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Do Health Check-Ups for Seniors Improve Diagnosis and Management of Hypertension and Diabetes in China?

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Do Health Check-Ups for Seniors Improve Diagnosis and Management of Hypertension and Diabetes in China?[†]

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Abstract

We estimate effects of a health check-up on non-communicable disease (NCD) diagnosis and management among Chinese adults aged 50 and older. Using five waves of the China Health and Retirement Longitudinal Study (CHARLS) spanning a period of 9 years and a fixed-effect instrumental variable (IV) framework, we exploit a policy that provided free health check-ups for those 65 and above as an IV for health check-ups to address the endogeneity between health check-ups and health characteristics. We estimate that a check-up increases the probability of diabetes diagnosis by 8.3 percentage points (p=0.042), particularly among females in rural areas (13.3 percentage points, p=0.063). However, there was no significant effect on hypertension diagnosis. Despite improving diabetes detection, check-ups do not significantly increase diabetes treatment, disease control, or provider recommendations. Similarly, while they increase health behavior recommendations for hypertension management –possibly because the policy helped integrate previously diagnosed individuals into formal care– this does not translate into improved hypertension control. These findings highlight the importance of health check-ups in improving diagnosis for certain conditions but reveal critical gaps in follow-up care and disease management.

Keywords: Health checkup | Hypertension | Diabetes | Diagnosis | China | Older adults

JEL classification: C23, C26, I12, I18, J14

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1 Introduction

Hypertension and diabetes are highly prevalent in China, yet awareness, treatment, and control rates remain alarmingly low. Among diabetic patients, only 39% are aware of their condition, and just half of them receive antidiabetic medication (Bai *et al.*, 2021). Similarly, in 2018, only 50% of hypertensive individuals aged 50-69 were aware of their condition, and only 15% had their blood pressure under control (Zhang *et al.*, 2023). These gaps pose serious public health risks and strain the healthcare system, highlighting the urgent need for interventions that improve detection and management of these two non-communicable diseases (NCDs) (Kämpfen *et al.*, 2018; The Lancet, 2023).

To address this challenge, China introduced the National Basic Public Health Service Program (NBPHSP) in 2009 as part of its broader push for universal health coverage. The program includes free annual health check-ups for individuals aged 65 and older, aiming to improve the prevention, diagnosis, and management of chronic diseases, particularly hypertension and diabetes (Deng *et al.*, 2017; Long *et al.*, 2023). However, despite its widespread implementation, evidence on its effectiveness remains limited.

In this study, we use data from the China Health and Retirement Longitudinal Study (CHARLS) to estimate the causal effects of health check-ups on the diagnosis and management of hypertension and diabetes. Specifically, we use the free health check-up policy as an instrument for health check-ups, leveraging the sharp age-based eligibility threshold at age 65 within a fixed-effect instrumental variable (FE-IV) framework to identify the impact of health check-ups on NCD diagnosis and management. Our analysis examines the effects of health check-ups on the likelihood of being diagnosed, receiving treatment, and being advised to adopt specific health-related behavioral recommendations for hypertension and diabetes. Additionally, we assess whether health check-ups improve the probability of achieving effective control of these two conditions.

The impact of health check-ups is likely to differ between diabetes and hypertension, given their distinct diagnosis rates (31.7% for hypertension vs. 9.9% for diabetes).

The relatively low pre-65 diabetes diagnosis rate suggests that the check-up could play a significant role in detecting previously undiagnosed cases, but might have little impact on subsequent treatment uptake and behavioral recommendations due to the low diagnosis rate. Conversely, since hypertension is more commonly diagnosed before age 65, the policy-induced check-up may primarily affect health education and behavioral adjustments rather than new diagnoses.

Our findings confirm these patterns. Health check-ups significantly increase the probability of a diabetes diagnosis by 8.3 percentage points (p-value=0.042) but have no statistically significant effect on hypertension diagnosis. The rise in diabetes diagnoses is primarily driven by females, particularly in rural areas (13.3 percentage points, p-value=0.063). The effects on treatment and behavioral recommendations are mixed. While health check-ups increase the likelihood that respondents diagnosed with hypertension report being advised to exercise (by 19.3 percentage points, p-value=0.010) and adjust their diet (by 23.8 percentage points, p-value=0.003) for hypertension management –particularly among females and rural residents– they do not significantly influence self-reported diabetes-related recommendations or treatment uptake. There is suggestive evidence that rural individuals, especially females, substitute traditional Chinese medicine for modern hypertension treatment. Importantly, health check-ups appear to have not improved the probability of having hypertension or diabetes under control, indicating that diagnostic gains and health behavior recommendation may not necessarily translate to better disease management or health outcomes. This may be partly because the free health check-up program does not include the provision of treatment, leaving patients to navigate barriers in accessing the necessary medications for effective disease control. Overall, our findings highlight the role of health check-ups in improving diagnosis rates, particularly for diabetes, while exposing gaps in subsequent treatment and disease management.

Our study makes several key contributions to the literature. First, we provide new causal evidence on how health check-ups influence key stages of managing non-communicable diseases (NCDs), including diagnosis, health recommendations, treatment uptake, and disease control. These four elements are essential to effective NCD care. While prior research has documented broader impacts of check-ups on healthcare utilization, caregiving burdens, and self-reported health, the pathways linking check-ups to concrete health outcomes remain underexplored. Using CHARLS data, Ma *et al.* (2023) leverage variations in the rollout of the free check-up program across different cities in China to estimate its effect on healthcare utilization. They find that the program increases the likelihood of regular check-ups, which in turn leads to lower healthcare spending. Using the same identification strategy, Guo *et al.* (2024) find that regular health check-ups reduce the caregiving burden. Similarly, Zhao *et al.* (2022), using data from the Chinese Longitudinal Healthy Longevity Survey (CLHLS) and employing matching and fixed-effects models, show that regular check-ups positively affect self-reported health. While these studies provide evidence on the broader impact of health check-ups, they do not examine the mechanisms through which check-ups influence health outcomes. Our study fills this gap by examining the intermediate steps crucial to disease management, and in particular NCDs: diagnosis, health recommendations, treatment uptake, and disease control. Moreover, our study also differs from existing studies in two important ways: (a) we assess the effects of health check-ups on the core objectives of the Chinese public health program: detection, treatment, and disease control at the population level, (b) we exploit a sharp age-based eligibility threshold at 65 for free health check-ups, using a fixed-effects instrumental variable (FE-IV) strategy. This design allows us to causally identify the effects of check-ups while avoiding confounding from other age-linked policies, such as retirement or pension eligibility.

Second, our study speaks directly to the emerging literature that delves into health-care seeking behaviors and related responses to incentives to seek care. In the Philippines, randomly induced check-up visits to clinics responsible for cardiovascular (CVD) risk screening are found to increase the probabilities of having blood pressure measured and of receiving medical advice, but they do not increase the likelihood of diagnosis or medication of hypertension (Capuno *et al.*, 2021). These results are consistent with our findings as health check-ups in China do not appear to increase the likelihood of hypertension diagnosis, although we find effects on the probability of receiving health behavior recommendations to control blood pressure.

Third, our study also contributes to the literature on the effects of health screening and diagnosis on related subsequent health outcomes, and more generally on behavioral responses to new health information (Ciancio *et al.*, 2025; Dupas, 2011). In high income countries, evidence on the effectiveness of hypertension screening is mixed (Kämpfen and Mosca, 2024; Pedron *et al.*, 2022; Rodriguez-Lesmes, 2021). Evidence from Low- and Middle-Income Countries (LMICs), including China (Chen *et al.*, 2019; Dai *et al.*, 2022), is somewhat more positive, though findings appear to depend on the context (Ciancio *et al.*, 2021; Kämpfen *et al.*, 2023; Sudharsanan *et al.*, 2020). Chen *et al.* (2019) and Dai *et al.* (2022) find that blood pressure screening and hypertension diagnosis in China lead to reduced blood pressure, lower fat intake, and increased likelihood of quitting smoking, likely driven by behavioral changes. The effects of receiving a diabetes diagnosis, on the other hand, generally points to muted and short-lived responses of behaviors and biomarkers (Alalouf *et al.*, 2023; Gaggero *et al.*, 2022; Iizuka *et al.*, 2021; Kim *et al.*, 2019; Oster, 2018; Slade, 2012). Our findings align more closely with this latter pattern, as we do not find significant effects of hypertension or diabetes diagnosis on the probability of having these conditions under control.

Crucially, our findings reveal a major limitation of the program: while check-ups improve diagnosis rates and lead to health recommendations, they do not significantly improve disease control, likely due to the lack of integrated treatment provision. This result challenges the assumption that screening alone is sufficient to improve health outcomes and highlights the need for policy reforms that link diagnostic programs with accessible medical treatment. By showing that health check-ups alone may be ineffective, our study provides important policy insights for designing more effective chronic disease management strategies in China and beyond.

2 Policy background

In 2009, China launched a large-scale healthcare reform aimed at achieving universal health coverage. One of the five key tasks outlined in the reform agenda was the establishment of the National Basic Public Health Service Program (NBPHSP), which committed to gradually providing essential public health services to all citizens free of charge and on an equal basis (CPC Central Committee and the State Council, 2009). Later that year, the National Health Commission (NHC) introduced nine categories of services included in NBPHSP (National Health Commission, 2009b)[1]: health record maintenance, health education, vaccinations, infectious disease monitoring, child health management, maternal health management, older adult health management, chronic disease management, and mental health management. For each category of services, NHC established corresponding standards to regulate the target population, coverage, procedure, requirements, and performance indicators (National Health Commission, 2009a, 2011, 2017).[2]

Two schemes within the NBPHSP play a crucial role for individuals aged 65 and above: the *older adult health management program* and the *chronic disease management program*. According to the NBPHSP standards, the *older adult health management program* covers adults aged 65 or older and offers free assessments of lifestyle and health status, physical examinations (including blood pressure measurement), laboratory tests (such as blood glucose testing),[3] and target health education. A typical procedure in the *older adult health management program* unfolds as follows. At the beginning of each year, primary care facilities[4] launch campaigns to inform local residents. Adults aged 65 and above are

[1]By 2024, NBPHSP has been expanded to cover 12 categories of services, with tuberculosis health management, traditional Chinese medicine, health surveillance support being added to the program.

[2]NHC has so far issued three versions of standards for NBPHSP in 2009, 2011 and 2017, respectively.

[3]Blood glucose testing became mandatory in 2009, with additional tests - such as blood count, urea nitrogen, and electrocardiogram - gradually incorporated into the package.

[4]In China, primary care facilities are responsible to provide basic public health services and basic medical services.

then contacted and invited for free health assessments and medical check-ups. Following the check-up, results are communicated to the individuals, accompanied by targeted health education. Those diagnosed with hypertension or type 2 diabetes are automatically enrolled in the *chronic disease management program*.

Under the *chronic disease management program*, patients with hypertension or type 2 diabetes[5] receive regular follow-up visits, health check-ups –including blood pressure monitoring for hypertension patients and blood glucose testing for diabetes patients– and targeted health education with recommendations on exercise, diet and other lifestyle modifications. Additionally, adults aged 35 and older are eligible for a free blood pressure test during their first visit to a primary care center each year. Adults with high risk of diabetes are given targeted health education, and blood glucose test is recommended but not delivered for free. Notably, while the program advises patients on medication use, it does not provide the medications themselves, likely reflecting its focus on prevention and monitoring rather than treatment. Given the central role of medication in managing hypertension and diabetes, this gap may limit the program's ability to improve health outcomes –an issue highlighted by the findings of our study.[6,7]

[5] As of 2024, chronic obstructive pulmonary disease was added as the third non-communicable disease into the service package.

[6] Performance assessment for NBPHSP implementation is conducted at each administrative level, from provinces and counties down to primary care facilities –the providers of these services. Standardized performance indicators are established for each program. For the older adult health management program, the key performance indicator is the management rate, defined as the ratio of residents receiving health management to the total number of residents in the administrative prefecture. Similarly, for hypertension and diabetes management, two key indicators are the management rate, which measures the proportion of diagnosed patients in the prefecture who are actively receiving treatment and care, and control rate, defined as the proportion of patients under management whose conditions are effectively controlled. Although NBPHSP funding is allocated on a per-capita basis, there are no regulations specifying how funds should be distributed across different service categories. According to a WHO-commissioned survey, the majority of funding is directed towards hypertension and diabetes management due to the extensive tasks involved (Long *et al.*, 2023).

[7] Health management for hypertension and diabetes is also prioritized in other public policies. The Healthy China 2030 Plan, launched in 2016, pledged universal coverage for hypertension and diabetes management (CPC Central Committee and the State Council, 2016). The National Basic Public Service List (State Council, 2017), introduced in 2017, includes hypertension and diabetes management as one of its 81 programs. Additionally, these conditions are covered under China's social health insurance schemes. Since 2008, the outpatient insurance scheme for chronic illnesses has provided coverage for hypertension and diabetes with complications. More recently, in 2019, a specialized outpatient insurance scheme specifically for hypertension and diabetes was introduced to cover hypertension and diabetes without complications (Ministry of Finance, 2019).

The free check-up program has different implications for individuals with hypertension and diabetes. Hypertension requires only a simple examination, which can be easily conducted by patients themselves or by primary care professionals. Consequently, hypertensive individuals are more likely to be diagnosed before age 65. Turning 65 however provide them with the opportunity to be formally included in *the chronic disease management program*, where they receive hypertension-related recommendations. In contrast, individuals with diabetes often remain undiagnosed until age 65, age at which they become eligible for the *older adult health management program.* Those diagnosed with diabetes at age 65 are then enrolled in *the chronic disease management program* where diabetes-related recommendations are provided. However, the absence of medication provision within this framework represents a critical gap, potentially limiting the program's impact on effective disease management.

3 Data, measures and models

3.1 Data source

We use longitudinal data from China Health and Retirement Longitudinal Study (CHARLS), a nationally representative sample of Chinese residents aged 45 and older. With a baseline wave in 2011, CHARLS is a general-purpose aging survey that collects information on health, financial and housing wealth, income, pension, health insurance, and many other later-life outcomes of about 17,500 individuals. This study uses publicly available data from CHARLS waves one to five, that were collected in 2011, 2013, 2015, 2018, and 2020. The design of CHARLS and a comprehensive documentation of the data files can be found elsewhere (Zhao *et al.*, 2014).

We retained information on individuals aged 50 to 80 years[8] and eliminated observa-

[8]The policy affects those 65 and above, thus leaving us with a window of 15 years on either side of the cutoff. Similar age restriction has been applied when estimating the causal effect of a policy affecting individuals at age 65 and older in the US (Kämpfen and Maurer, 2016). We show, however, that our results are robust to different age restrictions.

tions with missing information on any survey item used in our analysis. In our preferred econometric model (fixed-effect instrumental variable specification), our analytical sample consists of an unbalanced panel of 17,246 and 17,547 in our two main outcome of interests –probability of hypertension and diabetes diagnosis, respectively. This corresponds to 60,855 and 61,875 observations, respectively, with an average of approximately 3.5 observations per individual.

3.2 Main outcomes of interest: hypertension and diabetes diagnosis

Our two main outcomes of interest are hypertension and diabetes diagnoses. In CHARLS waves one to five, respondents are asked, "Have you been diagnosed with [conditions listed below, read one by one] by a doctor?". This list includes "hypertension" and "diabetes or high blood sugar". Because the policy specifically targeted these two NCDs, we restrict our analysis to these two diseases. From the answers to these questions, we create two dichotomous variables that take the value of one if respondents answered affirmatively, and 0 otherwise.[9]

3.3 Secondary outcomes of interest: treatments, recommendations, and control

Following diagnosis, a natural question that arises is whether respondents react to the information received and change behavior. Unfortunately, such information is not available across all CHARLS waves.[10] For instance, questions about treatment are asked only in waves one to four. More specifically, conditional on having been diagnosed with

[9] There are minor inconsistencies across waves in self-reported diagnoses, with a 1.5% discrepancy in hypertension and 0.9% in diabetes, where some respondents initially reported a diagnosis but denied it in following waves. As a robustness check, we manually recode these inconsistencies by setting the diagnosis status to one if a respondent ever reported being diagnosed. Our results remain robust to these adjustments.

[10] It is one of the reasons why we consider diagnosis as our main outcome of interest and relegate our analysis on treatment, recommendations, and control as secondary outcomes.

hypertension and diabetes, respondents are asked if they are now taking (a) traditional Chinese medicine (TCM), (b) Western modern medicine, or (c) none of the above for hypertension. In the case of diabetes, respondents are also given the option to report currently taking insulin injections. We use the answers to these questions to create three separate dichotomous variables: one indicating whether respondents are currently using TCM, another for Western medicine, and a third for using either treatment. Each variable takes the value of one if the respondent is receiving the respective treatment and zero otherwise.

Conditional on diagnosis, respondents are also asked whether their healthcare providers have given them health recommendations related to weight control, exercise, and diet. This information is also elicited only among respondents in CHARLS waves one to four. Moreover, respondents are asked whether they have their hypertension and diabetes under control (self-report). This information is available only in CHARLS waves two to four, which explains the smaller sample size pertaining to the corresponding analysis. We derive dichotomous variables based on respondent's answer to these various questions to evaluate whether health check-ups have had any effect on respondents being recommended to change their health behaviors, and whether they have their blood pressure and blood sugar levels under control.

Finally, we assess whether health check-ups have improved the blood pressure of individuals. Unfortunately, blood pressure information of CHARLS respondents is available only in waves one to three. We nonetheless derive three outcome variables based on blood pressure measurements: following WHO guidelines (World Health Organization, 2020), we compute the average of the second and third systolic and diastolic blood pressure measurements –SBP and DBP, respectively–, as well as a dichotomous variable for hypertension derived from those measurements, with $\mathbb{1}(\text{mean SBP} \geqslant 140 \vee \text{mean DBP} \geqslant 90)$.[11,12]

[11] The 140/90 thresholds are the most common cited in guidelines for hypertension diagnosis and treatment, although recent U.S. guidelines recommend lower thresholds of 130/80 (Chobanian, 2017; Vidal-Petiot, 2022). The thresholds are based on associations between blood pressure and cardiovascular risk (Whelton *et al.*, 2018).

[12] Information on blood sugar level is available only in CHARLS waves 1 and 3, therefore preventing us from convincingly implementing our fixed-effect instrumental variable models to estimate the effects

3.4 Main explanatory variable of interests: health check-up

We are interested in the effect of health check-ups on hypertension and diabetes diagnoses, and subsequent treatment and disease management. In the "health care costs and utilization" module of CHARLS waves 1-5, respondents are asked "When did you take the last physical examination?". We use information from that question and create a dichotomous variable that takes the value one if respondents have taken a check-up since the year prior to the year of interview, and zero otherwise. We use the calendar year before the interview year because respondents' age is measured in years. This means that they could have received a health check-up in the previous calendar year while still being eligible, as they had already turned 65 by then. However, we show that our results are very robust to an alternative definition of medical check-up in which we consider only the (calendar) year of interview instead.

3.5 Instrumental variables (IV) for health check-up: age 65 or above

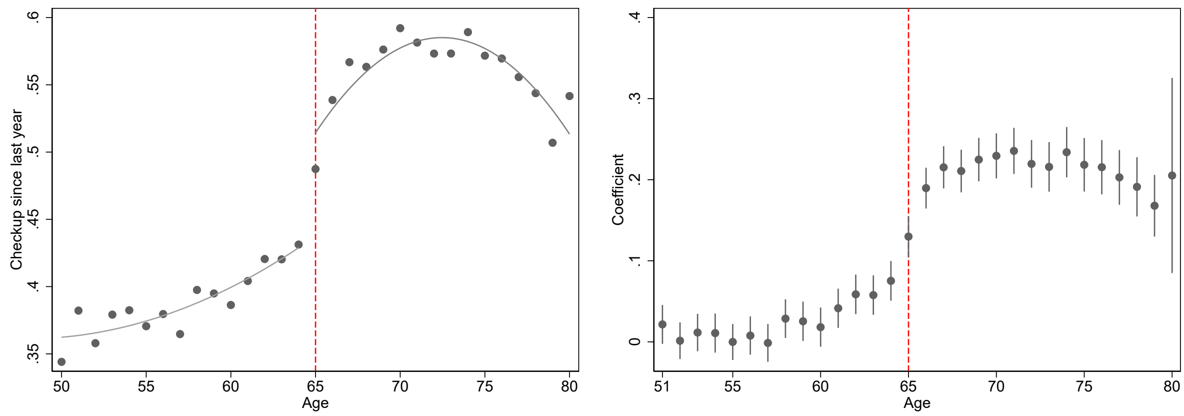
Our instrumental variable consists in a dichotomous variable that takes the value one if someone is subject to the free health check-up program, that is if someone is 65 or above, and zero otherwise. Ma *et al.* (2023) has shown that the policy has had an effect on health care utilization. We extend on this work by showing that the policy triggered behavioral responses among older individuals, leading to increased health care utilization through health check-ups.

Panel A of Fig. 1 presents age-specific rates of health check-ups since the year prior to the year of interview among CHARLS respondents aged 50–80 years. These rates generally increase with age up to 70 and then decline at older ages. The panel highlights substantial increase in the percentage of persons going through a health check-up at age 65, indicated by the vertical dashed red line. This basic bivariate descriptive evidence

of the health check-up on blood sugar level.

Figure 1: Relevance of instrumental variable

A) Mean rate of health check-up **B) Event study-type evidence**



Notes: Left plot: mean rates of recent health check-ups (y-axis) against age (x-axis). Vertical red dashed line is at age 65 and corresponds to the age when respondents have access to free health check-ups. The plot includes a quadratic fit on either side of the vertical dashed line. *Right plot*: Coefficients associated to age derived from the model: $Y_i = \alpha + \sum_{a=51}^{80} \beta_a \mathbb{1}[Age_i = a] + \gamma X_i + \epsilon_i$ where Y_i is recent health check-up, and X a vector of indepdendent variables including retirement status, whether the respondent is currently married, whether the respondent has a health insurance, sex, education, as well as CHARLS wave fixed-effects. Vertical black lines corresponds to 95% confidence intervals derived from clustered robust standard errors at the individual level.

based on raw age profiles already suggests an increase in health check-ups at age 65.

Panel B of Fig. 1 presents further evidence of the relevance of our IV for recent health check-ups. This plot shows coefficients derived from an event-study type analysis in which we regress recent health check-up on a set of age dichotomous variables along with several socio-demographic control variables (see figure note for more details on the specification). Even after controlling for individual characteristics, the associations between age and health check-up increase sharply at age 65, providing further evidence of the relevance of our IV for the endogenous variable at hand.

Our later econometric analyses will provide a more formal assessment of the impact of crossing age 65 on the probability of going through a recent health check-up (along with corresponding tests for instrument relevance and strength).

3.6 Control variables

Our empirical analyses also control for a range of other socio-demographic factors and individual characteristics that may affect disease diagnostic and management. Specifically, our models include a second order polynomial in age as well as controls for sex, marital status (currently married), educational attainment ("low" for those below elementary school, "medium" for respondents who did not complete high school, and "high" for those who graduated from high school or above), whether respondents are covered by a health insurance, and retirement status based on whether someone completed retirement procedure (including early retirement) or internal retirement.[13] Our model also includes CHARLS wave fixed-effects to capture any possible difference in survey procedure across waves.

It is worth noting that our individual fixed-effect models will control for all unobserved characteristics that are fixed over time and constant within individual. Moreover, our IV approach should take care of any potential omitted variable biases due to differences in health and health-seeking behaviors between individuals who visit a health facility for a health check-up and those who do not.

Table 1 presents sample means and standard deviations for all variables used in our analysis. As shown in column 1, not all information is available across all CHARLS waves one to five, which explains the smaller sample size for some of the variables shown in the last column of the table.

About 32% of our sample report having been diagnosed with hypertension, and 10% have been diagnosed with diabetes. About 45% percent of the sample have had a health check-up since the year prior to the year of the interview. The average age of our sample is about 62.6 years old and 38% of our sample is aged 65 or older. The level of education in our sample is relatively low, with only about 13% of the sample who graduated from

[13]The low retirement rate in our sample can be attributed to the absence of a formal retirement procedure for most individuals living in rural areas, particularly farmers, who effectively never retire. This does not threaten our identification strategy, as the key issue would be the official retirement age –which in China is not 65– and, in most cases, irrelevant to rural residents.

Table 1: **Sample descriptives**

	Waves available (1)	*Mean* (2)	*Std. dev.* (3)	*N* (4)
Outcome variables				
Hypertension				
Diagnosis	1-5	0.319	0.466	63407
Treatment TCM	1-4	0.031	0.174	47991
Treatment Modern	1-4	0.214	0.410	47991
Any treatment	1-4	0.227	0.419	47991
Recommended weight control	1-4	0.083	0.275	47924
Recommended exercise	1-4	0.112	0.316	47924
Recommended diet	1-4	0.139	0.346	47924
Blood pressure under control (self-report)	2-4	0.262	0.440	38827
Systolic blood pressure	1-3	129.555	20.439	28813
Diastolic blood pressure	1-3	75.464	11.693	28807
Hypertension	1-3	0.302	0.459	28814
Diabetes				
Diagnosis	1-5	0.099	0.299	64163
Treatment TCM	1-4	0.009	0.096	48908
Treatment Modern	1-4	0.046	0.210	48908
Treatment Insulin	1-4	0.013	0.115	48908
Any treatment	1-4	0.057	0.231	48908
Recommended weight control	1-4	0.030	0.170	48906
Recommended exercise	1-4	0.041	0.197	48906
Recommended diet	1-4	0.052	0.221	48906
Blood sugar under control (self-report)	2-4	0.064	0.245	39904
Independent variables				
Health check-up since previous year	1-5	0.450	0.498	67645
65 years old or above (IV)	1-5	0.376	0.484	67645
Female	1-5	0.510	0.500	67645
Below elementary school	1-5	0.422	0.494	67641
Below High-school	1-5	0.445	0.497	67641
High-school or above	1-5	0.133	0.340	67641
Age	1-5	62.595	7.628	67645
Retired	1-5	0.165	0.371	66538
Married	1-5	0.869	0.337	67639
No health insurance	1-5	0.047	0.211	67314

Notes: Descriptive statistics of our benchmark sample derived from CHARLS. Column 1 presents the CHARLS waves in which the variables are available. "Std. dev." stands for standard deviation and "N" the number of observations. "TCM" stands for traditional Chineses medicine. "Retired" is a dichotomous variable that takes the value 1 if a respondent completed retirement procedure (including early retirement) or internal retirement. Systolic and diastolic blood pressure corresponds to the average of the second and third measurements. Hypertension is an indicator variable derived from those measurements, $\mathbb{1}(\text{mean SBP} \geqslant 140 \vee \text{mean DBP} \geqslant 90)$.

high school or higher. The sample is predominantly female (51%) and married (87%). Only a small minority of the sample does not have any health insurance (4.7%).

Regarding diabetes, only 5.7% of our sample were undergoing any types of treatment.

Insulin treatment use was limited (1.3%), while modern treatments were the most commonly used (4.6%). Among the various lifestyle recommendations, following a diet (5.2%) was the most prevalent. 6.4% of our sample self-reportedly achieved blood sugar control.

Table A1 in the Appendix shows descriptive statistics of our various outcome variables across waves. Both hypertension and diabetes diagnoses increase over time. At wave 1, these rates are equal to 28.9% and 7.2%, respectively, and increase up to 40.2% and 15.4%, respectively, in wave 5. Treatment and recommendations for these two diseases also increase over time, although the increase is much less pronounced.

3.7 Econometric models

Our IV strategy addresses the potential endogeneity of health seeking behaviors in models for hypertension and diabetes diagnosis, which may arise from several unobserved factors that plausibly affect both health check-up and diagnosis such as hypertension- or diabetes-related symptoms and health shocks. A simple Ordinary Least Squares (OLS) strategy would result in biased estimates if it does not account for such confounders, which may be hard to fully capture using only observable characteristics available in CHARLS.

We use age 65 and older as IV to predict the probability of someone having a health check-up since the year prior to the year of interview.[14] As explained in the introduction, reaching 65 entitles any Chinese individuals for a free health check-up.

We believe that our instrument for health check-up is valid for our econometric models predicting hypertension and diabetes diagnosis, since being offered a free health check-up at 65 is an exogenous public health system characteristics that do not respond to individual circumstances such as health characteristics or health shocks. Moreover, the free check-up program for individuals aged 65 and older is unlikely to be confounded by other nationwide policies targeting older adults, as age 65 is not a common eligibility threshold for public policies in China. To our knowledge, no other national programs

[14] We show that we obtain very similar results if we use health check-up conducted in the same year as the year of the interview.

use this cutoff. In China, the legal retirement age varies: 60 for male employees, 55 for female managers and professionals, and 50 for other female employees. Pension benefits are available upon retirement for employees and at age 60 for rural residents and urban unemployed individuals. Additionally, the old-age allowance is typically granted at age 70 or 80, depending on local regulations. The only exception is Shanghai, which lowered the threshold to 65 in 2016. While we cannot directly test the exogeneity assumption of our IV, we assess the relevance of our instrument by examining its explanatory power in the first-stage regression by presenting the robust F-statistics on the excluded instruments.[15] While our IV appears strong enough, we nonetheless report Anderson-Rubin (AR) confidence sets and corresponding p-values, which are statistics that are robust to weak identification (Anderson and Rubin, 1949; Andrews *et al.*, 2019; Stephens *et al.*, 1985).

To capture any (smooth) direct effects of age, we include a second order polynomial in age as control into our models. Moreover, we conduct several robustness checks for our findings based on various sample selections, age polynomials, as well as placebo age (62 and 68) that would trigger free health check-ups to ensure that our findings do not capture any other unobserved characteristics that could drive our results.

We first perform fixed-effect OLS regressions (FE) to provide initial descriptive evidence on the partial association between health check-up and hypertension and diabetes diagnosis. The specification of this simple FE model can be written as:

$$Y_{it} = \alpha_0 + \varphi X_{it} + \alpha_1 Checkup_{it} + \varsigma_t + \gamma_i + \varepsilon_{it} \quad (1)$$

where Y_{it} represents our binary variable that takes value one if an individual i at time t is diagnosed with hypertension and diabetes (separately), and zero otherwise. $Checkup_{it}$ is a dichotomous variable that takes the value one if an individual has had a health check-up since the year prior to the year of interview, and zero otherwise, and X_{it} is a vector

[15] In the just-identified case with a single endogenous variable, this statistics corresponds to the Montiel-Olea and Pflueger's F-statistics (Olea and Pflueger, 2013; Pflueger and Wang, 2015).

of individual characteristics that include age and its quadratic term, retirement status, whether the respondent is currently married, and whether the respondent has a health insurance. ς_t is a set time dichotomous variables corresponding to CHARLS wave fixed-effects, γ_i individual fixed-effects, and ε_{it} the error term. The fixed-effect models allow for the presence of time-invariant individual-specific effects that may be correlated with our explanatory variables at hand. This model goes some way toward a causal analysis, but restricts the endogeneity of health check-up to stem from a correlated time-invariant individual-specific effect and can therefore not accommodate situations with time-varying confounders such as unobserved health shocks or changes in symptoms related to hypertension and diabetes that plausibly affect both health check-up and diagnosis.

In a second step, we perform our causal analysis with a classical fixed-effect two-stage Least Squares (FE-2SLS) framework. Our IV framework thereby appropriately deals with the likely endogeneity of health check-up irrespective of whether it stems from time-invariant and time-varying confounders. To this end, we use eligibility age at 65 as the instrument for check-up and estimate FE-2SLS regressions that incorporate additional unobserved individual fixed-effects in the structural equation of interest and reduced form, which may be correlated with the explanatory variables at hand. This econometric specification can analytically be written as follows:

$$Checkup_{it} = \alpha_0 + \phi X_{it} + \alpha_1 \mathbb{1}[Age_{it} \geq 65] + \delta_t + \gamma_i + \nu_{it} \tag{2}$$

$$Y_{it} = \beta_0 + \varphi X_{it} + \beta_1 \widehat{Checkup}_{it} + \tau_t + \lambda_i + \varepsilon_{it} \tag{3}$$

Eq. 2 is the first stage of our estimation in which we predict health check-up using our IV as well as our set of control variables and dichotomous variables. In the second stage (Eq. 3), we regress our binary outcome variables of interest Y_{it} on the predicted value of health check-up $\widehat{Check-up}_{it}$ and the same set of controls and dichotomous variables as in Eq. 2. β_1 therefore represents the treatment effect of health check-up on hypertension and diabetes diagnosis. FE-2SLS has the advantage that it only exploits information on persons who undergo a health check-up because they cross 65 years of age between waves to estimate the effect of the health check-up on hypertension and diabetes diagnosis. In all regressions, the standard errors are clustered at the individual level.[16]

4 Results

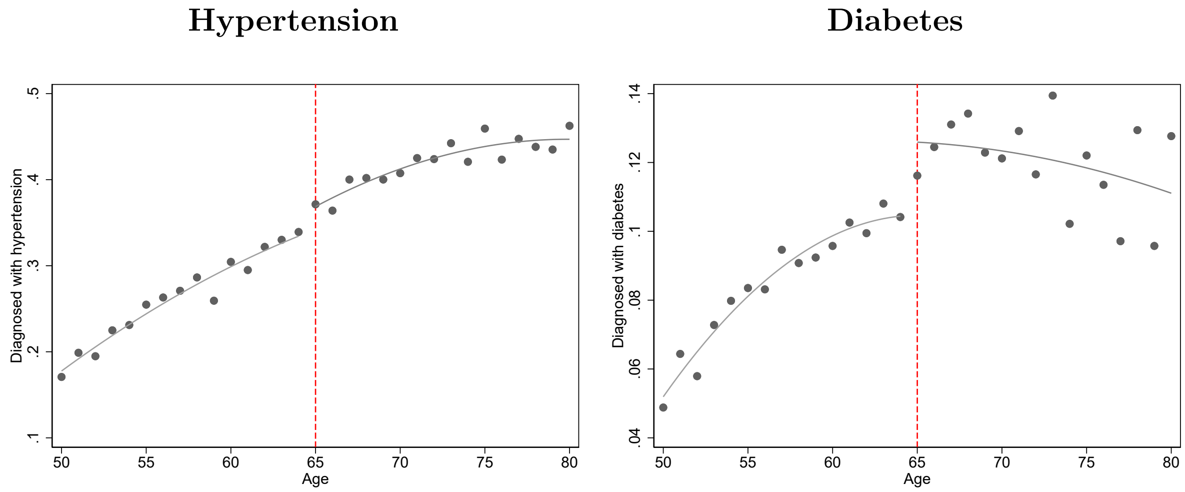
We first provide preliminary and visual evidence of the reduced form estimates of the policy affecting those 65 and above on hypertension and diabetes diagnosis. Figure 2 shows age profiles of hypertension and diabetes diagnoses and shows an overall increase in the share of respondents being diagnosed with age. There is an apparent increase in these rates at 65, especially in the rate of respondents being diagnosed with diabetes, while the discontinuity for hypertension diagnosis is noticeably smaller.. This basic bivariate analysis based on raw age profiles already provides suggestive evidence of an increase in diabetes diagnosis at 65, in line with our hypothesis of a positive effect of the health check-up on diagnosis for diabetes. It is worth noting that the diagnosis rate for hypertension already exceeds 30% before 65, indicating that a large proportion of individuals are diagnosed before being entitled to the free health check-up program at age 65.

The first panel of Table 2 presents estimates of associations and causal effects of health check-up on hypertension and diabetes diagnosis. The FE estimates in columns 1 and 3 indicate small positive and statistically significant partial associations between health check-up and diagnosis for the two conditions. Ceteris paribus, individuals who have gone through a health check-up since the year prior to the year of interview are 1.9 percentage points more likely to have been diagnosed with hypertension and 1.0 percentage points more likely to have been diagnosed with diabetes. These associations are statistically significant at the 1%-level.

By contrast, the FE-2SLS specification shows that the corresponding effect on hyper-

[16]For completeness, we report in the Appendix estimates of our models without individual fixed effects. This allows us to capture associations with time-invariant individual characteristics, such as sex and education, which would otherwise be omitted in the fixed-effect specification.

Figure 2: Diagnosis by age



Notes: Mean rates of hypertension (left) and diabetes (right) diagnoses on the y-axis against age (x-axis). Vertical red dashed line is at age 65 and corresponds to the age when respondents have access to free health check-up. The plot includes a quadratic fit on either side of the vertical dashed line.

tension diagnosis increases to 6.4 percentage points and is no longer statistically significant at conventional level,[17] whereas the effect on diabetes increases both in magnitude and precision to 8.3 percentage points (p-value=0.042).[18]

The second panel of Table 2 present first-stage estimates of our IV on our endogenous variable.[19] Specifically, being 65 years or older results in 10.3-10.4 (FE-2SLS) higher probability of having gone through a health check-up since the year prior to the year of the interview. These estimates support the visual evidence presented in Figure 1. These first-stage estimates of the impact of being 65 years or older are always statistically significant at the 1%-level. The F-statistics for the excluded instruments are around 150, and thus well above the threshold of 104.7 required to insure the *t*-tests to reject at a rate no higher than the correct 5% rate (Keane and Neal, 2023; Lee *et al.*, 2022). Reported at the bottom of the table, Anderson-Rubin confidence sets and p-values, which are robust to weak identification, are consistent with these results (Anderson and Rubin, 1949).

[17] The insignificant effect of the check-up on hypertension diagnosis may be due to a large proportion of individuals already being diagnosed before age 65, reducing the variation necessary for the IV to identify a meaningful impact.

[18] Results derived from similar models but excluding individual fixed-effects, i.e., pooled OLS (POLS) and pooled IV (P2SLS), are reported in Appendix Table A2.

[19] Full regression table is reported in Appendix Table A3.

Table 2: The effect of health check-up on the probability of hypertension and diabetes diagnoses

	Diagnosis			
	Hypertension		***Diabetes***	
	FE	FE-2SLS	FE	FE-2SLS
	(1)	(2)	(3)	(4)
	Second stage			
Health check-up	0.019***	0.064	0.010***	0.083**
	(0.003)	(0.055)	(0.002)	(0.041)
Age	-0.015	-0.017	-0.000	-0.004
	(0.020)	(0.021)	(0.016)	(0.016)
Age squared	0.000***	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Retired	-0.013	-0.012	0.005	0.007
	(0.009)	(0.009)	(0.007)	(0.007)
No health insurance	-0.010*	-0.008	0.003	0.006
	(0.006)	(0.007)	(0.004)	(0.005)
Married	-0.004	-0.005	-0.003	-0.004
	(0.009)	(0.009)	(0.007)	(0.007)
Mean outcome	0.317	0.317	0.099	0.099
	First stage			
IV		0.103***		0.104***
		(0.008)		(0.008)
Mean outcome		0.451		0.451
Obs	60855	60855	61875	61875
F excluded instruments		149.516		154.985
AR confidence set (95%)		[-0.039, 0.167]		[0.007,0.165]
AR p-value (95%)		0.229		0.040

Notes: Sample derived from CHARLS waves 1-5. Columns 1 and 3 present OLS estimates with individuals fixed-effects. Columns 2 and 4 present IV estimates with individuals fixed-effects. "IV" is a dichotomous variable that takes the value 1 if age is at or above 65, and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. First panel present results of the second stage estimates while the second panel presents the first stage estimates. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4 in the Appendix assesses the robustness of our FE-2SLS findings with regard to various sample selections and alternative specification of our outcome variables. Estimates based on a sample for which we restrict our analysis to at least three observations per respondents (columns 1 and 5) barely change our benchmark results. Various age restrictions (53 to 77 years old in columns 2 and 6, or 55 to 75 years old in columns 3 and 7) again result in similar effects and precision, indicating the robustness of our findings to different sample selections. Columns 4 and 8 show that manually correcting the small inconsistencies across waves in respondents self-reported diagnosis barely change our FE-2SLS estimates compared to those reported in Table 2.

We also explore the robustness of our findings to different specifications of age trends, i.e., using a linear and cubic age trend, in place of the quadratic age trend in our benchmark analysis (Appendix Table A5). Both alternative specifications of age trends yield by and large comparable estimates to our benchmark analyses, although the precision of our estimates is somewhat lower in models with cubic age trends.

To facilitate comparison across the models, we also estimate all our models by restricting the sample to be the same as the one used in our FE-2SLS model specification (Appendix Table A6). While this sample selection strategy results in some loss of data and potential selection, it also facilitates comparisons of results across model specifications considerably by isolating the impact of differences in model specification for potential variation in estimation samples. The corresponding results show that the differences that emerged across models are not due to difference in samples as patterns are very similar to those presented in Table 2.

Moreover, our benchmark model uses health check-up since the year prior to the year of the interview as endogenous variable. Results when using health check-up in the same calendar year as the year of the interview are presented in Appendix Table A7. Again, the estimates are very robust to this departure from the benchmark model.

Finally, we also estimate our models using placebo reforms to ensure that our findings are not just spurious and that the effect of our instrument on hypertension and diabetes diagnosis is not confounded with any other unobservable trend. To this end, we test whether our placebo instruments, at 62 and 68 years of age instead of 65, have any effect on our outcome variables of interest. Appendix Table A8 shows that these placebo reforms do not have any statistically significant effects on hypertension and diabetes diagnoses in the FE-2SLS models. Placebo reforms do however have an effects on our endogenous variable, although much smaller than the ones reported in our benchmark estimates. F-statistics on the excluded instruments are also much smaller than when using the actual reform at 65. These results are consistent with the visual patterns represented in Figure 1.

4.1 Beyond Diagnosis: Treatment and Management

Our analysis so far has shown that a health check-up induced by the policy has increased the probability of diabetes diagnosis among CHARLS respondents. A natural follow-up question is whether a recent health check-up improves managaement and treatment for hypertension and diabetes. We investigate this question using three sets of outcome variables: (a) current treatments, (b) health behaviors recommendations, and (c) having blood pressure or blood sugar under control (self-reports). As explained in the data section, a disadvantage of this analysis is that the information regarding these variables is not available in all CHARLS survey waves, thus reducing our sample size and the power of our analysis.

Table 3 shows the causal effects of health check-up on various types of treatment. The first panel shows that health check-up did not increase the probability of currently taking traditional Chinese medicine (TCM) (column 1), modern medicine (column 2), or any of the two (column 4) for hypertension.

The second panel showing the effects on diabetes-related treatments reveals that health check-up does not appear to have any causal effects on the probability to be currently under treatment. While the absence of an effect may partly reflect limited variation in diabetes treatment, these null results may also point to a broader issue –namely, a lack of integrated treatment provision within the healthcare program implemented for those 65 and older.

Table 4 shows the causal effects of health check-up on various recommendations received from healthcare providers for managing respondents' diagnosed conditions. In-

Table 3: The effect of health check-up on treatment for hypertension and diabetes (FE-2SLS models)

	TCM (1)	***Modern*** (2)	***Insulin*** (3)	***Any*** (4)
		Hypertension		
Health check-up	-0.038	0.079		0.057
	(0.045)	(0.071)		(0.070)
Mean outcome	0.031	0.214		0.228
Obs	43066	43066		43066
F excluded instruments	66.025	66.025		66.025
AR confidence set (95%)	[-0.130,0.050]	[-0.058,0.221]		[-0.078,0.198]
AR p-value (95%)	0.397	0.259		0.412
		Diabetes		
Health check-up	0.002	0.042	0.017	0.059
	(0.025)	(0.043)	(0.024)	(0.041)
Mean outcome	0.009	0.046	0.014	0.057
Obs	43790	43790	43790	43790
F excluded instruments	68.539	68.539	68.539	68.539
AR confidence set (95%)	[-0.046,0.050]	[-0.040,0.127]	[-0.030,0.066]	[-0.016,0.144]
AR p-value (95%)	0.928	0.318	0.477	0.137

Notes: Sample derived from CHARLS waves 1-4. All coefficients are derived from IV fixed effects models (FE-2SLS). The coefficients are second-stage estimates. "TCM" stands for traditional Chinese medicine. "Any" is a dichotomous variable that takes the value 1 if respondents take either TCM, modern medicine, or insulin for diabetes. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

terestingly, the first panel shows that despite health check-up not having any effects on being diagnosed and currently taking treatments for hypertension, respondents were more likely to have been recommended to exercise and to follow a diet. For individuals already diagnosed with hypertension before age 65, the exogenous check-up induced by the free health check-up policy at 65 may have little effect on hypertension diagnosis but could facilitate their enrollment into the *chronic disease management program*, where they receive targeted recommendations on health behavior changes. Indeed, our estimates in columns 2 and 3 indicate that a recent health check-up induced by the policy resulted in a 19.3 and 23.8 percentage points higher probability of being recommended to exercise and follow a diet for hypertension, respectively. All these effects are precisely estimated, at least at 5%-level of significance. Our analysis does however not detect any effects on

Table 4: The effect of health check-up on health behavior recommendations (FE-2SLS models)

	Weight (1)	***Exercise*** (2)	***Diet*** (3)
		Hypertension	
Health check-up	0.028	0.193**	0.238***
	(0.066)	(0.075)	(0.080)
Mean outcome	0.082	0.112	0.139
Obs	42991	42991	42991
F excluded instruments	67.038	67.038	67.038
AR confidence set (95%)	[-0.101,0.162]	[0.053,0.350]	[0.088,0.407]
AR p-value (95%)	0.677	0.008	0.002
		Diabetes	
Health check-up	0.004	0.024	0.021
	(0.039)	(0.044)	(0.047)
Mean outcome	0.029	0.040	0.051
Obs	43790	43790	43790
F excluded instruments	68.753	68.753	68.753
AR confidence set (95%)	[-0.075, 0.081]	[-0.074, 0.100]	[-0.070,0.116]
AR p-value (95%)	0.911	0.803	0.655

Notes: Sample derived from CHARLS waves 1-4. All coefficients are derived from IV fixed effects models (FE-2SLS). The coefficients are second-stage estimates. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

recommendations for diabetes management. A possible explanation is again the lack of variation in the corresponding outcome variables.

Finally, we assess whether recent health check-ups increase the probability of having hypertension and diabetes under control, as self-reported by the respondents. Table 5 shows that this is not the case (columns 1 and 2). The FE-2SLS estimates on the probability of having hypertension under control as per respondent's measured SBP and DBP do not reveal any precise effects either (columns 3 to 5).

Table 5: The effect of health check-up on hypertension and diabetes control, and blood pressure (FE-2SLS models)

	Self-reported		*Measured*		
	Hypertension control	*Diabetes control*	*Hypertension*	*Av. SDP*	*Av. DBP*
	(1)	(2)	(3)	(4)	(5)
Health check-up	-0.026	0.021	-0.089	8.537	3.840
	(0.098)	(0.059)	(0.174)	(6.705)	(3.741)
Mean outcome	0.261	0.064	0.305	129.697	75.495
Obs	33160	33871	23269	23269	23260
F excluded instruments	46.011	49.237	20.776	20.776	20.761
AR confidence set (95%)	[-0.233,0.163]	[-0.094, 0.140]	[-3.941,25.200]	[-3.418,12.500]	[-0.468,0.276]
AR p-value set (95%)	0.788	0.725	0.183	0.293	0.609

Notes: Sample derived from CHARLS waves 2-4. All coefficients are derived from IV fixed effects models (FE-2SLS). The coefficients are second-stage estimates. All models also control for CHARLS wave fixed-effects. "Av. SDP" and "Av. DBP" stand for average systolic and diastolic blood pressure, respectively. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2 Heterogeneous effects

Table 6 explores heterogeneity in the causal effects of health check-up on the probability of being diagnosed with hypertension and diagnosis by sex, rural vs urban, and (rural vs urban) × sex using FE-2SLS models. Separate models for female and male show that the positive effects of health check-up on diabetes diagnosis only occurs for females (10.3 percentage points, p-value=0.080). Similarly, the effects are relatively more precisely estimated in rural areas (8.0 percentage points, p-value=0.074) than in urban area, where the effect fails to be statistically significant at conventional level. Among all the different categories, the effect on diabetes diagnoses is the largest among females living in rural areas (13.3 percentage points, p-value=0.063). The null effect we report on hypertension diagnoses does not mask any heterogeneity across categories, as none of the effects in the first panel of Table 6 are statistically significant, even at the 10% level.

Similar heterogeneous analysis for the effects of health check-up on treatment for hypertension and diabetes are presented in Appendix Figure A1 (FE-2SLS models). This figure shows that a health check-up induced by the policy decreases the probability of individuals living in rural areas, especially females, of currently using traditional Chinese medicines (TCM) for hypertension (effects=-0.127, p-value=0.085), with a substitution effect for the same groups towards modern medicine. In fact, we find a positive causal effect of health check-up on the probability of currently taking modern medicine for hypertension for females (effects=0.195, p-value=0.057), whereas such effect are not detected for males.

We do not observe similar effects for diabetes treatment in any of the groups we consider: although estimates for modern medicine are consistently positive, they are not precisely estimated (Appendix A2). Possible explanations are again the lack of variation in the treatment outcome variables and smaller sample sizes.

Similar patterns are observed regarding recommendations given from healthcare providers for managing hypertension. While we do not observe any effects on weight management, we find precisely estimated effects of health check-up on the probability of being recommended to exercise and to follow a diet for females and individuals living in rural areas. Appendix Figure A3 shows that health check-up has a large causal effect on being recommended to exercise for females (effects=0.257, p-value=0.021) and individuals living in rural areas (effects=0.203, p-value= 0.015). The same heterogeneity is detected for diet recommendations with causal effects that are precisely estimated for females (effects=0.284, p-value=0.018) and individuals living in rural areas (effects=0.285, p-value=0.003). Again, we do not estimate any precise causal effects for recommendations related to managing diabetes (Appendix Figure A4).

Finally, we investigate whether a recent health check-up has had any heterogeneous effects on the probability of having blood pressure and blood sugar under control (self-reported). Appendix Figure A5 shows that –despite health check-ups having causal effects on hypertension treatment and recommendations for some subgroups of respondents, especially females and individuals living in rural areas–, we do not find any effects on the probability of having hypertension under control for similar subgroups. Our analysis does not reveal any heterogeneous effects on the probability of having diabetes under control either. Again, a possible explanation for this lack of evidence is the fact that information about hypertension and diabetes control is available only in CHARLS waves 2-4.[20]

[20]Due to smaller sample sizes, the first-stage results in our heterogeneous analysis for our models that consider measured hypertension and average blood pressures as outcome variables indicate weak instruments. Since IV estimation and inference under conditions of weak identification are unreliable (Andrews *et al.*, 2023), we have decided not to report these results.

Table 6: **Heterogeneous effects of health check-up on the probability of hypertension and diabetes diagnoses (FE-2SLS model)**

	Female	***Male***	***Rural***	***Urban***	***Female rural***	***Male rural***	***Female*** urban	***Male urban***
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Hypertension			
Health check-up	0.087	0.034	0.081	0.029	0.098	0.063	0.075	-0.055
	(0.071)	(0.080)	(0.062)	(0.100)	(0.088)	(0.087)	(0.117)	(0.183)
Mean outcome	0.330	0.304	0.304	0.338	0.320	0.287	0.345	0.331
Obs	31012	29843	37647	23208	19021	18626	11991	11217
F excluded instruments	84.764	64.796	118.108	37.641	59.539	57.867	27.963	11.201
AR confidence set (95%)	[-0.051, 0.231]	[-0.127, 0.189]	[-0.039, 0.206]	[-0.173, 0.231]	[-0.073,0.283]	[-0.106, 0.239]	[-0.162,0.321]	[-0.555, 0.330]
AR p-value (95%)	0.217	0.668	0.190	0.772	0.262	0.471	0.524	0.763
					Diabetes			
Health check-up	0.103*	0.056	0.080*	0.085	0.133*	0.024	0.043	0.148
	(0.059)	(0.056)	(0.045)	(0.084)	(0.071)	(0.055)	(0.099)	(0.151)
Mean outcome	0.107	0.090	0.081	0.127	0.092	0.069	0.130	0.123
Obs	31497	30378	38197	23678	19252	18945	12245	11433
F excluded instruments	85.308	69.631	123.473	38.506	61.323	61.643	27.168	12.480
AR confidence set (95%)	[-0.006, 0.221]	[-0.051,0.168]	[-0.003, 0.171]	[0.078,0.261]	[-0.000, 0.283]	[-0.082, 0.135]	[-0.158,0.252]	[-0.132,0.572]
AR p-value (95%)	0.076	0.310	0.070	0.304	0.057	0.656	0.664	0.304

Notes: Sample derived from CHARLS waves 1-5. All coefficients are derived from IV fixed effects models (FE-2SLS). The coefficients are second-stage estimates. This table presents heterogeneous analysis by sex, rural vs urban, and (rural vs urban) × sex. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80 unless otherwise specified. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

5 Discussion and conclusion

Among older adults in China, we find that a health check-up, induced by a free health check-up program for those 65 and older results in a significant increase in the probability of diabetes diagnosis (+8.3 percentage points, p-value=0.042), while we do not find any effect on hypertension diagnosis. These results are derived from a model specification that accounts for individual-specific time-invariant unobserved heterogeneity as well as the likely endogeneity of health check-up, that could stem from hypertension- or diabetes-related symptoms and health shocks, for instance. The difference in the effects for hypertension and diabetes diagnosis could potentially reflect differences in awareness and knowledge of the two diseases, as well as differences in detection mechanisms. Heterogeneous analyses reveal significant differences in the effects of health check-up across key subgroup categories: The increase in diabetes diagnoses was driven by females, particularly those in rural areas, with an effect size of 13.3 percentage points (p-value=0.063).

The downstream effects of health check-up on treatment and health recommendations were mixed. Although health check-up increased recommendations for exercise (19.3 percentage points, p-value=0.010) and diet (23.8 percentage points, p-value=0.003) for hypertension management, especially among females and individuals living in rural areas, it did not significantly affect diabetes-related recommendations or the likelihood of receiving treatment for either condition. However, we do find suggestive evidence that, following their recent health check-up, individuals living in rural areas, especially females, tend to substitute traditional Chinese medicine for modern medicine as treatment for hypertension.

Furthermore, health check-ups did not improve the probability of having hypertension or diabetes under control, suggesting that diagnostic gains may not translate into improved disease management or health outcomes. Overall, our results emphasize the role of health check-up in improving diagnosis rates, particularly for diabetes, while highlighting potential gaps in subsequent treatment and disease management.

As in Capuno *et al.* (2021) and Ma *et al.* (2023), our results highlight the fact that individuals respond to the incentive to seek medical care. We show that individuals increase their health seeking behavior (by about 10 percentage points) thanks to the free health check-up policy. Our first stage estimates align closely with the findings of Ma *et al.* (2023), who report an effect of +9.9% using variations in the rollout timing of the free check-up program across cities as an instrumental variable to identify a causal effect. Our findings thus suggest that financial constraint appears to be a barrier to medical care among older adults in China, revealing possible inequality in access to health care across socioeconomic status in this population. Moreover, Capuno *et al.* (2021) find that randomly induced check-up visits lead to an increase in health behavior-related recommendation but not in the likelihood of hypertension diagnosis or treatment. Our results align with their findings as individuals who respond to the free health check-up policy are more likely to be recommended to exercise and follow a diet for their hypertension, but are not more likely to be diagnosed or currently taking medication for their high blood pressure. We find that the increase in diabetes diagnosis for does who respond to the free health check-up policy does not translate into an increased probability of treatment and blood sugar control, which points toward similar muted effects of diabetes diagnosis reported in the literature (Alalouf *et al.*, 2023; Gaggero *et al.*, 2022; Iizuka *et al.*, 2021; Kim *et al.*, 2019; Oster, 2018; Slade, 2012).

Our study has some limitations. First, some outcomes variables were not available across all CHARLS waves, which reduces sample sizes and interpretability of our results across our different models. Second, as any IV study, our estimations only reveal local average treatment effects (LATE) for the so-called "compliers", i.e., individuals whose health-seeking behaviors are affected by the free health check-up policy. As a result, we cannot extrapolate our findings to the general population of older adults in China (Deaton, 2010; Heckman and Urzua, 2010; Imbens, 2009; Imbens and Angrist, 1994). Finally, while CHARLS makes every effort to remain nationally representative of its target population and to follow people over time, we cannot completely rule out selective study participation or attrition in our data.

To maximize the benefits of the free health check-up policy, complementary interventions are required to bridge the gap between diagnosis and effective disease management for NCDs in China. Integrating follow-up care pathways could increase the downstream effects of the new diagnosis. Targeted health education and information could also help translate health recommendations into better health outcomes. Addressing financial barriers to health care would also further promote equitable health outcomes among older adults in China.

Overall, our findings show that a recent health check-up induced by the free health check-up policy for older adults in China significantly increases the likelihood of diabetes diagnosis but has no comparable effect on hypertension diagnosis. The increase in diabetes diagnoses is particularly pronounced among females in rural areas. Although the recent health check-up also helped increase the promotion of health behavior recommendations, such as exercise and diet for hypertension management, it does not translate into higher treatment rates or improved disease control for hypertension and diabetes. These results underscore the potential of health check-up policies to improve disease detection but reveal critical gaps in subsequent disease management and treatment.

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ONLINE APPENDIX

Table A1: Sample descriptives of outcome variables by wave

	W1		***W2***		***W3***		***W4***		***W5***	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
Hypertension										
Diagnosis	0.289	9559	0.263	13077	0.277	12900	0.328	14442	0.402	16457
Treatment TCM	0.029	9557	0.031	13063	0.033	12757	0.033	14255	.	0
Treatment Modern	0.220	9557	0.197	13063	0.209	12757	0.235	14255	.	0
Any treatment	0.232	9557	0.210	13063	0.223	12757	0.249	14255	.	0
Recommended weight control	0.072	9543	0.074	13010	0.077	12749	0.105	14255	.	0
Recommended exercise	0.096	9543	0.105	13010	0.107	12749	0.137	14255	.	0
Recommended diet	0.141	9543	0.134	13010	0.129	12749	0.155	14255	.	0
Blood pressure under control	.	0	0.241	12944	0.270	12686	0.273	14059	.	0
Systolic blood pressure	130.878	7792	130.877	9889	128.043	12079	.	0	.	0
Diastolic blood pressure	75.589	7791	75.926	9887	75.072	12076	.	0	.	0
Hypertension	0.317	7793	0.328	9889	0.278	12079	.	0	.	0
Diabetes										
Diagnosis	0.072	9524	0.064	12998	0.072	12795	0.108	15423	0.154	16457
Treatment TCM	0.009	9524	0.009	12995	0.009	12722	0.011	15317	.	0
Treatment Modern	0.043	9524	0.040	12995	0.044	12722	0.057	15317	.	0
Treatment Insulin	0.010	9524	0.012	12995	0.015	12722	0.017	15317	.	0
Any treatment	0.052	9524	0.050	12995	0.054	12722	0.069	15317	.	0
Recommended weight control	0.027	9523	0.025	12994	0.026	12722	0.039	15317	.	0
Recommended exercise	0.035	9523	0.035	12994	0.035	12722	0.054	15317	.	0
Recommended diet	0.052	9523	0.045	12994	0.044	12722	0.065	15317	.	0
Blood sugar under control	.	0	0.058	12935	0.062	12694	0.071	15149	.	0

Notes: Descriptive statistics of our benchmark sample derived from CHARLS by wave. "N" corresponds to the number of observations. "TCM" stands for traditional Chineses medicine. "Retired" is a dichotomous variable that takes the value 1 if a respondent completed retirement procedure (including early retirement) or internal retirement. Systolic and diastolic blood pressure corresponds to the average of the second and third measurements. Hypertension is an indicator variable derived from those measurements, $\mathbb{1}(\text{mean SBP} \geqslant 140 \vee \text{mean DBP} \geqslant 90)$.

Table A2: The effect of health check-up on the probability of hypertension and diabetes diagnoses without fixed-effects

	Diagnosis			
	Hypertension		***Diabetes***	
	POLS	P2SLS	POLS	P2SLS
	(1)	(2)	(3)	(4)
	Second stage			
Health check-up	0.080***	0.155***	0.047***	0.068*
	(0.004)	(0.055)	(0.003)	(0.036)
Age	0.032***	0.032***	0.020***	0.020***
	(0.005)	(0.005)	(0.003)	(0.003)
Age squared	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Retired	0.029***	0.023**	0.053***	0.052***
	(0.009)	(0.010)	(0.006)	(0.007)
No health insurance	-0.030***	-0.021*	-0.011**	-0.009
	(0.009)	(0.011)	(0.005)	(0.006)
Married	-0.025***	-0.026***	0.003	0.003
	(0.009)	(0.009)	(0.005)	(0.005)
Female	0.028***	0.025***	0.019***	0.018***
	(0.006)	(0.007)	(0.004)	(0.004)
Below high school	0.011	0.009	0.004	0.004
	(0.007)	(0.007)	(0.004)	(0.004)
High school and above	0.007	-0.003	0.013*	0.010
	(0.011)	(0.013)	(0.007)	(0.009)
Mean outcome	0.317	0.317	0.099	0.099
	First stage			
IV		0.133***		0.133***
		(0.008)		(0.008)
Mean outcome		0.451		0.451
Obs	64907	64907	65674	65672
F excluded instruments		301.945		307.234
AR confidence set (95%)		[0.048, 0.262]		[-0.003,0.138]
AR p-value (95%)		0.005		0.063

Notes: Sample derived from CHARLS waves 1-5. Columns 1 and 3 present pooled OLS estimates without fixed effects. Columns 2 and 4 present IV estimates without fixed effects. "IV" is a dichotomous variable that takes the value 1 if age is at or above 65, and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. First panel present results of the second stage estimates while the second panel presents the first stage estimates. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: First stage of our FE-2SLS models

	Diagnosis	
	Hypertension	***Diabetes***
	(1)	(2)
	First stage	
IV	0.103***	0.104***
	(0.008)	(0.008)
Age	0.051	0.050
	(0.040)	(0.040)
Age squared	0.000***	0.000***
	(0.000)	(0.000)
Retired	-0.026*	-0.022
	(0.014)	(0.014)
No health insurance	-0.041***	-0.042***
	(0.009)	(0.011)
Married	0.009	0.006
	(0.014)	(0.014)
Mean outcome	0.451	0.451
Obs	60855	61875
F excluded instruments	149.516	154.985

Notes: Sample derived from CHARLS waves 1-5. This table presents IV estimates with individuals fixed-effects. "IV" is a dichotomous variable that takes the value 1 if age is at or above 65, and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: The effect of health check-up on the probability of hypertension and diabetes diagnoses: Robustness checks for sample selection and definition of outcome variables (FE-2SLS models)

	Diagnosis							
	Hypertension				***Diabetes***			
	At least 3 obs	Age 53-77	Age 55-75	Stock	At least 3 obs	Age 53-77	Age 55-75	Stock
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Health check-up	0.071	0.055	0.065	0.068	0.089**	0.089*	0.118**	0.077*
	(0.052)	(0.062)	(0.069)	(0.052)	(0.040)	(0.048)	(0.053)	(0.040)
Age	-0.023	-0.021	-0.020	-0.013	-0.004	-0.007	-0.008	-0.010
	(0.020)	(0.022)	(0.024)	(0.020)	(0.017)	(0.018)	(0.021)	(0.016)
Age squared	0.000***	0.000*	0.000	0.000**	0.000	-0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Retired	-0.014	-0.012	-0.009	-0.016*	0.013	0.008	0.009	0.008
	(0.010)	(0.010)	(0.012)	(0.009)	(0.008)	(0.008)	(0.009)	(0.007)
No health insurance	-0.009	-0.007	-0.004	-0.005	0.006	0.006	0.007	0.006
	(0.007)	(0.007)	(0.008)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)
Married	-0.003	-0.003	-0.003	-0.005	-0.006	-0.002	0.002	-0.003
	(0.010)	(0.010)	(0.011)	(0.009)	(0.008)	(0.008)	(0.009)	(0.007)
Obs	51573	50300	42830	60855	52225	51173	43578	61875
F excluded instruments	158.189	103.302	79.309	149.516	157.695	107.935	83.448	154.985
AR confidence set (95%)	[-0.030,0.171]	[-0.066,0.176	[-0.068,0.204]	[-0.032,0.169]	[0.014,0.171]	[-0.000,0.185]	[0.019,0.229]	[0.002,0.159]
AR p-value (95%)	0.171	0.375	0.342	0.186	0.025	0.059	0.022	0.054

Notes: Sample derived from CHARLS waves 1-5. All coefficients are derived from IV fixed effects models. The coefficients are second-stage estimates. Columns 1 and 5 restrict the sample to at least 3 observations per respondent. Columns 2 and 6 restrict the sample to individuals whose age is between 53 and 77. Columns 3 and 7 restrict the sample to individuals whose age is between 55 and 75. Columns 4 and 8 manually correct for misreports in hypertension or diabetes diagnoses. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80 unless otherwise specified. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: The effect of health check-up on the probability of hypertension and diabetes diagnoses: Robustness checks for age specification

	Diagnosis			
	Hypertension		***Diabetes***	
	FE	FE-2SLS	FE	FE-2SLS
	(1)	(2)	(3)	(4)
	Linear specification			
Health check-up	0.020***	0.088*	0.010***	0.083**
	(0.003)	(0.048)	(0.002)	(0.037)
F excluded instruments		180.648		184.965
AR confidence set (95%)		[-0.006,0.181]		[0.013, 0.158]
AR p-value (95%)		0.068		0.024
	Cubic specification			
Health check-up	0.019***	0.020	0.010***	0.107*
	(0.003)	(0.076)	(0.002)	(0.060)
F excluded instruments		61.474		62.342
AR confidence set (95%)		[-0.135,0.174]		[-0.004,0.232]
AR p-value (95%)		0.796		0.067
Mean outcome	0.317	0.317	0.099	0.099
Obs	64905	60855	65672	61875

Notes: Sample derived from CHARLS waves 1-5. First panel present estimates controlling for age using a linear specification. Second panel present estimates controlling for age using a cubic specification. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A6: The effect of health check-up on the probability of hypertension and diabetes diagnoses: Robustness checks for constant sample

	Diagnosis			
	Hypertension		***Diabetes***	
	FE	FE-2SLS	FE	FE-2SLS
	(1)	(2)	(3)	(4)
Health check-up	0.019***	0.064	0.010***	0.083**
	(0.003)	(0.053)	(0.002)	(0.041)
Age	-0.015	-0.017	-0.000	-0.004
	(0.020)	(0.021)	(0.016)	(0.016)
Age squared	0.000***	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Retired	-0.013	-0.012	0.005	0.007
	(0.009)	(0.009)	(0.007)	(0.007)
No health insurance	-0.010*	-0.008	0.003	0.006
	(0.006)	(0.007)	(0.004)	(0.005)
Married	-0.004	-0.005	-0.003	-0.004
	(0.009)	(0.009)	(0.007)	(0.007)
Mean outcome	0.314	0.314	0.097	0.097
Obs	60855	60855	61875	61875
F excluded instruments		149.516		154.985
AR confidence set (95%)		[-0.039,0.167]		[0.007,0.165]
AR p-value (95%)		0.229		0.040

Notes: Sample derived from CHARLS waves 1-5. Columns 1 and 3 OLS estimates with individuals fixed-effects. Columns 2 and 4 present IV estimates with individuals fixed-effects. These coefficients are derived from models that restrict the sample to be the same as the IV fixed-effects models (N=60,855 for hypertension and N=61,875 for diagnosis), for the sake of comparison. "IV" is a dichotomous variable that takes the value 1 if age is at or above 65, and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A7: The effect of health check-up on the probability of hypertension and diabetes diagnoses: Robustness checks for the year of health check-up

	Diagnosis			
	Hypertension		***Diabetes***	
	FE	FE-2SLS	FE	FE-2SLS
	(1)	(2)	(3)	(4)
Health check-up	0.019***	0.078	0.011***	0.103**
	(0.003)	(0.065)	(0.002)	(0.051)
Age	-0.016	-0.023	-0.001	-0.012
	(0.020)	(0.021)	(0.016)	(0.017)
Age squared	0.000***	0.000*	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Retired	-0.013	-0.010	0.005	0.010
	(0.009)	(0.010)	(0.007)	(0.008)
No health insurance	-0.011*	-0.009	0.003	0.006
	(0.006)	(0.007)	(0.004)	(0.005)
Married	-0.004	-0.005	-0.003	-0.004
	(0.009)	(0.009)	(0.007)	(0.007)
Mean outcome	0.317	0.317	0.099	0.099
Obs	60855	60855	61875	61875
F excluded instruments		105.871		106.263
AR confidence set (95%)		[0.048,0.210]		[0.008,0.205]
AR p-value (95%)		0.229		0.040

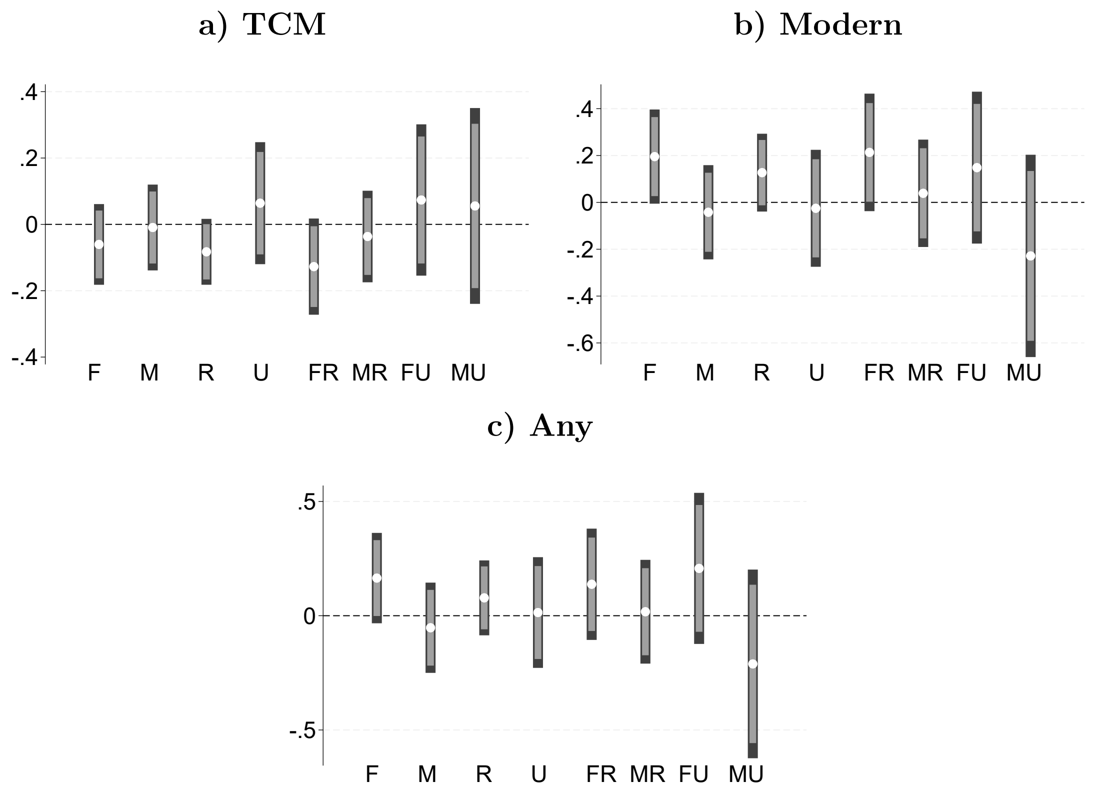
Notes: Sample derived from CHARLS waves 1-5. Columns 1 and 3 present OLS estimates with individuals fixed-effects. Columns 2 and 4 present IV estimates with individuals fixed-effects. Our benchmark estimates (reported in Table 2) use health check-up since the year prior to the year of interview as endogenous variable. Results reported in this table use health check-up in the same year as the year of interview as endogenous variable instead. "IV" is a dichotomous variable that takes the value 1 if age is at or above 65, and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A8: The effect of health check-up on the probability of hypertension and diabetes diagnoses: Robustness checks for placebo reform at ages 62 and 68 (FE-2SLS models)

	Placebo age 62		***Placebo age 68***	
	Hypertension	Diabetes	***Hypertension***	***Diabetes***
	(1)	(2)	(3)	(4)
		Second stage		
Health check-up	0.091	0.026	-0.148	-0.035
	(0.192)	(0.102)	(0.137)	(0.075)
Age	-0.018	-0.015	0.007	0.002
	(0.022)	(0.021)	(0.019)	(0.017)
Age squared	0.000	0.000**	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Retired	-0.011	-0.013	0.002	0.004
	(0.011)	(0.010)	(0.008)	(0.007)
No health insurance	-0.007	-0.010	-0.004	0.001
	(0.010)	(0.008)	(0.008)	(0.005)
Married	-0.005	-0.004	-0.002	-0.003
	(0.010)	(0.009)	(0.007)	(0.007)
Mean outcome	0.317	0.317	0.099	0.099
		First stage		
Placebo IV (62 or 68)	0.027***	0.062***	0.030***	0.061***
	(0.008)	(0.009)	(0.008)	(0.009)
Mean outcome	0.451	0.451	0.451	0.451
Obs	60855	61875	60855	61875
F excluded instruments	12.029	44.877	14.229	44.387
AR confidence set (95%)	[-0.362,0.569]	[-0.179,0.231]	[-0.523,0.107]	[-0.192,0.109]
AR p-value (95%)	0.632	0.800	0.255	0.635

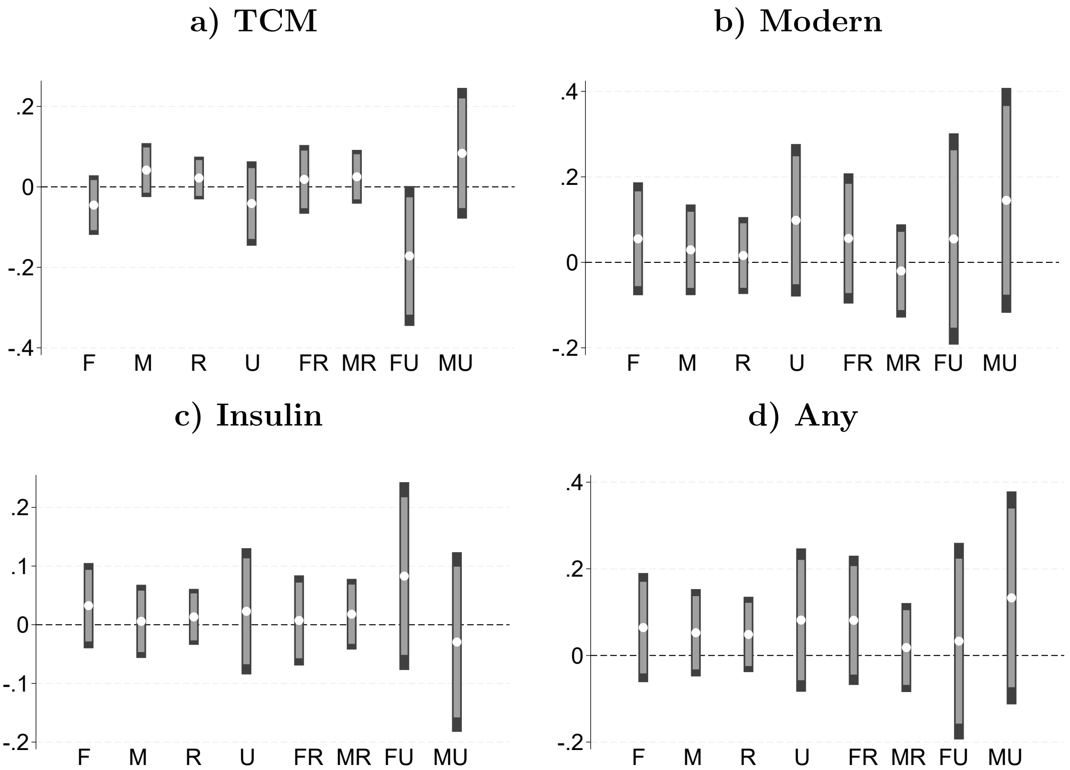
Notes: Sample derived from CHARLS waves 1-5. Placebo IV is a dichotomous variable that takes the value 1 if age is at or above 62 or 68 (separate models), and 0 otherwise. All models also control for CHARLS wave fixed-effects. Sample is restricted to individuals age between 50 and 80. First panel present results of the second-stage estimates while the second panel presents the first-stage estimates. "Mean outcome" refers to the average value of the outcome variable calculated from the sample used in the estimation. "AR" stands for Anderson-Rubin. Standard errors are clustered at the individual level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure A1: Heterogeneous effects on hypertension treatment (FE-2SLS models)



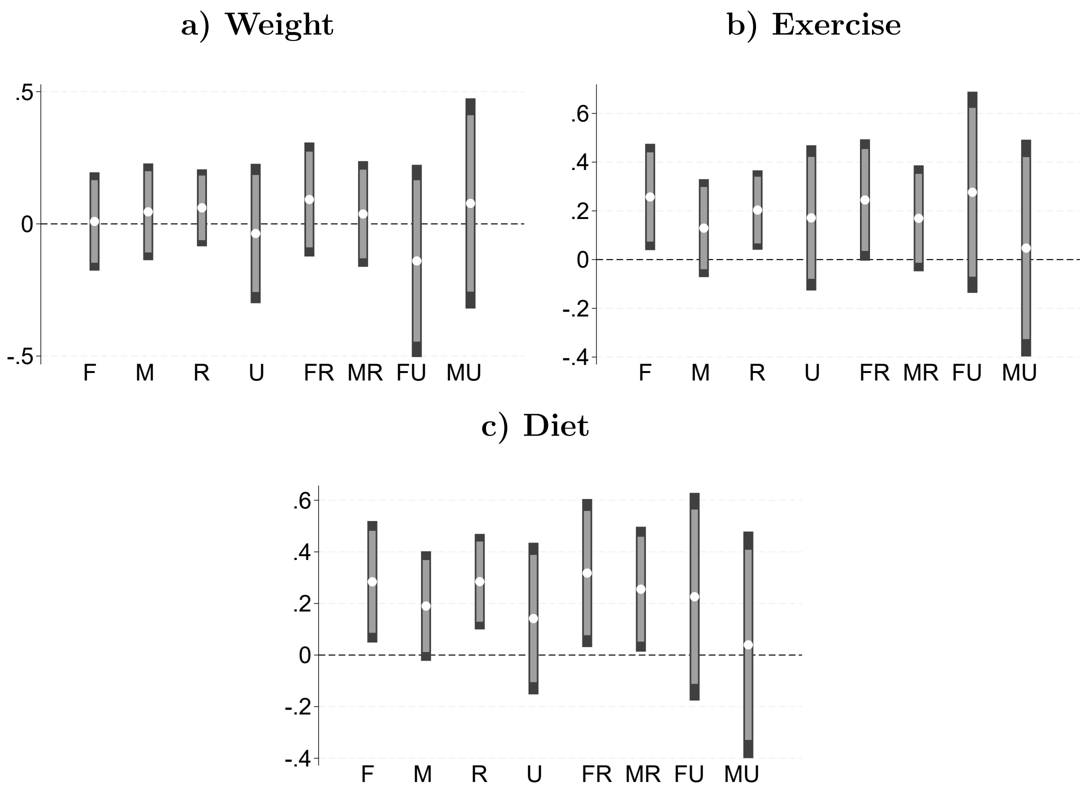
Notes: Sample derived from CHARLS waves 1-4. These plots present heterogenous effects of the policy on a) traditional Chinese medicine (CTM), b) modern medicine, and c) any of the two for hypertension treatment. Estimates are derived using FE-2SLS models. “F”= female, “M”= male, “R”= rural, “U”=urban. White dots are point estimates. Grey bars are 90%-confidence intervals. Black bars are 95%-confidence intervals. Estimates are derived using CHARLS waves 1-4.

Figure A2: Heterogeneous effects on diabetes treatment (FE-2SLS models)



Notes: Sample derived from CHARLS waves 1-4. These plots present heterogeneous effects of the policy on a) traditional Chinese traditional medicine (TCM), b) modern medicine, c) insulin, and d) any of the three for diabetes treatment. Estimates are derived using FE-2SLS models. "F"= female, "M"= male, "R"= rural, "U"= urban. White dots are point estimates. Grey bars are 90%-confidence intervals. Black bars are 95%-confidence intervals. Estimates are derived using CHARLS waves 1-4.

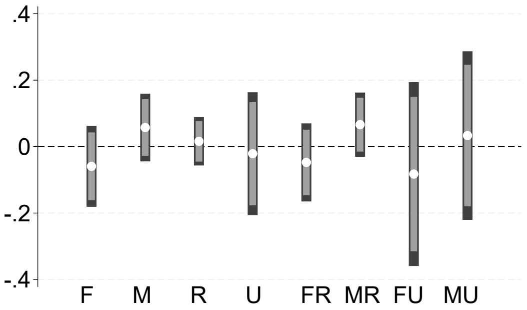
Figure A3: Heterogeneous effects on recommendations for hypertension (FE-2SLS models)



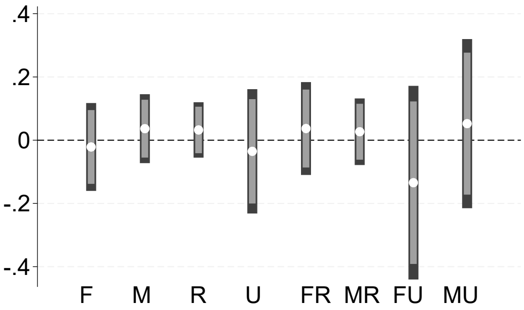
Notes: Sample derived from CHARLS waves 1-4. These plots present heterogeneous effects of the policy on having received recommendations about a) weight, b) exercise, and c) diet for hypertension treatment. Estimates are derived using FE-2SLS models. "F"= female, "M"= male, "R"= rural, "U"=urban. White dots are point estimates. Grey bars are 90%-confidence intervals. Black bars are 95%-confidence intervals. Estimates are derived using CHARLS waves 1-4.

Figure A4: Heterogeneous effects on recommendations for diabetes (FE-2SLS models)

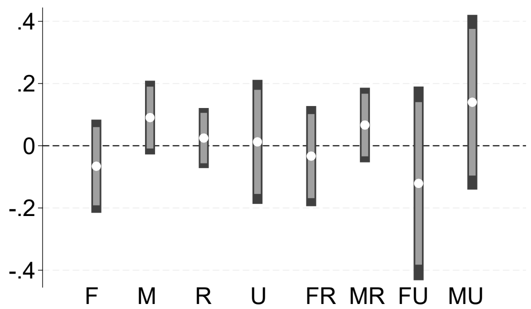
a) Weight



b) Exercise

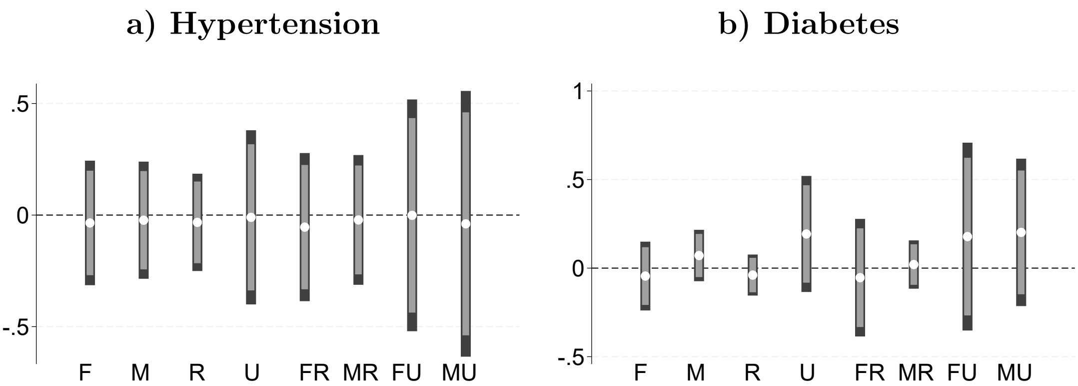


c) Diet



Notes: Sample derived from CHARLS waves 1-4. These plots present heterogeneous effects of the policy on having received recommendations about a) weight, b) exercise, and c) diet for diabetes treatment. Estimates are derived using FE-2SLS models. "F"= female, "M"= male, "R"= rural, "U"=urban. White dots are point estimates. Grey bars are 90%-confidence intervals. Black bars are 95%-confidence intervals. Estimates are derived using CHARLS waves 1-4.

Figure A5: Heterogeneous effects on the probability of having hypertension and diabetes under control (FE-2SLS models)



Notes: Sample derived from CHARLS waves 2-4. These plots present heterogeneous effects of the policy on having a) hypertension, and b) diabetes under control. Estimates are derived using FE-2SLS models. "F"= female, "M"= male, "R"= rural, "U"=urban. White dots are point estimates. Grey bars are 90%-confidence intervals. Black bars are 95%-confidence intervals. Estimates are derived using CHARLS waves 2-4.

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