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Prevalence, Diagnosis, and Management of Diabetes Mellitus among Older Chinese: Results from the China Health and Retirement Longitudinal Study

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Keywords

Diabetes mellitus; China; management; SES; Undiagnoses

Introduction

China has a large number of the world's population living with diabetes mellitus. According to the International Diabetes Federation, there were 96·3 million diabetes patients in China in 2014, 25% of the estimated world population of diabetics (International Diabetes Federation, accessed March 29, 2015). However, to date nationally representative surveys do not exist for China with which to estimate the prevalence of diabetes, the success in diagnosing diabetes and subsequent management of treatment for diabetes; overall and for different key population sub-groups. This study uses data collected from a nationally representative survey of mid-aged and elderly Chinese in 2011-2012, the China Health and Retirement Longitudinal Study (CHARLS), to assess prevalence, diagnosis, and management of diabetes in China among persons 45 years of age and older during that period. These data also allow us to estimate prevalence of pre-diabetes. As China's population ages rapidly (Zhao, Smith and Strauss 2014; Zhao et al. 2014b; Peng 2011), understanding these issues is essential for planning public health initiatives to address a growing epidemic.

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Diabetes is a non-communicative disease affecting 285-350 million people worldwide (Linetzky 2013) that significantly increases mortality and contributes to the global disease burden (GBD 2013 Mortality and Causes of Death Collaborators 2015). Randomized clinical studies have shown the benefit of controlling diabetes in reducing macro- and micro-vascular complications of the disease (The Diabetes Control and Complications Trial Research Group 1993; Gaede et al. 2003). This paper provides evidence that for important sub-groups of the Chinese mid-aged and elderly population there is still a distance to go to fully diagnose and adequately treat the disease; especially in rural areas, in poorer non-coastal regions, and within groups of elderly with lower economic resources. On the other hand, a recent expansion of health services has had a positive effect on increasing diabetes diagnosis especially among these more vulnerable groups. However, because of the large fraction of the population with prediabetes, the costs of improving diagnosis and adequate treatment may go up substantially in the future (Elgart et al. 2014).

Methods

Study design, setting, and participants

We use data from the baseline survey of the China Health and Retirement Longitudinal Study, a national survey representative of the middle-aged and elderly population (45 years old and above) in China. We summarize key design elements below; however additional information is available in separate publications (Zhao et al. 2013; Zhao et al. 2014b) and on the study's website (http://charls.ccer.edu.cn/en). It is the sampling that allows us to claim that CHARLS is truly nationally representative study of China. The CHARLS baseline national survey was fielded between June 2011 and March 2012. The sample is a multi-stage, stratified, random sample drawn at the county, neighborhood, and household levels. To avoid human manipulations all sampling was done by computer programming. At the first stage, 150 county-level units were selected randomly out of all county-level units (rural counties or city districts), with probability proportional to population (PPS), from all provinces except Tibet. The county sample was stratified, by region, urban-rural, and county per capita GDP. Twenty-eight provinces out of 30 are represented in the selected counties. At the second stage, three administrative villages in rural areas or resident communities in urban areas were randomly selected from each county with PPS sampling, resulting in a total of 450 villages/neighborhoods. These are the primary sampling units (PSU).

We then created new sample frames within each PSU using a mapping/listing software developed for CHARLS (CHARLS-Gis). Upon determining the boundary of a PSU using GPS, the electronic map is extracted from Google earth maps, all buildings shown on the map were visited by a special CHARLS mapping team, and dwelling units within a building were listed. All dwelling units within a PSU jointly form the sampling frame from which sample households were randomly drawn (Zhao et al. 2013). This new sample frame was designed in part to maximize our chances of not missing recent urban migrants from rural areas, a traditional problem with government lists. Households were then sampled from the frame to obtain approximately 20 age eligible households per PSU. Within sampled households, one person aged 45 or older (randomly sampled if there were more than one) became the main respondent. His/her spouse, no matter the age, was also interviewed. A total of 17,708 participants from 10,257 households were interviewed; the household response rate was 80.5%, which is very high by survey standards.

Information is collected on basic demographics, family, health status, health care, employment, and the household economy. Health-related questions included self-reported health status, previous medical history, lifestyle, health behaviors, and activities of daily living. Anthropometric and other physical measurements are taken.

Venous blood samples are collected by medically-trained staff from the Chinese Center for Disease Control and Prevention (CDC) in a subsequent visit to a local clinic (or from respondent homes when necessary) using a standard protocol. Respondents were asked to fast overnight and to confirm the fasting length at the time of sample collection. Venous blood was processed into plasma locally, frozen at -20 Celsius during transportation to Beijing where they were stored under -80 Celsius until assayed at the centralized laboratory (the Youanmen Center for Clinical Laboratory of Capital Medical University). The blood used for the glycosylated hemoglobin (HbA1c) assay was transported cold (4C) to Beijing within two weeks and then stored under −80 Celsius.

The study protocol was approved by the ethical review committee (IRB) of Peking University. Written informed consent was obtained from all study participants. Data collection was conducted at the site using a computer-assisted, personal interviewing (CAPI) system. All survey workers were trained using a standard protocol. A stringent quality assurance program was implemented to ensure reliability of study data.

Our analytic sample includes participants 45 years and older who completed questions regarding their medical history related to diabetes and who had valid fasting plasma glucose and whole blood HbA1c levels. We use only fasting samples because it is clearly preferable to use only fasting subjects when using plasma glucose levels as one of the indicators of diabetes. The use of non-fasting subjects would introduce imprecision that we are able to avoid when we use only fasting subjects. In addition, we present both prediabetes estimates as well as diabetes estimates and we wanted the same sample for both, so that percentages (including normal range) will add to 100. For prediabetes it is recommended by the American Diabetes Association (ADA, 2015) to take only fasting samples for plasma glucose. Also in one of our regression models, we include as a covariate having high total cholesterol, for which fasting samples are more accurate. Of the 17,289 respondents and spouses 45 and older, 11,603 provided blood samples and of those 10,412 were fasting. Some 10,141 respondents have complete assay readings and of those 10,008 have self-reports of medical diagnosis; our final sample size. Participants who have venous blood samples taken are not different in their SES characteristics such as education from non-participants. Women and younger men have higher probabilities of being measured. All samples are weighted in this analysis, with sample weights that have corrections for blood non-response using inverse probability weights (Wooldridge 2010).

Measures

Valid estimates of diabetes require a combination of data from self-reports and from measured blood indicators (Yuan et al., 2015). In this study diabetes is defined by (1) a self-report of doctor diagnosis; or 2) a fasting plasma glucose level of 126 mg/dL (7.0 mmol/L) or higher; or 3) HbA1c concentration of 6.5% or higher. Diagnosis is defined as the proportion of people who report a doctor diagnosis among patients who are diabetic. Prediabetes is defined as having either fasting plasma glucose levels between 100 mg/dL (5.6 mmol/L) and 125 mg/dL (6.9 mmol/L) or Hba1c levels between 5.7% and 6.4%.

Age is grouped into 45-59 years and then into 10-year intervals. Education is categorized as illiterate, literate (had some informal education, able to read/write), primary education, and middle school education and above. CHARLS has available the gold standard measure of household resources, per capita expenditures (pce) (Deaton 1997). PCE is a strongly preferred measure of household resources to income because it is measured far more accurately than is income in settings such as China where significant economic activity does not pass through markets. We take the log of PCE, since that is far closer to a normal distribution, and discretize that into terciles, using dummy variables to capture expected nonlinearities.

We include rural residency vs urban residency, as well as rural and urban hukou status. Hukou is a Chinese administrative registration system. A person who has urban residency but rural hukou is usually a migrant worker born and raised in rural areas. A person's hukou status is related to factors such as the ability to obtain better jobs and which health insurance scheme one is eligible to join. In general people with rural hukou living in urban areas are severely disadvantaged compared to residents with urban hukou. For example, most adults with urban hukou have the urban employee or the urban resident medical insurance plan, whereas most adults with rural hukou have the New Cooperative Medical Scheme, which is far less generous (Yip et al. 2012).

Body mass index (BMI) is calculated and reported in four categories: <23, 23-<25, 25-<30, and >=30 kg/m^2. Fasting total cholesterol is reported as having high levels (>=240 mg/dL). A dummy variable for waist circumference is set equal to 1 if it exceeds the threshold levels for high risk (>=88cm for females, >=102cm for males). We have also used Chinese standards for waist circumference (>=80cm for females and >=90cm for males) and the results are very similar. For respondents who had a diagnosed history of diabetes, indicators of routine diabetes care and self-management education received in the past year are included. Respondents also report how long ago the diagnosis of diabetes was initially made.

Statistical methods

Point estimates of prevalence of diabetes and prediabetes with 95% confidence intervals are estimated for the total country and for subgroups. As discussed above, all calculations are weighted to represent the overall Chinese adult population aged 45 years or older. The weights include corrections for household non-response in the initial sampling and separately for individual non-response in the blood sampling. Corrections for non-response are created using a propensity score from a logit regression of the household being measured or the individual giving blood on numerous covariates, including age dummies interacted with gender, education and per capita household expenditure. We then take the inverse probability for each observation and multiply that by the regular sample weight. There are no socio-economic variables that are related to blood non-response in our logit analysis. Women are more likely to give blood and there exists a positive age gradient for men, but not for women (Zhao et al. 2014a). This is reassuring because it indicates that selection of who gives blood based on socio-economic factors is not likely a problem. In any case, the use of the blood sample non-response weights (and the household survey non-response weights) makes the estimates representative of the entire population. Standard errors are calculated allowing for clustering at the local PSU level. Logit maximum likelihood is used in the multivariate analysis; p-values correspond to a two-tailed 0·05 level Type I error. All statistical analyses are conducted using STATA, version 13.

In order to explore factors associated with the prevalence of diabetes, we built a series of models. Variables in model 1 include the variables discussed above: age dummies and gender; education and log of per capita household expenditures as SES measures; and the rural-urban hukou and region dummies. For the logit analyses of being diabetic, we use two model specifications: our base model and a second model in which we add health conditions that should be related to being diabetic such as levels of BMI, large waist circumference and high total cholesterol. We do not include these in our base specifications because we want to see the total associations with the SES, hukou, gender and age covariates and part of any impact these have on diabetes will come through impacts on these other health variables.

Results

Prevalence rates of pre-diabetes and diabetes are shown in Table 1 alongside 95% confidence limits. Among persons aged 45 years and above, 17.4% have diabetes, and another 41.9% have prediabetes, representing 246.8 million Chinese people in total. Among people with diabetes, 59.3% are currently undiagnosed, which represents 10.3% of the entire Chinese mid-aged and elderly population, some 46.0 million. The 95% confidence limits show that these are all reasonably tight estimates for the Chinese population of these ages.

Table 2 reports socio-demographic and behavioral characteristics for four sub-samples: those who have normal plasma glucose and HbA1c and are not diagnosed, those who meet the criteria for prediabetes, those who meet the criteria for diabetes and among those with diabetes, those who are undiagnosed. Prevalence of DM is 14.4 % in the 45-59 year group and increases with age, more than one quarter of respondents (26.5%) have diabetes among those 80 and above. A very high fraction of older Chinese are either prediabetic or diabetic: 62.3%, 63.6%, and 69.7% of subjects in the 60-69, 70-79 and 80+ age groups. Undiagnosis is very high, 50-60% among younger age groups, and 90% among those 80 and above. Prevalence of diabetes increases with BMI, from 11.4% in BMI < 23 group to 29.1% in BMI >= 30 group. There is a higher diabetes prevalence for those with high levels of fasting cholesterol and for those with large waist circumference. Higher prevalence of DM is found among respondents who live in urban areas and have urban hukou. Higher levels of DM are also found in the coastal areas of China compared to non-coastal regions. No differences are found among different education levels, or between male vs female respondents.

Table 3 reports logit maximum likelihood regressions of the probability of being diabetic. Odds ratios are shown along with stars for significance levels of p-values. We show two specifications, one adding other health measurements thought to be related to diabetes: high BMI, large waist circumference, and high total cholesterol and one specification without these variables. Without other health variables, the socio-economic, hukou, and residence variables can be interpreted as having total effects that work through many factors, including through the other health variables. Model 1 shows that prevalence is higher for older age groups, and for those having an urban hukou, particularly in the coastal region. Conditional on these factors, education and log pce do not have significant effects; neither does gender. In Model 2, the same variables that are significant in Model 1 still are. Now conditional on these health variables, women are less likely to be diabetic than men. Higher levels of BMI, larger waist circumference, and high total cholesterol are all positively correlated with being more likely to be diabetic. A comparison of Model 1 and 2 estimates shows that some but not all of the high rates of diabetes in urban and coastal regions are due to these health variables.

Table 4 contains our estimates of the probability of being diagnosed among a sample of diabetics once again using logit maximum likelihood regressions. Diagnosis is far more likely among diabetic respondents with urban hukou and those living in the better-off coastal regions. Diagnosis is positively and significantly related to being in the top tercile of household pce so that in China the very well-to do are much more likely to be diagnosed.

In Table 5 respondents with diagnosed diabetes are examined with respect to how long ago they were diagnosed, what kinds of treatment they are receiving, what types of medical tests have been done and what type of information they are receiving from their doctors. Among the diagnosed, 63% were diagnosed in the last five years. This is encouraging because it may reflect the success of much stronger health campaigns that the Chinese government has undertaken since 2009 (Chen 2009). While mortality among those who have been diagnosed earlier plays a part of this story, 63% is too high for mortality selection to explain it alone.

Some 75% of diagnosed diabetics are receiving some type of treatment, with 59% receiving western medications and 9% receiving Chinese medicine when there is no insulin involved. Of those taking Western medication, the vast majority take Western meds only as only 3.4% of the total diagnosed diabetes population in our sample simultaneously take Western and Chinese meds. Since 5.3% of the population is taking only Chinese meds, the combined use of Western and Chinese meds is not very common. When we turn to insulin, 11% of our Chinese population receives insulin. A similar pattern exists for insulin since only 2.4% of the population is taking insulin along with Chinese meds and 3.6% combine insulin and Western meds..

A preponderance of diagnosed respondents, 82.3%, report they received at least one blood or urine test for diabetes during the previous 12 months, 21% have received a fundus exam and 19% a micro-albuminuria test. Only 15.9% have had no tests performed. In terms of health education, 80.2% received education regarding weight control, exercise, and diet. 24.4% of diagnosed diabetics received information regarding smoking control and 15.7% on foot care. Eighteen percent say they have not received any health education regarding diabetes.

Table 6 examines the management factors detailed in Table 5 once again using a multinomial logit model. It is striking that being diagnosed in the last five years is significantly and negatively associated with being in the top tercile of household pce and those with urban hukou living in coastal areas. Since these are the groups that are more likely to be ever-diagnosed (Table 4), recent diagnoses are successfully targeting people who were less likely to have been previously diagnosed- low economic resource and rural households.

In column 2 we examine using western medications or insulin versus other or no treatments. Since the data in Table 5 indicated that it was relatively rare to be simultaneously taking Western and Chinese meds, we are not able to provide estimates for combinations of treatments, Being in the top tercile of household pce is positively associated with a higher likelihood of getting such treatments, as is having an urban hukou in a coastal region and being an urban resident but with a rural hukou. Having a blood or urine test (column 3) is also significantly associated with being in urban areas. Finally, receiving health information on weight control, exercise, and diet (column 4) is positively and significantly associated with having an urban hukou and with being in the top pce tercile.

Discussion

We believe our study provides additional and unique information on the epidemic of diabetes among middle-aged and older Chinese adults. First, our survey has collected a myriad of data in social, economic, cultural and behavioral aspects of lives in contemporary China not available in the previous studies. We were also able to examine diabetes prevalence in special populations such as those with rural hukou living in urban areas who were not well represented in earlier studies. Second, in the world-wide epidemic of diabetes, the driving force has been Type 2 diabetes, which is much more prevalent among people aged 45 years or older. Since over 90% of diabetes are Type 2 and the majority of T2DM occur in the later life, it is worthwhile to focus on studying diabetes among middle aged and older Chinese adults. Third, the best prior national survey in China was based on Xu (2013) which was conducted in 2010. The understanding of diabetes is inherently dynamic and our study utilizes data on the date of disease onset to see changes over time in a nationwide scale of China. Finally, there is no other nationally representative health-related panel study in China.

In our sample, almost 60% of middle-aged and elderly Chinese have pre-diabetes or diabetes in 2011-2012, some 264.8 million. This prevalence is much higher than reported in national surveys administered in the early to mid-2000s (Yang et al. 2010; Jia et al. 2007; Hu et al. 2008). These earlier studies are not nationally representative, for example the Yang et al. (2010) study chooses their provinces and cities and counties non-randomly (they randomly select PSUs and households within cities and counties). Yang et al. also require sampled respondents to live in the area for at least five years, which leaves out recent urban migrants, an important part of the Chinese population. On the other hand, our results are very consistent with findings from the recent China Non-communicable Disease Surveillance Study undertaken in 2010 (Xu et al. 2013). This study uses the Chinese Centers for Disease Control and Prevention's (CDC) National Disease Surveillance Point System as its sample frame. This sample, consisted of 145 counties randomly chosen in 1989, may have lost representativeness over time because these sites have been used heavily for various government health projects and public health personnel have been given more trainings. However CHARLS is also a panel and so will be able to track changes over time. CHARLS also has more comprehensive measures of socio-economic status, measures which turn out to be very important in indicating differentials in diagnosis and management.

The main drivers of diabetes in China are thought to be rapid urbanization, excess calorie intake, sedentary life style, and a low grade of systemic inflammation from environment pollutants and smoking, all occurring in a population with possible pre-selection of genetic profiles limiting the adaption of beta cells to the circulating glucose overload (Hu 2011; Ma, Lin and Jia 2014; Chan, Zhang and Ning 2014; Kong, Chan and Chan 2013). Our findings provide support for many of these propositions.

A central finding of this study is that prevalence, diagnosis, and management of diabetes is higher for Chinese with urban hukou, especially those living in the better off coastal regions. Some of the higher prevalence among this group is related to nutrition, as evidenced by the significantly positive relative risks of being diabetic with higher BMI, greater waist circumference, and high levels of total cholesterol. When we add these factors to Model 1, the relative risk ratios of having an urban hukou fall, although they remain positive and significant, so other factors are evidently at work. These may include other dietary factors, a more sedentary lifestyle, exposure to environmental pollutants, and smoking.

Asians are known to develop diabetes at lower BMI levels compared to other racial and ethnic groups (Hsu et al. 2015). Our study demonstrates a step-wise increased risk of diabetes starting from BMI of 23 kg/m^2, a cutoff that can be considered as a potential screening criterion in China.

Better rates of diagnosis, management, and education regarding diabetes are highly associated with having an urban hukou and living in a coastal area. There are very good reasons for this, having to do with a combination of better access to health care, especially for those with urban hukou, and to higher quality health care in urban and coastal areas.

Being in a household with higher per capita expenditure, particularly being in the top tercile of pce, is significantly associated with higher rates of diagnosis and receiving better management and information, although interestingly not with prevalence (Ploubidis et al. 2013; Siegal and Stock 2013).

However, almost 2/3 of the diagnoses or the CHARLS sample have been in the most recent five years and these diagnoses are more likely for people in the lower two per capita expenditure terciles and for those with urban hukou in coastal areas. This strongly implies that recent efforts at diagnosis have been effective in reaching more vulnerable parts of the mid-aged and older population.

Some limitations of our study should be noted. First, we have used both HbA1c and fasting glucose levels to define prediabetes, but did not conduct an oral glucose tolerance test (OGTT). Therefore, the 41.9% prediabetes prevalence reported in our study may still be an underestimate of its true prevalence in China. Second, as with most diagnostic tests, a test result diagnostic of diabetes or prediabetes should be repeated to rule out laboratory error. We were not able to do this during our survey. Third, we have no information on diabetic symptoms (Levesque et al. 2013).

Conclusions

In sum, prevalence of diabetes and prediabetes for the mid-aged and the elderly in China is high and probably climbing. The problem is worse in urban areas, especially among those with urban hukou and who live in coastal areas. Diagnosis and management of diabetes is highly differential within China, being much better for those with urban hukou and from higher income households. On the other hand, very recent efforts to improve the health system within China seem to be paying off in beginning to address these inequalities. However the very high prevalence of prediabetes suggests a much more Intensive effort will be required in the future to mitigate the very likely rising costs of the disease (Elgart et al. 2014).

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Table 1

The Prevalence of Diabetes among Middle-aged and Older Chinese, CHARLS 2011-12

	%	95% CI	
Prevalence of Diabetes (N=10,019)			
Normal (N=3,951)	40.7	38.2	43.2
Prediabetes (N=4,417)	41.9	39.2	44.6
Diabetes (N=1,651)	17.4	16.0	19.0
Undiagnosed Diabetes Among Diabetics (N=1,032)	59.3	54.4	63.9
Undiagnosed Diabetes in Population	10.3	9.3	11.5

Table 2

Sample Characteristics, China Health and Retirement Longitudinal Study (CHARLS) China **2011-12**

		Normal			Prediabetes			Diabetes					
								All			Undiagnosed		
		%	95% CI		%	95% CI		%	95% CI		%	95% CI	
Age	45-59	44.1	40.0	48.2	41.6	38.3	44.9	14.4	12.8	16.1	63.1	56.9	68.9
	60-69	37.7	35.0	40.5	42.2	38.3	46.1	20.1	17.5	23.1	50.2	40.4	59.9
	70-79	36.4	31.8	41.3	42.1	37.0	47.4	21.5	16.5	27.4	52.5	37.6	66.9
	80+	30.3	21.9	40.2	43.2	31.1	56.2	26.5	14.0	44.4	90.0	75.0	96.4
Gender	Male	40.9	37.9	43.9	42.2	39.1	45.3	16.9	15.0	19.1	62.6	53.8	71.8
	Female	40.5	37.3	43.7	41.6	38.1	45.2	17.9	16.3	19.7	56.2	48.6	63.4
Education	Illiterate	39.5	36.3	42.8	42.2	39.1	45.4	18.2	15.0	22.1	58.7	45.4	70.8
	Literate	38.6	35.0	42.3	42.2	38.9	45.6	19.2	15.9	22.9	59.4	47.5	70.4
	Primary School	41.6	38.4	44.8	44.2	41.2	47.3	14.2	12.1	16.6	61.3	45.5	67.7
	Junior School+	41.8	36.8	47.0	40.3	35.1	45.9	17.8	15.4	20.6	57.8	47.1	67.8
Log PCE	Bottom Tertile	40.0	37.2	42.8	44.8	42.3	47.5	15.2	13.5	17.0	67.6	62.4	72.4
	2nd Tertile	40.1	37.0	43.2	41.8	38.2	45.5	18.1	15.1	21.6	64.3	52.2	74.8
	Top Tertile	41.6	36.7	46.7	40.0	35.7	44.5	18.4	16.3	20.8	51.0	42.5	59.4
Urban-Rural	Rural Hukou/Rural Residence	41.5	38.9	44.1	43.8	41.3	46.2	14.7	13.5	16.1	68.1	63.9	72.1
	Rural Hukou/Urban Residence	46.2	39.3	53.3	38.9	33.5	44.7	14.9	12.3	18.0	66.3	57.9	73.8
	Urban Hukou/Coastal	36.3	28.3	45.2	38.0	30.1	46.5	25.7	19.1	33.7	43.3	30.5	60.0
	Urban Hukou/Noncoastal	33.9	29.7	38.4	44.3	39.3	49.4	21.9	17.8	26.5	51.8	41.8	61.6
Region	Coastal	43.4	38.9	48.0	38.3	33.4	43.6	18.3	15.7	21.2	52.2	43.7	60.6
	Non-coastal	38.7	36.3	41.2	44.5	42.1	46.9	16.8	15.3	18.5	64.8	60.4	69.0
BMI	<23	48.6	45.2	51.9	40.1	37.2	43.0	11.4	10.0	12.9	64.2	56.7	71.1
	[23, 25)	42.9	36.1	49.8	40.9	35.7	46.3	16.3	13.8	19.1	56.3	48.9	63.4
	[25, 30)	33.1	28.7	37.9	44.9	41.9	48.0	22.0	18.5	25.8	43.7	30.7	57.7
	>=30	25.8	20.4	32.0	45.2	39.6	50.8	29.1	23.3	35.6	53.8	42.5	64.7
Total Cholesterol	<240 mg/dL	42.2	39.6	44.8	41.3	38.4	44.2	16.6	15.0	18.2	56.9	51.7	62.0
	>=240 mg/dL	27.5	24.0	31.2	47.4	43.5	51.4	25.1	22.1	28.4	72.8	65.9	78.7
Waist Circumference	Female<88cm, Male<102cm	45.4	41.6	49.3	41.3	38.4	44.3	13.2	11.6	15.0	64.9	59.8	69.7

	Normal			Prediabetes			Diabetes					
							All			Undiagnosed		
	%	**95% CI**		**%**	**95% CI**		**%**	**95% CI**		**%**	**95% CI**	
Female>=88cm, Male>=102cm	30.1	27.5	32.9	43.7	40.8	46.8	26.1	23.3	29.2	55.2	47.9	62.4
N	3,951			4,417			1,651			1,032		

Table 3

Odds Ratios from Logistic Regressions of Having Diabetes on Selected Characteristics, CHARLS, China 2011-2012

		Model 1	Model 2
Age	*(45-59)*		
	60-69	1.48***	1.49***
	70-79	1.43*	1.51*
	80+	1.75*	1.89*
Gender	*(Male)*		
	Female	1.06	0.81*
Education	*(Junior School+)*		
	Illiterate	1.19	1.21
	Literate without Schooling	1.31	1.34
	Primary School	0.83	0.83
Log PCE	*(Bottom Tertile)*		
	2nd Tertile	1.08	1.05
	Top Tertile	1.10	1.10
Urban-Rural	*(Rural Hukou/Rural Residence)*		
	Rural Hukou/Urban Residence	1.07	1.01
	Urban Hukou/Coastal	2.00**	1.78**
	Urban Hukou/Non-coastal	1.62***	1.41*
Region	*(Non-coastal)*		
	Coastal	0.91	0.86
BMI	(<23)		
	[23, 25)		1.44**
	[25, 30)		1.72***
	>=30		2.23***
Total Cholesterol	>=240 mg/dL		1.78***
Waist Circumference	Female >= 88cm, Male >=102cm		1.77***
	N	9,996	

Note:

(1) Statistical Significance:

(2) Missing indicators of Log PCE, waist Circumference and BMI were included in all the models.

*** $p<0.001$

** $p<0.01$

* $p<0.05$.

Table 4

Odds Ratios from the Logistic Regression on Diabetes Diagnosis Among Individuals with Diabetes, CHARLS China, 2011-2012

		Diagnosis
Age	*(45-59)*	
	60-69	1.52**
	70-79	1.33
	80+	0.08**
Gender	*(Male)*	
	Female	1.31
Education	*(Junior School+)*	
	Illiterate	1.33
	Literate without Schooling	1.36
	Primary School	1.10
Log PCE	*(Bottom Tertile)*	
	2nd Tertile	0.97
	Top Tertile	1.44*
Urban-Rural	*(Rural Hukou/Rural Residence)*	
	Rural Hukou/Urban Residence	0.95
	Urban Hukou/Coastal	2.41*
	Urban Hukou/Non-coastal	2.19***
Region	*(Non-coastal)*	
	Coastal	1.56*
	N	1,644

Note:

(1) Statistical Significance:

(2) A missing indicator of Log PCE was included in the model.

*** $p<0.001$

** $p<0.01$

* $p<0.05$.

Table 5

Diabetes Diagnosis, Management, and Education Among Diabetics with Diagnosed Disease, CHARLS, 2011-2012 China, 2011-2012

		%	95% CI	
Diabetes Diagnosis				
	in last 5 years	63.0	50.8	73.8
	6-10 years	26.4	15.6	41.1
	More than 10 years	10.6	7.4	15.0
Treatment	No Treatment	24.4	19.1	30.7
	Chinese Med without insulin	8.7	6.1	12.3
	Chinese Med only	5.3	3.4	8.4
	Western Med within insulin	59.2	50.4	67.4
	Western Med only	55.9	46.7	64.7
	Chinese Med and Western Med	3.4	2.1	5.2
	Insulin	11.1	7.9	15.3
	Insulin only	5.1	2.9	8.6
	Western Med and Insulin	3.6	2.3	5.5
	Western Med, Chinese Med and Insulin	2.2	1.1	4.4
Tests (not mutually exclusive categories)				
	Blood/Urine Glucose Test	82.3	76.7	86.7
	Fundus Examination	21.0	15.8	27.4
	Micro-albuminuria Test	19.2	14.4	25.0
	None	15.9	12.0	20.7
Health Education (not mutually exclusive categories)				
	Weight Control/Exercise/Diet	80.2	74.8	84.7
	Smoking Control	24.4	18.4	31.6
	Foot Self-care	15.7	10.8	22.2
	None	18.1	13.9	23.2
	N		619	

Table 6

Odds Ratios from the Logistic Regressions on Diabetes Diagnosis, Control, Treatment, Test, and Health Information Among the Individuals Who Have Been Diagnosed with Diabetes on Selected Characteristics, China, 2011-2012

		Diagnosis in the Last 5 Years	Treatment	Test	Health Information
Age	*(45-59)*				
	60-69	0.35***	0.93	1.17	0.80
	70+	0.55	1.02	0.62	0.44*
Gender	*(Male)*				
	Female	1.17	0.66	0.95	0.53*
Education	*(Junior School+)*				
	Illiterate	0.55	2.59*	0.78	1.74
	Literate without Schooling	2.30	1.41	0.72	1.33
	Primary School	0.68	1.68	0.80	1.12
Log PCE	(Bottom Tertile)				
	2nd Tertile	0.78	1.50	1.12	1.04
	Top Tertile	0.54*	2.54***	1.70	1.95*
Urban-Rural	*(Rural Hukou/Rural Residence)*				
	Rural Hukou/Urban Residence	1.10	2.40**	2.14*	1.48
	Urban Hukou/Coastal	0.33*	3.82**	3.44	3.12*
	Urban Hukou/Non-coastal	0.99	1.77	1.30	3.58**
Region	*(Non-coastal)*				
	Coastal	0.93	0.68	1.39	1.09
	N	613		617	

Note:

(1) Statistical Significance:

(2) Age groups 70-79 and 80+ were combined due to very small N for the age group 80+.

(3) A missing indicator of Log PCE was included in all the models.

(4) Treatment = Western meds or insulin.

Test = Blood/Urine Glucose Test.

Health Information = Weight Control/Exercise/Diet.

*** $p<0.001$

** $p<0.01$

* $p<0.05$.