	54.8		
	Men	4,804	45.2		4,804	45.2		1.000
Age	Years	10,618		56.0 (45-66)	10,618		56.0 (47-67)	1.000
Age groups	< 30 years	170	1.6		170	1.6		
	30-39 years	1,328	12.5		1,328	12.5		
	40-49 years	2,232	21.2		2,232	21.2		
	50-59 years	2,385	22.5		2,385	22.5		
	60-69 years	2,832	26.7		2,832	26.7		
	70-79 years	1,349	12.7		1,349	12.7		
	80-89 years	309	2.9		309	2.9		
	≥ 90 years	13	0.1		13	0.1		1.000
Physical activity in spare time	Mainly passive	721	7.0		747	7.1		
	Light activity 2-4 hours/week	5,121	49.6		4,788	45.6		
	Light/moderate activity > 4 hours/week	3,997	38.7		4,355	41.5		
	Very active > 4 hours/week	482	4.7		609	5.8		< 0.0005
Smoking	Never smoked	3,987	39.7		3,880	38.4		
	Previously smoked	4,004	39.9		3,805	37.7		
	Current smoker	2,053	20.4		2,411	23.9		< 0.0005
Alcohol intake and disease risk ^a **	Low disease risk	7,947	74.8		6,471	60.9		
	Medium disease risk	1,573	14.8		2,231	21.0		
	High disease risk	1,098	10.3		1,916	18.0		< 0.0005

Results for GESUS vs. CGPS matched by gender and age: Data from questionnaire & CPR-register.

CPR = civil registration number. A unique identification number assigned at birth to all Danes; CGPS = Copenhagen General Population Study, Herlev, Denmark; GESUS = General Suburban Population Study, Naestved, Denmark; IQR = Interquartile range.

a) χ^2 for categorized variables, Mann-Whitney for continues variables.

b) By national board of health recommendations: Low disease risk: Women<=7, Men<=14; Medium disease risk: Women:8-14, Men:15-21; High disease risk: Women > 14, Men > 21. Numbers are "standard drinks".

a) "standard drink" in Denmark is defined as 1 glass of wine (12.5 centilitres), 1 bottle of beer (33 centilitres), 1 glass of liqueur (12.5 centilitres) or 1 shot glass of spirits (4 centilitres), and contains app. 12 g alcohol.

years. Compared to non-participants, participants were more frequently women (54.8% versus 49%), had a higher median age (56 versus 52 years), a higher frequency of suburban residence, a higher frequency of marriage/registered partnerships (68.2% versus 51.7%) and a lower frequency of co-morbidities (cancer, cardiovascular disease, diabetes and hypertension) (26.6% versus 28.0%) and death in the follow-up period (0.3% versus 1.3%) (Table 1).

Study power

With 80% power, alpha = 0.05 and diseases occurring in 30%, 20% and 10% of participants, the minimal detectable odds ratios in GESUS among the participants included (n = 10,621) will be 3.3, 3.4 and 4.1 for rare (0.2%) exposures, and 1.3, 1.4 and 1.5 for common (5%) exposures. Correspondingly, the minimal detectable odds ratios in GESUS among participants aimed for (n = 25,000) will be 2.2, 2.3 and 2.8 for rare (0.2%) exposures, and 1.2, 1.2 and 1.3 for common (5%) exposures (Supplementary Table 2).

Lifestyle and health factors within a suburban and an urban population.

Compared to the urban population (n = 10,618, CGPS), the suburban participants (n = 10,618, GESUS) were less physically active, smoked less and ingested less alcohol (Table 2). Furthermore, they had higher anthropometric measures (BMI and WHR) (Table 3), less undiagnosed hypertension but more undiagnosed diabetes (Table 3), less frequency of elevated total and LDL-C but higher frequency of decreased HDL-C and elevated TG (Table 3).

DISCUSSION

The overall participation rate in GESUS (49%) resembles that of the CGPS (49%) [1]. Among people aged 40-79 years, the participation rate was 53.9%. Participation rates in general population studies in Europe vary from 10% [15] to 72% [16]. In Denmark, the typical age of retirement is 65 years and the high participation rate for this age group might signify that people have more time to participate or are healthier than participants aged

TABLE 3

Results for GESUS vs. CGPS matched by gender and age: Data from health examinations

		GESUS			CGPS			p*
		n	%	median (IQR)	n	%	median (IQR)	
Weight	kg	10,584		76.3 (66.0-87.5)	10,596		75.3 (65.5-86.0)	< 0.00005
Height	m	10,597		1.70 (1.63-1.77)	10,597		1.71 (1.64-1.78)	< 0.00005
BMI		10,569		26.1 (23.5-29.2)	10,593		25.5 (23.1-28.4)	< 0.00005
BMI group	< 18.5 kg/m ²	112	1,1		119	1,1		
	18.5-24.9 kg/m ²	4,057	38,4		4,629	43,7		
	25-29.9 kg/m ²	4,218	39,9		4,172	39,4		
	30-34.9 kg/m ²	1,579	14,9		1,281	12,1		
	35-39.9 kg/m ²	438	4,1		296	2,8		
	≥ 40 kg/m ²	165	1,6		96	0,9		< 0.0005
Waist circumference	cm	10,525		92 (83-101)	10,554		90 (80-99)	< 0.00005
Hip circumference	cm	10,525		102 (96-107)	10,554		102 (97-107)	< 0.00005
WHR	All	10,525		0.90 (0.84-0.96)	10,554		0.87 (0.81-0.93)	< 0.00005
	women, WHR > 0.85	2,947	50,9		1,855	32,1		< 0.0005
	men, WHR > 0.90	3,663	77,4		3,170	66,4		< 0.0005
Hypertension ^a	Normal blood pressure	1,255	11,8		1,181	11,1		
	Pre-hypertension	2,992	28,2		3,244	30,6		
	Known hypertension	2,362	22,3		1,826	17,2		
	Undiagnosed hypertension	3,995	37,7		4,363	41,1		< 0.0005
Diabetes ^c	No diabetes	9,878	95,0		10,191	96,1		
	Known diabetes	492	4,7		390	3,7		
	Undiagnosed diabetes	26	0,3		21	0,2		0,001
Total cholesterol	≥ 5 mmol/l	7,149	67,7		7,650	72,1		< 0.0005
LDL-cholesterol	≥ 3 mmol/l	5,740	55,8		6,193	58,4		< 0.0005
HDL-cholesterol	≤ 1 mmol/l	1,389	13,2		935	8,8		< 0.0005
Triglyceride	≥ 2 mmol/l	3,508	33,2		2,974	28,1		< 0.0005

* χ^2 for categorized variables, Mann-Whitney for continues variables.

a) Normal blood pressure: systolic blood pressure < 120 mmHg and diastolic blood pressure < 80 mmHg, no use of blood pressure-lowering medication. Pre-hypertension: Systolic blood pressure of 120-139 mmHg and/or diastolic blood pressure 80-89 mmHg, no use of blood pressure-lowering medication. Known hypertension: Use of blood pressure-lowering medication.

Undiagnosed hypertension: Systolic blood pressure ≥ 140 and/or diastolic blood pressure ≥ 90, no use of blood pressure-lowering medication.

b) No diabetes: Glucose < 11 mmol/l & "no" to diabetes & "no" to antidiabetic medication/insulin in questionnaire.

Known diabetes: Use of antidiabetic medication/insulin and/or "yes" to diabetes in questionnaire.

Undiagnosed diabetes: glucose ≥ 11 mmol/l & no use of antidiabetic medication/insulin & "no" to diabetes in questionnaire.

BMI = body mass index.

CGPS = Copenhagen General Population Study, Herlev, Denmark.

GESUS = General Suburban Population Study, Naestved, Denmark.

IQR = Interquartile range.

WHR = waist-hip-ratio.

80+ years. Overall, the participation rate is generally high among people aged 40-79 years, which is the population of interest in most general population studies.

Participants in GESUS have less co-morbidity and are more often married/live in registered partnerships than non-participants; these results resemble those of other population-based studies [17]. However, assessment of the impact of a potential non-participation selection bias also depends on whether there is an association between non-participation and exposure.

We have calculated ORs at 80% power and alpha 0.05 for different ratios of exposure and endpoints. In order not to commit a Type II error, calculation of study power, n and effect size will be necessary in future association studies. A larger sample size will be needed in order to detect a rare co-morbidity for a rare exposure

compared to a common co-morbidity for a common exposure.

Compared to the CGPS, participants in the GESUS had a different cardiovascular risk profile. Levels of TG are higher among participants in the GESUS, which is a cause for concern because high levels of TG is an important risk factor for cardiovascular disease [18]. Thus, stratified prophylaxis and targeted finding and treatment of these risk factors may be needed in the different areas. Other Scandinavian studies investigating rural, suburban and urban populations differ compared to this study and are not directly comparable [19, 20].

The strengths of the study include the mixed invitation pattern (by gender, age and residence) throughout the study period which eliminates confounding due to seasonal variation; a second invitation adding 8.3 per-



SUPPLEMENTARY TABLE 2

Power and odds ratios in The Danish General Suburban Population Study. The table shows the minimal detectable odds ratio with 80% power, $\alpha = 0.05$, end point frequencies of 30%, 20% and 10%, and different levels of exposure for those participants already included and those aimed for.

Total n	Power	Alpha	End-point %	% n with Exp	OR
<i>Included</i>					
10,621	80	0.05	30	0.2	3.3
10,621	80	0.05	30	1	1.8
10,621	80	0.05	30	2	1.5
10,621	80	0.05	30	5	1.3
10,621	80	0.05	20	0.2	3.4
10,621	80	0.05	20	1	1.9
10,621	80	0.05	20	2	1.6
10,621	80	0.05	20	5	1.4
10,621	80	0.05	10	0.2	4.1
10,621	80	0.05	10	1	2.0
10,621	80	0.05	10	2	1.7
10,621	80	0.05	10	5	1.5
<i>Aimed for</i>					
25,000	80	0.05	30	0.2	2.2
25,000	80	0.05	30	1	1.5
25,000	80	0.05	30	2	1.3
25,000	80	0.05	30	5	1.2
25,000	80	0.05	20	0.2	2.3
25,000	80	0.05	20	1	1.5
25,000	80	0.05	20	2	1.4
25,000	80	0.05	20	5	1.2
25,000	80	0.05	10	0.2	2.8
25,000	80	0.05	10	1	1.7
25,000	80	0.05	10	2	1.5
25,000	80	0.05	10	5	1.3

OR = odds ratio.

centage points to the participation rate; similar questions and data collection for the CCHS and the CGPS which makes direct comparisons possible; and a data handling process with error and inconsistency correction. The limitations of the study included the length of the questionnaire (20 pages), no availability of an internet-based questionnaire and no weekend examinations. These limitations may have made participants less comparable to the general population.

CONCLUSION

This paper presents the first baseline results of disease and risk factor prevalence in GESUS and the comparison of participants and non-participants contributes with information which is important for the design and interpretation of future studies within GESUS. Participants differ from non-participants with regard to sex, age, residence, marital status, morbidity and mortality, and participants overall seem to be in better health than non-participants. A comparison between data from GESUS

and the CGPS indicates several differences between sub-urban and urban population studies.

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