

The Effect of Home Care on Chest Pain, Body Pain and Fall: An Empirical Study from CHARLS Data Using Propensity Score Matching

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Abstract—In this paper, we aim to investigate the causal effects of home care on the elder people's physical health outcomes which mainly deals with body pain, chest pain and fall. We address the selection bias by using propensity score matching in the estimation process. We find that the elder people who were accompanied with home care in their daily life are less likely to have fall incidence. For the chest pain, we find that home care can help the elder people to reduce the probability of feeling chest pain. However, home care has no significant effects on body pain. Our results indicate that we should provide more home care to the elder people's body pain to prevent the depreciation of their health capital.

Keywords—home care, physical health outcomes, propensity score matching

I. INTRODUCTION

Home care, mainly providing care for the children, disabled people, or ageing people, has been widely studied. Home care is the care that people take time to look after a relative or friend who needs care because of age, physical or learning disability or illness, including mental illness[1]. Most of prior studies focused on health outcomes of caregivers when they provide home care to others. The importance of home care in the total care has been recognized since the society confront with the challenge of successful ageing. However, the research about health outcomes of care receiver that produced by home care are less studied. Although existing literature show that the effects of home care on health outcome are positive, there is literature suggest to raise the quality of home care [2]. Taking care of the elder people, the caregiver may have to withdraw from the labor market, work less or make the retirement decision, and the elder people use more home care and less formal care resources, caregiver's health is affected negatively. In these circumstances that the caregivers are negatively affected by providing home care. However, does the home care provided by caregivers can still help the elder people improve their health or keep in good health? In this empirical research aspects, it has not get much attention in the empirical literature and the literature are rare.

Understanding the effect of home care on the health outcome are of great importance for both the policy makers and caregivers. For policy makers, since elder people are more vulnerable because of the body composition variation induced by ageing, our results could help them better understand the real mechanism of health impact about the home care on the elder

people's health outcome and provide appropriate home care policy, labor stimulation policy and support services to reach successful ageing. For caregivers, the results could help them understand which health aspects they should invest more to improve in order to optimize their home care outcomes and have less negative effect on their own health. Identifying the effect of home care on the elder people's health in China is of great significance since the ageing population size is giant and has been increasing and the ageing rates in China is accelerating[3]. According to the 2015 census, the elder people aged 60 years exceed 17 million and nearly 3 million older people are in unhealthy status or cannot care themselves in life. However, compared with the ageing environment in developed countries, China's ageing are coming before China is becoming a developed countries which would produce high economical pressure on successful ageing. And at the same time, the elder's care support environment are changed because of the one child policy implemented in 1970s and the rapid undergoing urbanization accompanied by the youngest population moving from rural countries[4]. One child policy means that two couples of parents would be cared by one couple of husband wife which is deeply different with previous caring status that one couple of parents were cared by many couples. This may lead to high care pressure and press high pressure on caring time. Also in this year, 2016, China implements the postponed retirement policy implements which would also reduce the caring time. More working time for caregivers may also lead to worse health status and less input caring time on home care. Our aim in this paper is to estimate the effect of home care on pain and fall clearly, a specific and universal health concern for elder people. To reduce the selection bias, we use the propensity score model to estimate the causal effect.

II. DATA AND METHOD

In this paper, our data comes from China Health and Retirement Longitudinal Study (CHARLS), 2011-2012 national baseline data[5]. In this paper given our research aim we drop the data where the respondents' age is < 60 years old. Also considering our method in this paper, we don't use CHARLS 2013 data since we cannot confirm the older people who do not get any care in the 2013 questionnaire.

We mainly examine four health outcomes: body pain, chest pain and fall. We only focus our research sample on the elder people who are cared by children (1 = Treated group) and who

don't get any help (0 = Control group). Body pain variable is measured as the following question: are you often troubled with body pains? Respondent's answers are coded as 0 = "No", 1 = "Yes". We measure chest pain variable according to this question: do you ever feel chest pains when climbing stairs/uphill or walking quickly and code the answer 0 = "No", 1 = "Yes". Fall variable is measured by this question: Have you fallen down in the last two years? Both chest pain and fall variable is coded as the same as body pain variable.

Covariates in our empirical study mainly includes: age, hukou, gender, marital status, sleeping time at night, sleeping time for nap at noon, household annual total income, basic insurance, supplemental commercial insurance, smoke, drink, housing characteristics, issues of everyday activities, issues of various activities and social activities. The coding rule for social activities is as follows: the respondent was asked "Have you done any of these activities in the last month" while the social activities variable would be coded "1" when the respondent answer range are 1 to 11, and "0" for answer option 12 namely "None of these". Household annual total income are the sum of six income section which contain wage income, individual transferred income, individual operating income, governmental transferred income and capital income. Housing characteristics are mainly described from these aspects: the type structure of the building, housing age range, building layers and construction area of the building. Hukou is a variable indicates the respondents living in rural area or urban area. For marital status we only concern two types: married or unmarried. If the respondent's answer for marital status is widowed or the spouse have died, we consider this situation as married and if the respondent's answer is cohabited but not married we still consider it as married. Issues of everyday activities are calculated the sum of the difficulties items because of a physical, emotional or memory problem. Specially, we consider these issues when respondents have difficulties: dressing, bathing or showering, eating, getting into or out of bed, using the toilet, controlling urination and defecation, doing household chores, preparing hot meals, shopping for groceries, managing money, taking medications. The coding rules for each issue are: 0 = "No, I don't have any difficulty" and 1 = "I have difficulty but can still do it" or "Yes, I have difficulty and need help" or "I cannot do it". Issues of various activities are mainly measured based on whether the respondent have difficulty with running or jogging about 1 km, walking 1 km, walking 100 meters, getting up from a chair after sitting for a long period, climbing several flights of stairs without resting, stooping, kneeling or crouching, reaching or extending arms above shoulder level, lifting or carrying weights over 5 kilograms, like a heavy bag of groceries, picking up a small coin from a table. There are 9 items in total for measuring issues of various activities. The coding rules are the same as issues of everyday activities. Basic insurance mainly indicate the type of the insurance that the respondent is covered. There are various health insurance in China while different types insurance means different health benefits. In CHARLS we mainly observe the listed health insurance: urban employee medical insurance (UEMI), urban resident medical insurance (URMI), new cooperative medical insurance (NCMI), urban and rural resident medical insurance (URRMI), government medical insurance (GMI), medical aid (MA), private medical insurance purchased by respondent's union, private medical

insurance purchased by individual, other medical insurance (OMI). For our research, we combine the two type of private medical insurance as one insurance group called private medical insurance (PMI). Medical aid is rather rare, so we attribute it to other medical insurance group (OMI).

We aim to estimate the causal effect of home care on health outcome. However, there may exist the endogenous problem between home care and the health outcome. For instance, the older people with worse health are more likely to receive home care. To pure the potential selection bias, we employ propensity score matching. In detail, each elder individual in the cared group will have one or more similar individual in the non-cared group. Subsequently we can obtain the average treatment effects on the treated (ATT) under certain assumptions [6] as the follows:

$$E(Y_{i1}|D_i = 1, \hat{P}(X_i)) - E(Y_{i0}|D_i = 0, \hat{P}(X_i)) \quad (1)$$

where Y_i is the health outcome of the i^{th} individual, $D_i = 1$ denotes that the individual is in the cared group and $D_i = 0$ denotes the individual in the non-cared group, X_i is the observable characteristics and $\hat{P}(X_i)$ is the selected individual's propensity score.

All of analytical research work in this paper are performed through the R language programme[7]. Missing data is a critical issue in survey data and deleting the missing data blindly can lose much information and lead to biased inference results. To avoid missing important research information and reduce the possible biased result, in our paper we do not delete the missing data directly or blindly. Instead, for the non-critical missing data, we adapt the general multiple imputation method[8].

The R package we used for multiple imputation is Amelia[9] while for propensity score matching, we use the R package called "MatchIt"[10]. Different with other matching software, we run the propensity score calculation through logit and matching process together at the first step. The matching methods we used in this paper including nearest neighbor matching and full matching.

III. RESULTS

Table I shows the descriptive analysis of the health outcome in body pain, chest pain and fall. Individuals without home care are more likely to have worth health outcomes. More than 2/3 elder people would feel chest pain and more than half of the individuals feel body pain. Nearly 1/3 elder people have experienced fall accidents.

We document the estimated effects of home care on body pain, chest pain and fall in Table II. Regarding body pain, the older individual who received home care from their children displays a lower probability to feel body pain than the comparable non-cared older individuals while the care effects are not statistical significant for both "Full Matching" and "Nearest Neighbor Matching". For chest pain, the cared older individuals receive the lowest probability of feeling chest pain when climbing at the significance level of 0.01 for both "Full Matching" and "Nearest Neighbor Matching". The caring effect are a little higher in absolute value when we use "Full Matching" than "Nearest Neighbor Matching". Finally, the

cared older individuals receive less probability of experiencing fall incidence than the non-cared older individuals. The caring effects receive a significance level of 0.1 for "Full Matching" and 0.05 for "Nearest Neighbor Matching" which is much similar to left-chest pain. And the caring effects are larger in "Nearest Neighbor Matching" in absolute value than in "Full

Matching". Overall our caring results for left-chest pain, chest pain and fall are very robust both quantitatively and qualitatively. However, we cannot get the causal effects of home care on body pain both in "Full Matching" and "Nearest Neighbor Matching" in any significance level.

TABLE I. MEANS OF CHARACTERISTICS FOR CARED AND NON-CARED INDIVIDUALS

	Means (%)						
	Cared		Non-cared		Cared		Non-cared
Age (70, 80]	40.3	34.7	38.9	35.6	40.9	35.1	
Age > 80	22.2	5.0	31.2	6.4	25.1	5.8	
Married	43.3	64.8	37.7	63.5	41.5	64.0	
Non-agricultural	13.4	13.6	15.9	13.3	14.9	13.8	
Female	69.9	64.3	69.3	65.2	69.8	64.4	
Middle school	5.1	3.5	4.6	3.9	4.9	4.0	
High school and above	1.5	1.5	1.5	2.6	1.5	2.2	
UEMI	3.9	3.5	6.0	3.4	4.9	3.6	
URMI	2.4	5.0	2.9	5.6	2.6	5.8	
NCMI	80.2	77.9	76.5	78.5	78.1	78.2	
OMI	2.9	1.0	2.9	0.9	3.4	0.9	
SCMI (Purchased)	7.8	5.0	7.0	4.7	7.0	4.9	
Social activities (Participate)	35.5	39.2	34.9	39.9	34.7	39.1	
Ex-smoke (Yes)	30.3	37.7	31.7	36.9	30.6	37.8	
Drink (Yes)	9.5	17.6	9.8	18.0	9.6	18.2	
Sleeping time at night							
(4, 6] hours	26.2	32.2	25.0	32.6	25.3	32.0	
(6, 8] hours	26.9	30.2	25.2	30.0	26.0	29.8	
≥ 8 hours	13.0	9.5	16.6	9.9	14.0	9.8	
Sleeping time for a nap							
(20, 60] minutes	26.9	29.1	30.3	28.8	28.3	27.6	
> 60 minutes	13.0	12.1	18.2	12.4	14.3	11.6	
Housing layer							
2 levels	31.1	22.1	31.7	21.5	32.3	20.9	
Housing area							
(60, 90] m ²	18.8	22.6	19.0	21.9	18.1	21.8	
(90, 120] m ²	25.9	21.1	24.7	21.0	24.5	21.3	
> 120 m ²	29.1	21.6	27.9	20.6	29.8	20.9	
Housing structure							
Bricks and wood	43.3	53.3	43.2	55.8	43.2	55.6	
Mixed structure	10.8	7.0	9.9	6.0	10.6	6.2	
Wood, bamboo, grass	5.9	3.0	6.2	3.0	6.2	3.1	
Cave dwelling	0.7	1.0	1.4	0.9	0.6	0.9	
Adobe	12.5	17.1	12.8	16.3	13.4	16.4	
Other	1.7	1.5	1.2	1.3	1.5	1.3	
Housing age range							
5-10 years	10.5	8.5	11.0	8.2	10.9	8.4	
10-20 years	29.1	18.6	28.1	18.0	29.1	17.8	
20-30 years	20.8	33.2	21.4	32.2	20.4	32.0	
30-40 years	9.5	12.6	9.9	13.7	9.8	13.8	
> 40 years	13.2	15.1	13.5	16.3	12.8	16.0	
Issues of everyday activities	4.38 ± 2.95	2.78 ± 2.13	5.03 ± 3.22	2.89 ± 2.22	4.70 ± 3.09	2.87 ± 2.21	
Issues of various activities	4.83 ± 2.24	3.98 ± 2.14	5.19 ± 2.27	5.82 ± 2.29	5.06 ± 2.23	4.08 ± 2.12	
Household annual income							
(2000, 7000] RMB	21.3	28.6	19.9	27.5	21.3	28.0	
(7000, 20000] RMB	21.3	23.1	22.6	22.7	22.1	22.7	
> 20 000 RMB	36.2	22.1	36.8	21.5	36.0	21.3	
Chest pain	69.4	84.4					
Body pain			52.2	55.8			
Fall					27.0	32.0	
Observations	409	199	584	233	470	225	

^a Note: the baseline categories are 'Age: Age ≤ 70', 'Marital status: Unmarried', 'Hukou: Agricultural', 'Gender: Male', 'Education: primary school and below', 'Basic insurance: no insurance', 'Supplemental commercial medical insurance: Don't purchased', 'Social activities: Don't participate', 'Ex-smoke: No', 'Drink: No', 'Sleeping time at night: ≤ 4 hours', 'Sleeping time for a nap at noon: ≤ 20 minutes', 'Housing layer: 1 level', 'Housing area: ≤ 60 m²', 'Housing structure: Concrete and steel', 'Housing age range: 0-5 years', 'Household annual income: ≤ 2000 RMB'. UEMI: urban employee medical insurance; URMI: urban resident medical insurance; NCMI: new cooperative medical insurance; OMI: other medical insurance. SCMI: Supplemental commercial medical insurance.

TABLE II. CAUSAL EFFECTS OF HOME CARE ON BODY PAIN, CHEST PAIN AND FALL

	Matched sample ^a		Means ^a (%)		ATT ^a	Matched sample ^b		Means ^b (%)		ATT ^b
	Cared	Non-cared	Cared	Non-cared		Cared	Non-cared	Cared	Non-cared	
Body pain ^c	584	233	52.2	55.8	-0.255 (0.190)	315	177	49.8	55.4	-0.201 (0.219)
Chest pain ^d	409	199	69.4	84.4	-0.898*** (0.262)	218	141	72.0	84.4	-0.873*** (0.316)
Fall ^e	470	225	27.0	32.0	-0.381* (0.211)	470	175	27.0	35.4	-0.484** (0.217)

^bNote: *, ** and *** denote significance at the 10, 5 and 1% level, respectively. Standard errors are reported in parentheses. The score calculation method is default: "logit".

^caThe propensity score matching method is "Full Matching". All matching parameters are default. bThe propensity score matching method is "Nearest Neighbor Matching".

^deThe "Nearest Neighbor Matching" method parameter is: replace = TRUE, ratio = 3, capliper = 0.01. dThe "Nearest Neighbor Matching" method parameter is: replace = TRUE, ratio = 2, capliper = 0.01. eThe "Nearest Neighbor Matching" method parameter is: replace = TRUE, ratio = 2, capliper = 0.25

IV. DISCUSSION

We use the propensity score matching approach to empirically estimate the effect of home care provided by the elder people's children on the elder people's health consequences in three aspects: body pain, chest pain and fall, taking the observable covariate into account. To the best of our knowledge, our study is the first study to empirically estimate the effects of home care on the care receivers' health. We mainly obtain two major conclusions through the econometric analysis. First, home care provided by the elder people's children can reduce the probability for the elder people feel body pain, chest pain and the probability of experiencing fall incidence. Moreover, the effects are differently since we can only get the causal effects for chest pain and fall while we cannot obtain the causal effects for body pain. Our results are robust in these four health aspects.

From a policy perspective, the one child policy and postponed retirement policy may lead to less caring time which could result in insufficient health capital production that cannot offset the depreciation of the health capital. So obtaining the balance between the postponed retirement time and the health capital's depreciation and production is of great significance. Moreover, we should also not forget the older people who cannot get the home care if we want to ageing healthily since they experienced worse health than the cared older people. Although the relationship between formal care and home care are mixing, how to provide enough formal care to those older people who have no access to home care is critical to help them improve their health or stay in good health status.

Overall our results are clearly in one direction: home care provided by the elder people's children can improve the elder people's health in four aspects: feeling body pain, chest pain and the fall incidence but for body pain, we cannot obtain the causal effects. However, we should take this into heart that the effects we report here are average treatment effects. Depending on one's diverse preferences, home care is likely to have quite different effects on health consequence. Also here we neglect other's home care like siblings, spouse, or other unrelated people. Their home care is also an important input. And if we take them together, we may get more significant causal effects even for the body pain here or fully opposite effects.

V. CONCLUSIONS

We estimated the effect of home care on fall, body pain and chest pain by using propensity score matching. We find that

home care can help elderly people to have less fall injuries. Also, the probability of feeling chest pain can be reduced. However, home care has no significant effect on body pain.

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