

**Venous Blood Based
Biomarker Data from the China
Health and Retirement
Longitudinal Study (CHARLS)**

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Collaborators

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Rationales for Objectively Measured Biomarkers

- Validate and supplement self-reported health information
- Capture aspects of health unknown to survey participants
- Allow richer modeling of pathways of influence between socioeconomic factors and health

Sampling of CHARLS Biomarkers Study

- CHARLS national baseline survey
 - 17,708 individuals in 10,257 households
 - Households from 28 provinces, 150 counties/districts, 450 villages/urban communities
 - Representative of people aged 45 and over, living in households in China
 - Collected blood samples from 11,847 individuals (an overall response rate of 67%)
 - Higher response rate in women (69%) than in men (65%)
 - Younger men were less likely to have blood drawn
 - Higher response rate in rural (71%) than in urban (6%)
 - No significant effect from education levels

Blood Sample Collection, Processing, Transportation, Storage

- Collaboration with the China Center for Disease Control and Prevention
- 92% respondents reported fasting overnight
- 3 tubes of venous blood were collected by medically-trained staff
 - 2 mL blood for complete blood count (CBC) test
 - Transported at 4°C to local CDC laboratories or hospitals or health centers
 - 97% laboratories participate in regular QC program
 - Median time from collection to CBC assay was 97 minutes

Blood Sample Collection, Processing, Transportation, Storage

- 3 tubes of venous blood were collected
 - 4 mL blood was processed into plasma and buffy coat
 - Transported at 4°C to local CDC laboratories or hospitals or health centers within the same timeframe as CBC test
 - Plasma stored in three 0.5 mL cryovials and buffy coat in 4th cryovial
 - Cryovials were frozen at -20°C and transported to China CDC in Beijing within 2 weeks, then stored under -80°C until the time of assays
 - 2 mL blood for Hba1c
 - Immediately stored and shipped at 4°C to China CDC in Beijing within 2 weeks
 - Then stored under -80°C until the time of assay

List of Blood Based Biomarkers

- Complete blood counts
 - White blood cell count, hemoglobin, hematocrit, platelet
- High-sensitivity C-reactive protein (hsCRP)
- Glycosylated hemoglobin (Hba1c)
- Lipid panel
 - Total-C, LDL-C, HDL-C, triglyceride
- Blood chemistry
 - Glucose, uric acid, blood urea nitrogen (BUN), creatinine
- Cystatin C

Laboratory Facility

- Collaboration with Clinical Laboratory of Capital Medical University in Beijing
- Excellent performance during regular external quality control assessments
- Measured quality control samples on daily basis, when CHARLS study samples were being measured

Assay Methodology

Biomarker	Method	Within-assay CV	Between-assay CV
hsCRP	Immunoturbidimetric assay	< 1.3%	< 5.7%
Hba1c	Boronate affinity HPLC	1.9%	2.1%
Total-C	Enzymatic colormetric test	0.8%	1.7%
HDL-C	Enzymatic colormetric test	1.0%	1.3%
LDL-C	Enzymatic colormetric test	0.7%	1.2%
Triglyceride	Enzymatic colormetric test	1.5%	1.8%

Assay Methodology

Biomarker	Method	Within-assay CV	Between-assay CV
Blood urea nitrogen (BUN)	Enzyatic UV method with urease	<4.4%	<4.1%
Creatinine	Jaffe creatinine method	<1.6%	<2.1%
Glucose	Enzymatic colormetric test	0.9%	1.8%
Uric acid	UA Plus method	1.1%	1.9%
Cystatin C	Particle-enhanced turbimetric assay	< 5%	< 5%

Descriptive Statistics of Complete Blood Counts in CHARLS

	N	Mean (SD)	Median	Ranges
WBC, in 1,000s	11528	6.17 (2.06)	5.90	1.14 – 110.80
Hemoglobin, g/dL	11530	14.28 (2.16)	14.20	5.44 – 27.88
Hematocrit, %	11839	41.20 (6.23)	41.40	14.10 – 78.40
Platelet, 10⁹/L	11531	209 (73)	203	10 - 1990

Descriptive Statistics of Blood-based Biomarkers in CHARLS

	N	Mean (SD)	Median	Ranges
CRP, mg/L	11664	2.75 (7.28)	1.04	0.01 – 178.1
Hba1c, %	11706	5.2 (0.8)	5.1	3.5 – 14.5
Glucose, mg/dL	11636	109 (35)	102	18 – 723
Uric acid, mg/dL	11664	4.6 (1.3)	4.4	0.3 – 13.3

Descriptive Statistics of Blood-based Biomarkers in CHARLS

	N	Mean (SD)	Median	Ranges
Total-C, mg/L	11655	191 (38)	188	24 – 627
HDL-C, mg/L	11663	50 (15)	48	3 – 159
LDL-C, mg/dL	11642	115 (35)	113	0.4 – 386
Triglyceride, mg/dL	11656	135 (109)	106	3 – 1905

Descriptive Statistics of Blood-based Biomarkers in CHARLS

	N	Mean (SD)	Median	Ranges
BUN, mg/L	11662	16 (5)	15	4 – 89
Creatinine, mg/dL	11634	0.8 (0.3)	0.8	0.2 – 11.6
Cystatin C, mg/L	8878 *	1.03 (0.32)	0.98	0.36 – 8.75

* Analyzed all respondents aged 70 and over, and a random sample of those under 70

Prevalence of High Risk Biomarker Levels by Gender in CHARLS

	Total	Men	Women
% Total-C \geq 240 mg/dL	9.97	7.65	12.12
% HDL-C $<$ 40 mg/dL	28.40	31.69	25.39
% LDL-C $>$ 160 mg/dL	9.46	7.35	11.42
% Triglyceride \geq 200 mg/dL	15.2	14.24	16.16

Prevalence of High Risk Biomarker Levels by Gender in CHARLS

	Total	Men	Women
% CRP > 3 mg/L	18.66	20.35	17.13
% low Hb (<13 g/dL for men; <12 g/dL for women)	13.65	11.62	15.52
% Hba1c ≥ 6.5%	4.76	4.31	5.19
% glucose ≥ 126 mg/dL	13.45	13.99	12.95

Prevalence of High Risk Biomarker Levels by Gender in CHARLS

	Total	Men	Women
% cystatin C > 1.44 mg/L	7.09	9.18	5.21
% creatinine > 1.4 mg/dL	1.32	2.43	0.29

Summary

- CHARLS national baseline experience in collecting and analyzing whole blood specimens was a success
- Venous blood based biomarker data look good and should be very useful for scientific analyses
- CHARLS will collect blood samples again during wave 3 in 2015

Release of CHARLS Wave 1 Blood Based Biomarkers Data

- Will be released for public use
TODAY !
- <http://charls.ccer.edu.cn/en>

