KNOWING IS HALF THE BATTLE: THE EFFECT OF DIAGNOSING DIABETES ON ALCOHOL CONSUMPTION IN CHINA

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ABSTRACT

The diagnosis of a disease can significantly change the health behavior of a population, leading to a significant improvement in public health. This study observed how China's alcohol consumption changes in response to a diabetes diagnosis from a health check-up. The 1991–2015 China Health and Nutrition Survey was used in this study. A difference-in-difference with a fixed effect model was applied to the dataset. The survey's 2009 health check-up generated the treatment status, also known as the diabetes diagnosis status. The results showed that the diagnosis of diabetes decreased alcohol consumption (Beta = -0.032; 95% CI = -0.022, -0.011; P-value = 0.015). The effect was more prevalent and significant among men (Beta = -0.077; 95% CI = -0.122, -0.031; P-value = 0.001). The findings of this study showed that a health check-up to inform individuals of their diabetes status could alter alcohol consumption behavior in China. This implies that a health check-up policy in developing countries could lead to significant health improvements and reduce the costs associated with alcohol consumption.

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INTRODUCTION

Diabetes is one of the most prevalent diseases in the world. In 2014, approximately 8.5% of the population over the age of 18 had diabetes[1]. More recently, diabetes is estimated to have caused 6.7 million deaths in 2021, with a cost to the world of USD 966 million in the same year[2]. Additionally, diabetes is a chronic disease that can lead to significant disabilities in life. Studies have shown that diabetes is associated with lower employment and work productivity[3–6]. Given the prevalence and economic cost of diabetes, policymakers and public health officials have a growing interest in preventing its continual increase.

A particular problem associated with chronic diseases such as diabetes is the lack of awareness of the disease among the affected individuals. Globally, it is estimated that about 239.7 million people were unaware of their diabetes status in 2021[2]. Undiagnosed diabetes is particularly dangerous to the affected individual, given that diabetes can cause death through various body function failures, such as kidney failure. Policies, such as health check-ups, that increase awareness of an individual's diabetes status have important

implications for the world. In particular, policies that can increase awareness and lead to behavioral change in affected individuals to manage their diabetes have significant public health benefits.

To investigate how health information and check-ups could alter behavior, this study leveraged a natural experiment in China. In 2009, the China Health and Nutrition Survey (CHNS) performed a biomarker test on participants. Participants who were originally unaware of their diabetes status would become aware of it through this test. This study used this experiment to examine its effect on alcohol consumption in China.

Understanding the effect of diabetes check-ups on alcohol consumption is important because alcohol is one of the most consumed drinks in the world. Alcohol consumption is a risk factor for diabetes[7,8]. Moreover, heavy use of alcohol for diabetics could trigger ketoacidosis and hypertriglyceridemia[9], both of which can be life-threatening for diabetics. Finally, China is one of the fastest-growing economies, and its rate of alcohol consumption is one of the highest in the world[10]. Any benefit from diabetes check-ups on public health will have a significant cost-saving effect for the Chinese healthcare system.

This study examined the effect of diabetes check-ups on alcohol consumption in China using the 1991-2015 CHNS. Using the experiment that occurred in 2009 and a quasi-experimental design, this paper showed that when an individual becomes aware of their diabetes status through a check-up, they decrease their alcohol consumption in the past year. Moreover, the effect was more prevalent among men than women. The findings from this paper have important public health implications for policymakers around the globe.

MATERIALS AND METHODS

Data and Variables' Construction.

This study utilized data from the CHNS, a longitudinal survey that collected health, insurance, and demographic information from individuals of all ages in China. The survey has been conducted periodically since 1989, with data collected in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009, 2011, and 2015. In 2009, biomarkers were collected from a subset of respondents by a technician, and these samples were analyzed in a laboratory. The results were subsequently sent back to the respondents. The biomarkers collected included information on triglycerides, HbA1c, and other measures.

To construct the analytic sample, respondents who knew their diabetes status before 2009 were excluded. Additionally, respondents without any demographic information, without HbA1c measurements, or under the age of 18 were also excluded. Finally, the respondents in 1989 were excluded from the sample due to a lack of information on alcohol consumption.

For the main independent variable, this study used HbA1c information to examine the impact of diabetes diagnosis on alcohol use. HbA1c, or glycated hemoglobin, is hemoglobin with sugar attached to it. It was widely used as a measurement for blood glucose control[11,12]. An elevated level of HbA1c typically indicates abnormalities in blood sugar regulation mechanisms in the body and may indicate the presence of diabetes. The cut-off for HbA1c in diagnosing diabetes is approximately 6.5% [13]. To define diabetes

diagnosis, it is a binary variable equal to one if a respondent has HbA1c greater than or equal to 6.5%, and zero otherwise. Given that HbA1c information was only collected in 2009, the information was extrapolated across respondents and surveys using the longitudinal nature of the dataset. For the post-treatment period variable, it is a binary variable equal to one if a respondent was surveyed after 2009, and zero otherwise.

To generate the alcohol consumption, this study used a survey questionnaire regarding a respondent's usage of alcoholic drinks in the past year. The variable was defined as a binary variable equal to one if a respondent drank in the past year and zero otherwise. For socioeconomic variables, a set of binary variables was constructed for education levels, household size, and the year of the survey. Age was generated as a continuous variable that represents a respondent's age at the time of the survey. For education levels, five education variables were generated: elementary, junior high, senior high, college, and missing education information. Each education variable was defined as a binary variable that was equal to one if a respondent had the corresponding level of education and zero otherwise. The omitted category was respondents with no education. For household size, four binary variables were defined: two household members, three household members, four or more household members, and missing household information. Each household size variable was defined as a binary variable that was equal to one if a respondent had the corresponding household size, and zero otherwise. The omitted category is households with only one household member. For the survey year, nine variables were constructed: 1993, 1997, 2000, 2004, 2006, 2009, 2011, and 2015. Each survey year variable was defined as a binary variable that was equal to one if a respondent was sampled in the corresponding survey year, and zero otherwise. The omitted category is 1991.

Statistical Analysis

This study used a difference-in-difference (DID) approach combined with a fixed-effect (FE) model to estimate the effect of diabetes diagnosis on alcohol consumption. The FE model eliminates any observed or unobserved time-invariant variable that is constant over the years, reducing confounding bias. The following equation (1) was estimated to capture the causal effect:

$$\mathrm{Y_i} = \beta_0 + \beta_1 Treat_i \times Post_{it} + Year_t'\gamma + X_{it}'\alpha + \sigma_\mathrm{i} + \eta_\mathrm{it}, (1)$$

where $Treat_i$ is whatever the respondents were diagnosed with diabetes in 2009 from the check-up or not, and $Post_{it}$ is the treatment year variable. $Year_t'$ is a vector of binary variables for survey years, X_{it}' is a vector of socioeconomic variables, σ_i is the time-invariant variable, and η_it is the error term. β_1 is the main parameter of interest in capturing the causal effect of diabetes diagnosis on alcohol consumption. The analyses were further stratified by gender, and standard errors were clustered at the individual level. The beta estimates, 95% confidence intervals (CI), and p-values were reported from the regression model. All analyses were performed on STATA17 MP, and the significance level was set at 5% level.

RESULTS

Descriptive statistics showed in Table 1 presents the descriptive statistics

for the variables used in this study. The table shows that 33.0% of the respondents reported consuming alcohol in the past year. Regarding the "treat" variable, 7.7% of the respondents knew their diabetes status from their 2009 check-up. The average age of the entire sample was 48.488. In terms of education levels, 6.3% of the respondents had elementary education, 28.3% had junior high education, 13.4% had senior high education, 3.8% had college education, and 1.8% had missing education information. Regarding household size, 18.7% of the households had 2 members, 23.9% had 3 members, 54.0% had 4 or more members, and 1.1% had missing information on household size. The total number of observations in the sample is 49,020.

Main results showed in Table 2 displays the results of the analysis, indicating the estimated effect of a diabetes diagnosis on alcohol consumption. The table shows the beta coefficients, 95% CI, and p-values. The findings suggest that the diabetes diagnosis had a significant negative effect on the likelihood of drinking in the past year (Beta = -0.032; 95% CI = -0.022, -0.011; P-value = 0.015). Specifically, the diabetes diagnosis decreased the probability of drinking by 3.2 percentage points. These results suggest that diabetes diagnosis has a beneficial impact on drinking behavior among Chinese individuals.

Tables 3 and 4 present estimates of the effect of a diabetes diagnosis on alcohol use stratified by gender. Table 3 shows the estimates for men, while Table 4 reports the estimates for women. The results indicate that diabetes diagnosis significantly reduced the likelihood of engaging in drinking for men (Beta = -0.077; 95% CI = -0.122, -0.031; P-value = 0.001). In contrast, the estimates suggest that diabetes diagnosis did not have a significant effect on the likelihood of engaging in drinking for women (Beta = 0.008; 95% CI = -0.017, 0.034; P-value = 0.514). Specifically, the diabetes diagnosis decreased the probability of drinking among men by 7.7 percentage points. These findings suggested that the effect of a diabetes diagnosis on alcohol use was stronger among men compared to women.

Table 1. Descriptive Statistics

	OBS	MEAN	SD	MIN	MAX
Drink in the Past Year	49020	0.330	0.470	0	1
Treat	49020	0.077	0.266	0	1
Age	49020	48.488	14.463	18	100
Elementary	49020	0.063	0.242	0	1
Junior High	49020	0.283	0.451	0	1
Senior High	49020	0.134	0.341	0	1
College	49020	0.038	0.192	0	1
Education: Missing	49020	0.018	0.133	0	1
2 Household Members	49020	0.187	0.390	0	1
3 Household Members	49020	0.239	0.426	0	1
4 or More Household Members	49020	0.540	0.498	0	1
Household Size: Missing	49020	0.011	0.104	0	1
1993	49020	0.068	0.252	0	1
1997	49020	0.094	0.292	0	1
2000	49020	0.098	0.298	0	1
2004	49020	0.117	0.322	0	1
2006	49020	0.129	0.335	0	1
2009	49020	0.174	0.379	0	1
2011	49020	0.141	0.348	0	1
2015	49020	0.111	0.314	0	1

Note: OBS represents the observation size. SD represents the standard deviations. MIN represents the minimum, and MAX the maximum.

Table 2. The effect of diabetes diagnosis on alcohol consumption

Dependent Variable:	Drink in the Past Year		
	Beta	95% CI	P-Values
Treat×Post	-0.032	(-0.057,-0.006)	0.015
1993	-0.010	(-0.047,0.026)	0.586
1997	0.024	(-0.077,0.124)	0.644
2000	0.032	(-0.117,0.181)	0.670
2004	0.037	(-0.177,0.251)	0.736
2006	0.044	(-0.202,0.290)	0.726
2009	0.074	(-0.221,0.369)	0.623
2011	0.079	(-0.249,0.407)	0.636
2015	0.050	(-0.345,0.446)	0.803
Age	-0.006	(-0.022,0.011)	0.481
Elementary	0.010	(-0.011,0.031)	0.354
Junior High	0.013	(-0.004,0.030)	0.123
Senior High	0.019	(-0.004,0.043)	0.109
College	0.031	(-0.012,0.073)	0.156
Education: Missing	0.032	(0.004,0.060)	0.027
2 Household Members	0.015	(-0.014,0.044)	0.323
3 Household Members	0.041	(0.012,0.071)	0.006
4 or More Household Members	0.041	(0.011,0.070)	0.007
Household Size: Missing	-0.022	(-0.065,0.020)	0.303
Constant	0.530	(-0.043,1.104)	0.070
OBS		49020	

Note: 95% CI represents the 95% confidence interval.

Table 3. The effect of diabetes diagnosis on alcohol consumption for men

Dependent Variable:	Drink in the Past Year		
	Beta	95% CI	P-Values
Treat×Post	-0.077	(-0.122,-0.031)	0.001
1993	0.002	(-0.065,0.069)	0.952
1997	0.071	(-0.115,0.257)	0.455
2000	0.077	(-0.200,0.353)	0.588
2004	0.103	(-0.295,0.501)	0.612
2006	0.113	(-0.345,0.571)	0.628
2009	0.167	(-0.382,0.716)	0.552
2011	0.164	(-0.445,0.773)	0.597
2015	0.143	(-0.591,0.877)	0.703
Age	-0.010	(-0.041,0.020)	0.507
Elementary	0.029	(-0.007,0.064)	0.116
Junior High	0.024	(-0.005,0.053)	0.102
Senior High	0.028	(-0.011,0.067)	0.158
College	0.029	(-0.032,0.091)	0.351
Education: Missing	0.054	(-0.002,0.109)	0.057
2 Household Members	0.067	(0.006,0.129)	0.031
3 Household Members	0.111	(0.049,0.173)	0.000
4 or More Household Members	0.112	(0.050,0.174)	0.000
Household Size: Missing	-0.003	(-0.095,0.088)	0.945
Constant	0.879	(-0.183,1.941)	0.105
OBS		22790	

Note: 95% CI represents the 95% confidence interval.

Table 4. The effect of diabetes diagnosis on alcohol consumption for women

Dependent Variable:	Drink in the Past Year		
	Beta	95% CI	P-Values
Treat×Post	0.008	(-0.017,0.034)	0.514
1993	-0.022	(-0.058,0.013)	0.211
1997	-0.025	(-0.119,0.069)	0.604
2000	-0.014	(-0.153,0.125)	0.841
2004	-0.032	(-0.231,0.166)	0.750
2006	-0.030	(-0.258,0.198)	0.796
2009	-0.023	(-0.297,0.252)	0.872
2011	-0.013	(-0.318,0.291)	0.933
2015	-0.053	(-0.420,0.315)	0.779
Age	-0.010	(-0.031,0.012)	0.383
Elementary	0.004	(-0.012,0.020)	0.637
Junior High	0.017	(-0.009,0.043)	0.189
Senior High	0.049	(-0.004,0.102)	0.071
College	0.017	(-0.011,0.046)	0.231
Education: Missing	-0.004	(-0.034,0.026)	0.796
2 Household Members	0.006	(-0.024,0.037)	0.683
3 Household Members	0.006	(-0.025,0.036)	0.717
4+ Household Members	-0.019	(-0.057,0.018)	0.319
Household Size: Missing	0.166	(-0.369,0.702)	0.542
Constant	0.879	(-0.183,1.941)	0.105
OBS		26230	

Note: 95% CI represents the 95% confidence interval.

DISCUSSION

Recently, the International Diabetes Federation predicted that the number of people with diabetes worldwide would reach 643 million by 2030 and 783 million by 2045[14]. Of particular concern is the growing number of diabetics in South and East Asia, where it is predicted that the number of diabetic adults will reach 113 million by 2030 and 151 million by 2045[14]. Policymakers need to be aware of this increase to help deal with the growing burden of diabetes on society.

This study investigated the effect of a diabetes diagnosis on alcohol consumption using data from the 1991-2015 China Health and Nutrition Survey. Using a difference-in-differences approach with fixed effects, the results showed that a diabetes diagnosis reduced alcohol use among those exposed to the treatment, with the effect being most prevalent among men. These findings suggested that providing diabetes diagnosis to the population can improve population health.

This study contributes to the literature that examines the effect of health screening on behaviors[15–20]. Existing studies have found conflicting evidence on the behavioral impact of health check-ups. For example, Iizuka et al. (2022) used mandatory health check-ups in Japan to investigate their effect on behavioral outcomes and found that those with elevated blood sugar levels were more likely to seek medical care related to diabetes, but no effect was found for alcohol use. Zhao et al. (2011) examined the effect of check-ups on dietary outcomes and found that high blood pressure decreased the consumption of fatty foods. Similarly, Oikawa et al. (2022) examined the effect of mandatory health check-ups among employed individuals in Japan on health behaviors and found that those exposed to check-ups had better health behaviors, such as less drinking and more exercise. Oster (2019) investigated the

effect of a diabetes diagnosis on food purchases and found that it reduced calorie consumption and the purchase of unhealthy foods. In contrast, Kim et al. (2019) examined the effect of health check-ups in Korea on health behaviors and found that they did not affect them. Jones et al. (2019) investigated the effect of workplace health check-ups on health behavior and generally did not find any effect on health behavior, such as physical exercise. This study contributed to the literature by providing evidence of the effect of a diabetes diagnosis on alcohol consumption in China.

This study had important policy recommendations. It highlighted the importance of informing individuals of their diabetes status, as this information can lead to changes in behavior, particularly with respect to alcohol consumption. This suggested that health check-ups could be an effective health promotion policy in China. Moreover, the findings showed that the effect of health check-ups is significant in a developing country, implying that their implementation could be an effective policy for promoting moderate alcohol consumption in other developing and Asian countries. Finally, the policy could reduce the drinking culture among men in China, as they are the most affected by it.

However, this study was not without limitations. First, the experiment only provided other information to the participants during the check-up. This means that other health information may have influenced the behavior of diagnosed individuals, apart from their diabetes status. Unfortunately, it was impossible to alter the nature of the check-up. Future research using more targeted and specific health check-ups could provide more robust findings. Second, the study did not specify the types of drinks consumed by the participants. Therefore, this study assumed that the effect of a diabetes diagnosis on alcohol consumption was the same for all types of drinks.

CONCLUSION

A diabetes check-up can have a positive effect on reducing alcohol consumption among those who are diagnosed with diabetes in China. This finding highlights the importance of health check-ups and informing individuals of their health status for promoting healthy lifestyles. Policymakers in developing countries can use these results to implement effective health promotion policies, especially in the context of alcohol consumption. However, it is important to note the limitations of this study, and further research should be conducted to confirm these findings and address the identified limitations.

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CONFLICT OF INTEREST

The author declares that he has no conflict of interest

ETHICS CONSIDERATION

No ethnic approval was obtained or needed due to no human subjects were directly involved in this study.

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AUTHOR CONTRIBUTION

The author contributes to this study by collecting data, analyzing data, and drafting the manuscript. The author has approved of the study.

REFERENCES

1. World Health Organization. Diabetes, https://www.who.int/news-room/fact-sheets/detail/diabetes (accessed 12 March 2023).
2. Ogurtsova K, Guariguata L, Barengo NC, et al. IDF diabetes Atlas: Global estimates of undiagnosed diabetes in adults for 2021. *Diabetes Research and Clinical Practice* 2022; 183: 109118.
3. Pedron S, Emmert-Fees K, Laxy M, et al. The impact of diabetes on labour market participation: a systematic review of results and methods. *BMC Public Health* 2019; 19: 25.
4. Rodríguez-Sánchez B, Cantarero-Prieto D. Performance of people with diabetes in the labor market: An empirical approach controlling for complications. *Economics & Human Biology* 2017; 27: 102–113.
5. Schofield D, Cunich M, Kelly S, et al. The Impact of Diabetes on the Labour Force Participation, Savings and Retirement Income of Workers Aged 45-64 Years in Australia. *PLOS ONE* 2015; 10: e0116860.
6. Tunceli K, Bradley CJ, Nerenz D, et al. The Impact of Diabetes on Employment and Work Productivity. *Diabetes Care* 2005; 28: 2662–2667.
7. Holst C, Becker U, Jørgensen ME, et al. Alcohol drinking patterns and risk of diabetes: a cohort study of 70,551 men and women from the general Danish population. *Diabetologia* 2017; 60: 1941–1950.
8. Lee D-Y, Yoo M-G, Kim H-J, et al. Association between alcohol consumption pattern and the incidence risk of type 2 diabetes in Korean men: A 12-years follow-up study. *Sci Rep* 2017; 7: 7322.
9. Emanuele NV, Swade TF, Emanuele MA. Consequences of Alcohol Use in Diabetics. *Alcohol Health Res World* 1998; 22: 211–219.
10. Zhao Z, Wang L, Zhang M, et al. Geographic Distribution of Alcohol Use Among Chinese Adults — China, 2015. *CCDCW* 2020; 2: 98–103.
11. Alqahtani N, Khan WAG, Alhumaidi MH, et al. Use of Glycated Hemoglobin in the Diagnosis of Diabetes Mellitus and Pre-diabetes and Role of Fasting Plasma Glucose, Oral Glucose Tolerance Test. *Int J Prev Med* 2013; 4: 1025–1029.
12. Goldenberg R, Punthakee Z. Definition, Classification and Diagnosis of Diabetes, Prediabetes and Metabolic Syndrome. *Canadian Journal of Diabetes* 2013; 37: S8–S11.
13. Wang B, Liu M-C, Li X-Y, et al. Cutoff Point of HbA1c for Diagnosis of Diabetes Mellitus in Chinese Individuals. *PLOS ONE* 2016; 11: e0166597.
14. Home, Resources, diabetes L with, et al. IDF Diabetes Atlas | Tenth Edition, https://diabetesatlas.org/ (accessed 12 March 2023).

15. Iizuka T, Nishiyama K, Chen B, et al. False alarm? Estimating the marginal value of health signals. *Journal of Public Economics* 2021; 195: 104368.
16. Jones D, Molitor D, Reif J. What do Workplace Wellness Programs do? Evidence from the Illinois Workplace Wellness Study*. *The Quarterly Journal of Economics* 2019; 134: 1747–1791.
17. Kim HB, Lee SA, Lim W. Knowing is not half the battle: Impacts of information from the National Health Screening Program in Korea. *Journal of Health Economics* 2019; 65: 1–14.
18. Oikawa M. The role of education in health policy reform outcomes: evidence from Japan. *Eur J Health Econ*. Epub ahead of print 8 February 2023. DOI: 10.1007/s10198-023-01568-9.
19. Oster E. Diabetes and Diet: Purchasing Behavior Change in Response to Health Information. *American Economic Journal: Applied Economics* 2018; 10: 308–348.
20. Zhao M, Konishi Y, Glewwe P. Does information on health status lead to a healthier lifestyle? Evidence from China on the effect of hypertension diagnosis on food consumption. *Journal of Health Economics* 2013; 32: 367–385.