BMJ Open Protocol for the China PEACE (Patient-centered Evaluative Assessment of Cardiac Events) Million Persons Project pilot

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ABSTRACT

Introduction: Collection of high-quality data from large populations is considered essential to generate knowledge that is critical to an era of precision medicine. Cardiovascular disease (CVD) is a leading cause of mortality in China and is a suitable focus of an initiative to discover factors that would improve our ability to assess and modify individual risk.

Methods and analysis: The pilot phase of China PEACE (Patient-centered Evaluative Assessment of Cardiac Events) Million Persons Project is being conducted during 2014–2015 in four provinces across China to demonstrate the feasibility of a population-based assessment. It is designed to screen 0.4 million community-dwelling residents aged 40–75 years with measurements of blood pressure, height and weight, a lipid blood test, and a questionnaire on cardiovascular-related health status. Participants identified at high risk of CVD receive further health assessments, including ECG, ultrasound scan, blood and urine analysis, and a questionnaire on lifestyle and medical history. Collection of blood and urine samples is used to establish a biobank. High-risk subjects are also counselled with suggestions regarding potential lifestyle changes. In addition, high-risk subjects are followed-up either in a return clinic visit or by telephone interview, with measurement of blood pressure, weight, ECG, and a questionnaire on survival status, hospitalisations and lifestyle. The first 0.1 million participants screened were used to conduct a preliminary analysis, with information on baseline characteristics, health-related behaviours, anthropometric variables, medical history, and prevalence of high-risk subjects.

Ethics and dissemination: The central ethics committee at the China National Center for Cardiovascular Disease (NCCD) approved the pilot. Written informed consent is obtained from all participants on entry into the project. Findings will be disseminated in future peer-reviewed papers and will inform strategies aimed at developing precise methods of assessing and modifying risk.

Trial registration number: NCT02536456.

Strengths and limitations of this study

- The pilot is the first large-scale population-based screening project in China aimed at identifying subjects at high risk of cardiovascular disease (CVD) and collecting detailed information and biospecimens as part of a precision medicine project.
- With rigorous methodological design and data collection, this public health effort can serve as a powerful research-grade database for future precision medicine investigations into the biological, environmental, behavioural and other contextual factors associated with CVD in the Chinese population.
- The pilot project was conducted primarily to test the feasibility of a large-scale screening project, and the integrated quality assurance procedures ensure its ability to act as a reliable resource for future research.
- Insights garnered from this project will inform approaches for future efforts in developing individualised approaches to primary and secondary CVD prevention in China.

INTRODUCTION

A central challenge in medicine is to individualise approaches to patient treatment. However, much of medicine is based on study results of averages for populations, and there is a general lack of knowledge about how best to individualise strategies. Precision medicine is a term that refers to efforts to better understand individual differences and to tailor clinical care for each person in a more customised way.[1] To generate knowledge about individuals requires studies of massive numbers of people, so that those with similar characteristics can be studied and their risks understood.

China is an ideal country to undertake such studies because of its large population, and cardiovascular disease (CVD), a major

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Figure 1. Geographic distribution of pilot sites. The pilot sites are located in 20 geographically defined regions from four provinces (Jilin, Liaoning, Zhejiang, Guangxi) in China. The 20 local regions consist of 11 urban districts and 9 rural counties.

Table 1. Information collected in the pilot project.

Domain	Initial screening	Assessment for high-risk subjects	1-month follow-up
Patient interviews			
Health behaviours			
Smoking	√	√	√
Alcohol use/misuse	√	√	√
Physical activity		√	√
Dietary		√	√
Medical history			
Hypertension	√		
Diabetes	√		
MI	√		
PCI	√		
CABG	√		
Stroke	√		
Angina		√	
Heart failure		√	
Valvular heart disease		√	
Arrhythmia		√	
Hypercholesterolaemia		√	
Dyslipidaemia		√	
Chronic renal disease		√	
Peripheral vascular disease		√	
Cancer (except skin cancer)		√	
Family history of disease			
Hypertension		√	
CHD		√	
Ischaemic stroke		√	
Haemorrhage stroke		√	
Diabetes		√	
Cancer		√	
Hypercholesterolaemia		√	

Table 1. Continued.

Domain	Initial screening	Assessment for high-risk subjects	1-month follow-up
Identification of special case			
Family history of longevity, premature death, and chronic disease	√		
Medication history			
Antihypertension	√		
Lipid-lowering	√		
Antidiabetic	√		
Antiplatelet	√		
Traditional Chinese medicine	√		
Menstruation			
Menstrual period		√	
Menopause		√	
Pregnancy		√	
Quality of life (EQ-5D-3L)		√	√
Survival status			
Date and cause of death			√
Hospitalisations			
Date of admission			√
Length of hospitalisation			√
Diagnosis of discharge			√
Physical measurements			
Blood pressure	√		√
Height	√		
Weight	√		√
BMI	√		
Lipid blood test	√		
TC	√		

Table 1. Continued.

Domain	Initial screening	Assessment for high-risk subjects	1-month follow-up
TG	√		
LDL-C	√		
HDL-C	√		
Imaging examinations			
ECG		√	√
Echocardiogram		√	
Carotid artery ultrasound		√	
Biosamples			
Blood		√	
Urine		√	
Laboratory analysis			
Biochemistry test			
Blood lipid		√	
Glucose		√	
ALT		√	
AST		√	
Creatinine		√	
Uric acid		√	
HbA1c		√	
Urine routine test			
Glucose		√	
Ketone		√	
Occult blood		√	
Protein		√	
Nitrite		√	
Bilirubin		√	
Gravity		√	
pH		√	
Urobilinogen		√	
Erythrocyte		√	
Leucocyte		√	

ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; CABG, coronary artery bypass grafting; CHD, coronary heart disease; ECG, 12-lead ECG; HbA1c, glycated haemoglobin; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; MI, myocardial infarction; PCI, percutaneous coronary intervention; TC, total cholesterol; TG, triglyceride.
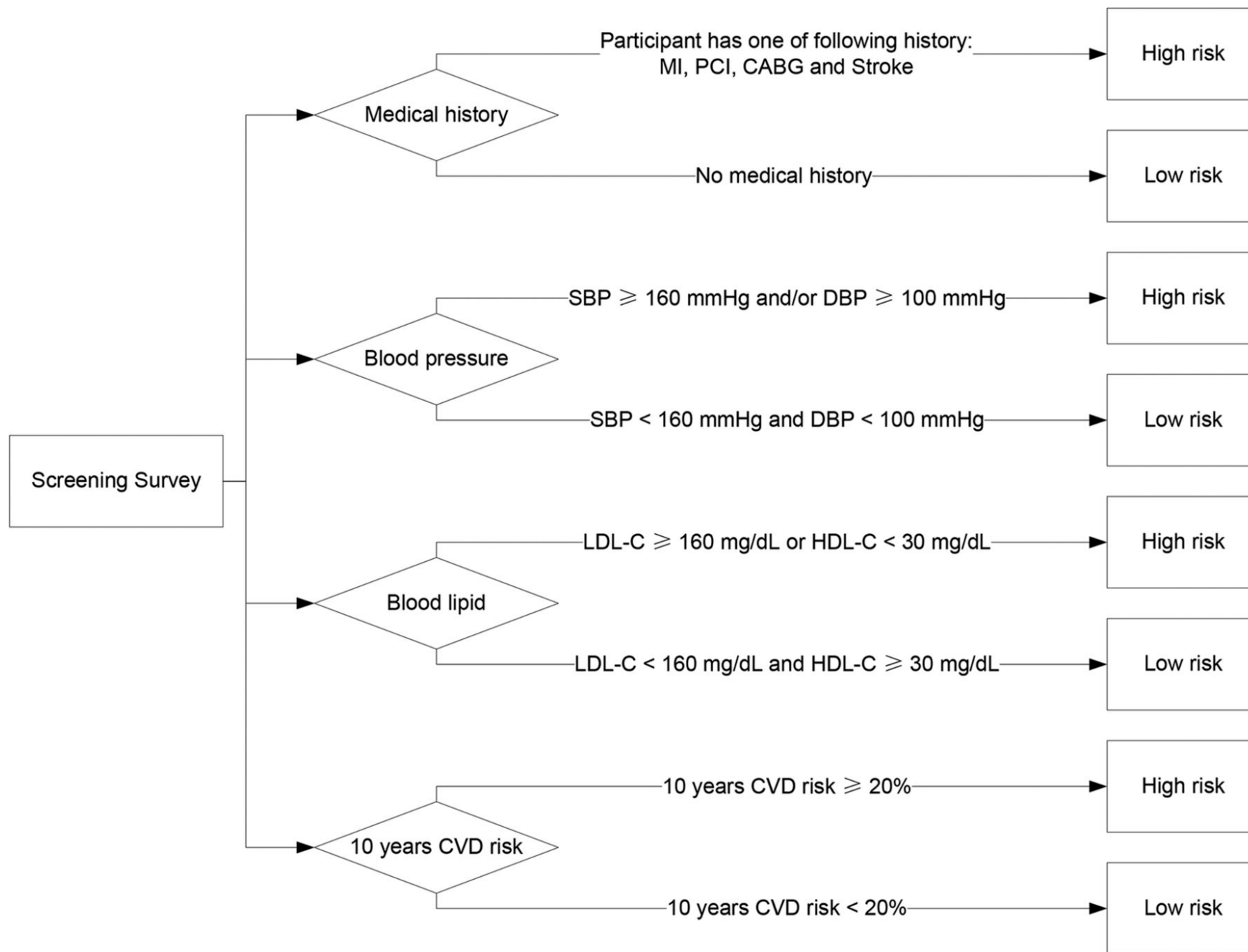
Figure 2. Criteria for identification of high-risk subjects.

Table 2. Characteristics of screened subjects.

	Male (N=42 469)		Female (N=57 531)		Total (N=100 000)		
	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	p Value*
Age (years)							<0.001
40–49	10 454	24.62	14 594	25.37	25 048	25.05	
50–59	13 651	32.14	19 536	33.96	33 187	33.19	
60–69	13 993	32.95	18 326	31.85	32 319	32.32	
70–75	4256	10.02	4979	8.65	9235	9.24	
Total†	57.06	9.27	56.59	10.68	56.79	10.11	<0.001
Han nationality	34 838	82.03	46 493	80.81	81 331	81.33	<0.001
Hukou status							<0.001
Non-agricultural	12 661	29.81	18 652	32.42	31 313	31.31	
Agricultural	21 716	51.13	29 109	50.60	50 825	50.83	
Unified Residency Hukou	8088	19.04	9765	16.97	17 853	17.85	
Do not have Hukou	4	0.01	5	0.01	9	0.01	
Marital status							<0.001
Married with spouse	40 543	95.46	52 244	90.81	92 787	92.79	
Widowed, separated, divorced	1379	3.25	4880	8.48	6259	6.26	
Never married	311	0.73	68	0.12	379	0.38	
Unknown	173	0.41	256	0.44	429	0.43	
Refuse to answer	63	0.15	83	0.14	146	0.15	
Education							<0.001
Illiterate	1283	3.02	4195	7.29	5478	5.48	
Less than primary school	1201	2.83	2590	4.50	3791	3.79	
Primary school	12 837	30.23	18 902	32.86	31 739	31.74	
Middle school	14 757	34.75	18 310	31.83	33 067	33.07	
High school	8508	20.03	9689	16.84	18 197	18.20	
College or university	3736	8.80	3681	6.40	7417	7.42	

Table 2. Continued.

	Male (N=42 469)		Female (N=57 531)		Total (N=100 000)		p Value*
	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	
Household income (Yuan/year)							<0.001
<5000	5426	12.78	7996	13.90	13 422	13.42	
5000–9999	2659	6.26	3888	6.76	6547	6.55	
10 000–19 999	7078	16.67	11 418	19.85	18 496	18.50	
20 000–50 000	15 646	36.84	19 369	33.67	35 015	35.02	
>50 000	5352	12.60	6260	10.88	11 612	11.61	
Unknown	1271	2.99	2198	3.82	3469	3.47	
Refuse to answer	5037	11.86	6402	11.13	11 439	11.44	
Current smoker	16 921	39.84	1503	2.61	18 424	18.42	<0.001
Alcohol drinker							<0.001
Never	22 148	52.15	51 703	89.87	73 851	73.85	
Monthly or less	3194	7.52	2293	3.99	5487	5.49	
2–4 times a month	5453	12.84	1487	2.58	6940	6.94	
2–3 times a week	11 337	26.69	1405	2.44	12 742	12.74	

All values are n (%) except for Total† which is mean (SD).
*χ^2 test for proportion and two-tailed t test (or t′ test if equal variances not assumed) for means, $\alpha=0.05$.

Table 3. Anthropometric variables and medical history of screened subjects.

Variable	Male (N=42 469)		Female (N=57 531)		Total (N=10 000)		p Value*
	N or mean	% or SD	N or mean	% or SD	N or mean	% or SD	
Height (cm)	166.81	6.91	156.22	6.42	160.72	8.45	<0.001
Weight (kg)	68.22	10.34	59.21	9.39	63.03	10.77	<0.001
BMI (kg/m^2)	24.46	3.05	24.23	3.36	24.33	3.24	
<18.5	583	1.37%	1449	2.52%	2032	2.03%	
18.5–24.9	25 237	59.42%	34 903	60.67%	60 140	60.14%	
25.0–29.9	14 656	34.51%	17 984	31.26%	32 640	32.64%	
≥30.0	1974	4.65%	3195	5.55%	5169	5.17%	
SBP (mm Hg)	140.53	19.33	138.96	20.54	139.63	20.05	<0.001
DBP (mm Hg)	82.91	10.78	80.10	10.80	81.29	10.88	<0.001
High blood pressure†	20 193	47.55%	25 275	43.93%	45 468	45.47%	<0.001
TC (mmol/L)	4.65	1.02	5.01	1.12	4.86	1.09	<0.001
TG (mmol/L)	1.88	1.17	2.02	1.19	1.96	1.18	<0.001
HDL-C (mmol/L)	1.44	0.46	1.58	0.45	1.52	0.46	<0.001
LDL-C (mmol/L)	2.50	0.84	2.65	0.90	2.58	0.88	<0.001
Medical history							
Hypertension	8254	19.44%	12 602	21.90%	20 856	20.86%	<0.001
Diabetes	2197	5.17%	3536	6.15%	5733	5.73%	<0.001
MI	512	1.21%	486	0.84%	998	1.00%	<0.001
PCI	272	0.64%	143	0.25%	415	0.42%	<0.001
CABG	39	0.09%	31	0.05%	70	0.07%	0.025
Stroke	2031	4.78%	2466	4.29%	4497	4.50%	<0.001
Haemorrhage stroke	1604	3.78%	2016	3.50%	3620	3.62%	
Ischaemic stroke	194	0.46%	161	0.28%	355	0.36%	

Values are n (%) or mean (SD) as indicated.
*χ^2 test for proportion and two-tailed t test (or t′ test if equal variances not assumed) for means, α=0.05.
†High blood pressure: SBP≥140 mmHg or DBP≥90 mmHg.
BMI, body mass index; CABG, coronary artery bypass grafting; DBP, diastolic blood pressure; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; MI, myocardial infarction; PCI, percutaneous coronary intervention; SBP, systolic blood pressure; TC, total cholesterol; TG, triglyceride.

Table 4. Prevalence of high-risk subjects of all and each type of high-risk criterion.

Criterion	Liaoning N	Per cent	Jilin N	Per cent	Zhejiang N	Per cent	Guangxi N	Per cent	Total N	Per cent	p Value
Total CVD high-risk subjects	6712	26.85	8961	35.84	5269	21.08	5957	23.83	26 899	26.90	<0.001
CVD disease	1225	18.25	3061	34.16	347	6.59	968	16.25	5601	20.82	<0.001
High blood pressure	4898	72.97	5774	64.43	4156	78.88	3481	58.44	18 309	68.07	<0.001
Dyslipidaemia	1569	23.38	1857	20.72	1045	19.83	2340	39.28	6811	25.32	<0.001
WHO risk $\geq$20%	1817	27.07	2125	23.71	1450	27.52	1614	27.09	7006	26.05	<0.001
No risk	18 288	73.15	16 039	64.16	19 731	78.92	19 043	76.17	73 101	73.10	

χ^2 tests for proportion, α=0.05.
CVD, cardiovascular disease.

Strengths and limitations of this study

- The pilot is the first large-scale population-based screening project in China aimed at identifying subjects at high risk of cardiovascular disease (CVD) and collecting detailed information and biospecimens as part of a precision medicine project.
- With rigorous methodological design and data collection, this public health effort can serve as a powerful research-grade database for future precision medicine investigations into the biological, environmental, behavioral and other contextual factors associated with CVD in the Chinese population. The pilot project was conducted primarily to test the feasibility of a large-scale screening project, and the integrated quality assurance procedures ensure its ability to act as a reliable resource for future research.
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