Availability and social determinants of community health management service for patients with chronic diseases: An empirical analysis on elderly hypertensive and diabetic patients in an eastern metropolis of China

Zhijun Wu, Weiyan Jian

Abstract

Objective: This study aimed to determine the availability of community health management services and the relevant social determinants for elderly patients with chronic diseases.

Methods: All data were obtained from the 2013 random sampling household survey on an elderly population conducted by the School of Public Health of Peking University in an eastern metropolis in China. Information from the database of the above survey involving 1495 hypertensive or diabetic patients $\geq$60 years of age, as representatives of the city, were included. The study described the availability of follow-up services by community doctors among elderly hypertensive and diabetic patients during the 12 months before the survey. An ordinal multinomial logistic regression model was used to conduct the analysis on the influence of socio-economic background upon such availability.

Results: Eighty-one percent of hypertensive patients and 84.7% of diabetic patients had not received any follow-up service from community doctors within 12 months prior to the survey. Among elderly hypertensive patients, those registered as non-agricultural household members, those with high and above-average income, as well as management personnel of government agencies, enterprises, and social programs have a greater chance of accepting follow-up service by community doctors because of their relatively higher socio-economic rankings. Among elderly diabetic patients, such socio-economic factors had no significant influence on the availability of the follow-up service for chronic diseases.

Conclusion: The coverage of community health management services for elderly hypertensive and diabetic patients needs improvement. More effort should focus on promoting the availability of community health management services for elderly hypertensive patients, especially those with lower socio-economic status.

Keywords: Community health management; hypertension; diabetes; socio-economic status; elderly population

School of Public Health, Peking University, Haidian District 100191 Beijing, China

CORRESPONDING AUTHOR:
Weiyan Jian
School of Public Health, Peking University, Haidian District 100191 Beijing, China
E-mail: jianweiyan@bjmu.edu.cn

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Introduction

Community health care institutions providing primary care services play a very important role in the prevention and control of chronic diseases globally [1–5]. China's efforts in comprehensive prevention and control of community chronic diseases began in 1997 [6], and has focused on "early-stage intervention" [7] for years. According to the *China Work Plan on the Prevention and Control of Chronic Diseases (2012–2015)*, the twelfth 5-year period focusing prominently on standardized management in communities, holds the key in strengthening the country's efforts in targeting chronic diseases [8]. This study adopted community cases of elderly patients with hypertension and diabetes of an eastern metropolis in China to provide evidence that supports policies on improving community chronic disease management by investigating the availability of community chronic disease management services and the influence of relevant social determinants.

Data and methods

Data source

Information on a hypertensive and diabetic population >60 years of age with hospital diagnoses was obtained from the database of the 2013 "Influenza Vaccination and Health Status Survey on Aged Population of an Eastern Metropolis" conducted by the School of Public Health of Peking University. We received consent to use the database from the original survey. Eight hundred and seventy-three patients with hypertension, 372 patients with diabetes, and 250 patients with hypertension and diabetes were included. Probability-Proportional-to-Size Sampling (PPS) was implemented to carry out the survey that covered 8 local counties, 64 urban and rural communities, and a total of 1717 residents >60 years of age. The subjects of the survey were representative of the city population. The variables of the study consisted of basic social demographics, hypertension, and diabetes prevalence, as well as information on community health services for chronic diseases.

Methods

Household type, household per capita income, educational level, and type of profession were used to describe the objective socio-economic status in the study. Subjects were divided into 5 groups based on income, which in ascending order were: lowest (20%), lower (20%), middle (20%), higher (20%), and highest (20%). Times of visits to hypertensive and diabetic patients during the past 12 months before the survey were considered the index for chronic disease management services in communities, and divided into four grades (no visit, 1–2 visit/visits, 3–4 visits, and >4 visits).

To investigate the coherence between social determinants and the follow-up services for patients with chronic diseases, the ordinal multinomial logistic regression model was adopted to calculate the age- and gender-matched odds ratio (OR). Dependent variables for indices of objective social status included four grades (no follow-up visit by community doctors, 1–2 visit/visits, 3–4 visits, and >4 visits among patients with hypertension and diabetes). If the OR was >1, then the index represented a contributing factor; if not, an impeding factor. Indices of objective socio-economic status consisted of household type (0 for rural household and 1 for non-rural), household per capita income (4 dummy variables by the contrast of the lowest 20% in an ascending order [lower 20%, middle 20%, higher 20%, and the highest 20%]; 1 for yes and 0 for no), educational level (4 dummy variables using "never been to school" in contrast to primary school, junior high school, senior high, vocational or technical secondary school, junior college and above; 1 for yes and 0 for no), type of profession (7 dummy variables in contrast with management of government agencies, enterprises, and social programs [professionals and technical, clerical, commercial and service, personnel engaged in agricultural, forestry, livestock husbandry, fishery and water resources-related production, production and transportation equipment operators, unemployed, and others]; 1 for yes and 0 for no). The statistical analysis was performed using SPSS 19.0.

Results

Basic information

Please refer to Table 1 for subjects' basic information. Six hundred and twenty-three patients with hypertension with no co-morbidities were included. Subjects 60–69 years of age accounted for the majority (50.1%) of the patients. There were more women (60.5%) than men (39.5%). The patients were mainly from non-agricultural households (81.7%) with educational levels lower than primary or junior high school (62.9%).

Table 1. Basic information

Variable	Patients with hypertensions but without other co-morbidities	Patients with diabetes but without other co-morbidities	Patients with hypertension and diabetes
Total	623	122	250
Age			
60–69	312 (50.1%)	73 (59.8%)	124 (49.6%)
70–79	221 (35.5%)	39 (32.0%)	89 (35.6%)
80 and above	89 (14.4%)	10 (8.2%)	37 (14.8%)
Gender			
Male	246 (39.5%)	50 (41.0%)	98 (39.2%)
Female	377 (60.5%)	71 (58.2%)	151 (60.4%)
Income			
Lowest 20%	569.4±26.3	789.3±68.9	658.8±47.2
Lower 20%	1433.9±14.3	1442.0±34.6	1393.7±23.7
Middle 20%	2022.1±14.2	2037.1±26.9	2004.3±23.1
Higher 20%	2735.1±20.6	2697.7±48.5	2725.6±33.7
Highest 20%	4339.5±116.6	4600.6±288.4	4292.2±163.0
Educational level			
Never been to school	64 (10.3%)	13 (10.7%)	23 (9.2%)
Primary school	159 (25.5%)	24 (19.7%)	56 (22.4%)
Junior high school	169 (27.1%)	36 (29.5%)	87 (34.8%)
Senior high, vocational, or technical secondary school	123 (19.7%)	25 (20.5%)	45 (18.0%)
Junior college and above	106 (17.0%)	24 (19.7%)	38 (15.2%)
Household type			
Non-agricultural household	509 (81.7%)	107 (87.7%)	215 (86.0%)
Agricultural household	109 (17.5%)	10 (8.2%)	34 (13.6%)
Migrant household	5 (0.8%)	4 (3.3%)	1 (0.4%)
Occupational status			
Employed	28 (4.5%)	1 (0.8%)	7 (2.8%)
Retired	520 (83.5%)	114 (93.4%)	223 (89.2%)
Unemployed	75 (12.0%)	7 (5.7%)	20 (8.0%)
Profession			
Management of government agencies, enterprises, and social programs	86 (13.8%)	16 (13.1%)	38 (15.2%)
Professional and technical	190 (30.5%)	33 (27.0%)	83 (33.2%)
Clerical/military	67 (10.8%)	20 (16.4%)	24 (9.6%)
Commercial and service/production and transportation equipment operators	46 (7.4%)	16 (13.1%)	29 (11.6%)
Agricultural, forestry, livestock husbandry, fishery, and water resources-related production	97 (15.6%)	18 (14.8%)	38 (15.2%)
Production and transportation equipment operators	45 (7.2%)	7 (5.7%)	9 (3.6%)
Unemployed	75 (12.0%)	7 (5.7%)	20 (8.0%)
Others	14 (2.2%)	4 (3.3%)	9 (3.6%)

Occupational analysis indicated that 4.5% of the patients were employed and 83.5% were retired. Employees and ex-employees were mostly professionals and technicians (30.5%). Monthly household per capita incomes of the lowest and highest 20% groups were 569.4 yuan and 4339.5 yuan respectively.

One hundred and twenty-two patients with diabetes without co-morbidities were included. Subjects 60–69 years of age accounted for the majority (59.8%) of the patients. There were also more women (58.2%) than men (41.0%). Patients were mainly non-agricultural household members (87.7%) with educational levels lower than primary or junior high school (59.9%). Of the patients with diabetes, 0.8% were employees and 93.4% were retired. Occupational status revealed that 27.0% of employees and ex-employees were professionals and technicians. The monthly household per capita incomes of the lowest and highest 20% groups were 789.3 yuan and 600.6 yuan, respectively.

Two hundred and fifty patients with hypertension and diabetes were included at the same time. Patients 60–69 years of age constituted the majority (49.6%). There were more women (60.4%) than men (39.2%). The patients were mostly from non-agricultural households (86.0%) with educational levels lower than primary or junior high school (66.4%). Occupational status showed that 2.8% of the patients were employees and 89.2% were retired. Most of the employees and ex-employees were professionals and technicians (32.2%). The monthly household per capita incomes of the lowest and highest 20% groups were 658.8 yuan and 4292.2 yuan, respectively.

Community health management services for patients with hypertension and diabetes

As shown in Table 2, on average, weekly blood pressure (BP) measurements were obtained among 41.6% of the patients with hypertension; 39.7% had their BPs measured monthly, 14.8% failed to have the BPs measured, and 1.5% did not have BPs measured in the past year. Of the patients with hypertension, 81.5% received no follow-up service by community doctors, 8.1% received 1–2 visit/visits, 2.6% received 3–4 visits, and 7.6% received >4 visits. Follow-up services for patients with hypertension were mainly carried out in the outpatient department (63.8%) and over the telephone (23.9%).

On average, blood glucose levels were measured every week among 17.7% of all patients with diabetes, 44.4% had

Table 2. Community health management services

Variable	Total patients with hypertension	Total patients with diabetes
Total blood pressure/blood glucose tests in the past year	(blood pressure tests)	(blood glucose tests)
0	13 (1.5%)	7 (1.9%)
Less than once a month on average	129 (14.8%)	122 (32.8%)
More than once a month on average	347 (39.7%)	165 (44.4%)
More than once a week on average	363 (41.6%)	66 (17.7%)
Follow-up visits by community doctors during the past 12 months		
0	707 (81.0%)	315 (84.7%)
1–2	71 (8.1%)	13 (3.5%)
3–4	23 (2.6%)	10 (2.7%)
Above 4	66 (7.6%)	22 (5.9%)
Approaches of follow-up services		
Visits at patients' homes	22 (15.8%)	9 (20%)
Visits at the outpatient department	88 (63.8%)	24 (53.3%)
Visits over the phone	33 (23.9%)	15 (33.3%)
Collective visits	5 (10.9%)	7 (15.6%)
Others	1 (0.7%)	0

glucose determinations monthly, 32.8% did not have blood glucose determinations, and 1.9% did not have blood glucose determinations in the past year. Of the patients with diabetes, 87.5% received no follow-up services by community doctors, 3.5% received 1–2 visit/visits, 2.7% received 3–4 visits, and 6.1% received >4 visits. Follow-up services for patients with diabetes were mainly carried out in the outpatient department (53.3%) and over the telephone (33.3%).

Social determinants of the availability of community health management services for patients with hypertension and diabetes

Tables 3 and 4 show the results of the ordinal multinomial logistic regression analysis. Age- and gender-matched

Table 3. Age- and gender-matched relationship between socio-economic status and follow-up visits among elderly hypertensive population

Variable	β value	SE	OR (95% CI)	p
Household type (agricultural household as contrast)				
Non-agricultural household	0.959	0.228	2.609 (1.667, 4.084)	<0.001
Household per capita income				
(the lowest 20% group for comparison)				
Lower 20%	0.08	0.285	1.083 (0.619, 1.895)	0.779
Middle 20%	0.42	0.297	1.522 (0.850, 2.726)	0.157
Higher 20%	0.809	0.32	2.246 (1.198, 4.208)	0.012
Highest 20%	0.836	0.337	2.307 (1.192, 4.464)	0.013
Educational level ("never been to school" for comparison)				
Primary school	0.148	0.365	1.160 (0.567, 2.373)	0.539
Junior high school	0.087	0.37	1.091 (0.528, 2.250)	0.496
Senior high, vocational, or technical secondary school	0.164	0.387	1.178 (0.553, 2.514)	0.225
Junior college and above	0.447	0.418	1.564 (0.689, 3.547)	0.141
Profession (management of government agencies, enterprises,				
and social programs for comparison)				
Professional and technical	–0.005	0.347	0.995 (0.504, 1.964)	0.987
Clerical	0.03	0.433	1.030 (0.440, 2.408)	0.946
Commercial and service	0.109	0.472	0.870 (0.331, 2.291)	0.779
Agricultural, forestry, livestock husbandry, fishery, and water resources-related production	–0.781	0.36	0.458 (0.226, 0.928)	0.03
Production and transportation equipment operators	0.161	0.5	1.175 (0.441, 3.130)	0.747
Unemployed	0.029	0.424	1.029 (0.448, 2.363)	0.946
Others	1.029	1.096	2.798 (0.326, 23.975)	0.348

patients with hypertension without co-morbidities from non-agricultural households received more follow-up visits than those from agricultural households (OR=2.609, p<0.01). In comparison to the 20% group with the lowest income, the higher 20% and highest 20% groups received more follow-up visits. When compared with those working in management of government agencies, enterprises, and social programs (the group of higher-ranked employees), people engaged in agricultural, forestry, livestock husbandry, fishery, and water resources-related production received fewer follow-up visits. No significant difference existed between educational level and the number of follow-up visits. For patients with diabetes with no co-morbidities, the influence of household type, income, education, and vocation on the availability to follow-up services were insignificant.

Discussion

Insufficient coverage of health management services for community chronic diseases

Effective control cannot be achieved with insufficient coverage of chronic disease management. With most chronic disease patients out of the health management service, true efficiency can never be achieved regardless of how effective the prevention and control measures are. As indicated by this study, <20% of the elderly patients with hypertension and diabetes living in the city received follow-up services by community doctors during the past 12 months before the survey. Scholars suggest that those with BPs under control should receive community follow-up services at least once every 6 months, and even once a month for those in whom BPs are not well-controlled [9]. The study revealed that only 10.2% of elderly

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Table 4. Age- and gender-matched relationship between socio-economic status and follow-up visits among elderly diabetic population

Variable	β value	SE	OR (95% CI)	p
Household type (agricultural household for comparison)				
Non-agricultural household	–0.287	0.873	0.751 (0.136, 4.154)	0.743
Household per capita income (the lowest 20% group for comparison)				
Lower 20%	0.711	1.014	2.036 (0.279, 14.865)	0.483
Middle 20%	–0.551	0.82	0.576 (0.115, 2.875)	0.501
Higher 20%	0.532	1.034	1.702 (0.224, 12.910)	0.607
Highest 20%	1.326	1.22	3.766 (0.345, 41.141)	0.277
Educational level ("never been to school" for comparison)				
Primary school	2.217	1.321	9.180 (0.690, 122.12)	0.093
Junior high school	0.218	0.933	1.244 (0.199, 7.752)	0.815
Senior high, vocational, or technical secondary school	0.647	1.014	1.910 (0.262, 13.943)	0.523
Junior college and above	1.665	1.304	5.286 (0.411, 68.033)	0.202
Profession (management of government agencies, enterprises, and social programs for comparison)				
Professional and technical	0.7701082	1.71265	2.160 (0.403, 11.565)	0.368
Clerical	0.9218751	1.92897	2.514 (0.380, 16.663)	0.339
Commercial and service	0.2600539	1.99041	1.297 (0.195, 9.645)	0.788
Agricultural, forestry, livestock husbandry, fishery, and water resources-related production	1.0490718	2.10618	2.855 (0.362, 22.466)	0.319
Production and transportation equipment operators	0.0449734	1.72817	1.046 (0.192, 5.680)	0.959
Unemployed	0.7400308	2.42779	2.173 (0.201, 23.430)	0.523
Others	0.7761087	2.32693	2.096 (0.214, 20.471)	0.525

hypertensive patients had received follow-up services at least twice a year. Some scholars also advise that the frequency of community follow-up services should be thrice a year (every March, June, and December) for patients with type 2 diabetes [10]. As shown in this study, however, only 8.6% of elderly patients with diabetes living in the city had received follow-up services at least thrice a year.

Another weak link of the chronic disease management in the city is the "service approach." Chronic disease management is different from medical services. The latter clearly depends on the "initiative of the demand side." Instead, chronic disease management is needed before the demand side has encountered any trouble, thus community health service providers must take the initiative for the demand side. According to the results of this study, approximately 20% of patients with hypertension and diabetes received chronic disease follow-up services at home, while most patients received such services in the outpatient department. The sufficiency and quality of the service cannot be guaranteed when the provider and demand sides both lack initiative.

Different socio-economic rankings and different chronic disease management services among the elderly population

The study observed less availability of those diagnosed with chronic diseases for follow-up services among patients from agricultural households, lower income, and engaged in agricultural, forestry, livestock husbandry, fishery, and water resources-related production. Thus, the availability for chronic disease management services varies as per different socio-economic rankings. Such availability of those at lower socio-economic levels is also lower.

There are two reasons that possibly account for this result. First, those with higher socio-economic rankings enjoy better community environment and facilities, thus the quality of health care service is better as well. As a

consequence, they are apt to acquire correct health information, participate in physical exercises, and form a healthy life style. Second, when the provider side shows a lack of initiative, the demand side holds the key to the availability of chronic disease management services. People with higher socio-economic rankings, especially those that have been better educated, care more for their own health condition [11, 12], and are thus more prone to proactively seek health care services. As a result, the availability of being included in health care management is higher among those ranking higher in socio-economic status.

Coping strategy and advices

Based on the analysis above, efforts to improve the outcome of chronic disease management services should be focused on the two aspects below.

Comprehensive approaches to promote the initiative of community health care service providers:

It can be extremely difficult for community health care providers to actively offer diagnosis and management services at the homes of patients with chronic diseases. One of the countermeasures is to reduce the "cost" for community doctors to perform chronic disease management. Currently, automated health examination equipment is already allocated to "community health homes" [13–15] in a few areas, which with a "health ID card" allows residents to easily obtain their measurements, such as height, body weight, BP, and blood glucose. These measured results are then transferred and input into residents' electronic health records (EHRs) [16] so that community doctors can conveniently grasp the health status of community residents, identify patients with chronic diseases or residents with high risks, and provide relevant management services accordingly.

Additionally, it is necessary to reform the incentive mechanism for health care providers. Allowing for relevant experience globally, a "capitation fee" [17–21] based on "contract services of family doctors" could be considered. On the basis of residents "voting with their feet," community doctors could have the "surplus after balancing revenue and expenditures." In this way, if no residents at high risk develop chronic diseases, or conditions of the latter are under steady control, no

or less medical resources would be then consumed, and the revenue for community doctors would increase. Eventually, such an incentive mechanism would urge community doctors to expand the coverage of quality health care management services. Moreover, it could also be considered that a special "chronic disease management" budget out of the per capita public health care fund be secured to support the "performance payment" for community doctors. With respect to contracting details, the payment of community doctors could be determined by evaluating the coverage, course, and outcome indices of the chronic disease management services. Similarly, the revenue of community doctors would be directly related to the performance of their services.

Strategies on the prevention and control of chronic diseases covering "socio-economic determinants of health" and community-specific strategies with encouraged participation of local residents:

Socio-economic status is extremely influential on the risks of developing chronic diseases [22–26], and people from different socio-economic levels may face different chronic disease risks. Therefore, targeted strategies to prevent and control chronic diseases at different socio-economic levels are necessary for a better service outcome. Specifically, two management measures should be considered.

First, prevention and control strategies should be "lowered" to the level of communities [27–29]. Presently, such strategies are mostly released and executed at the levels of cities or districts in China. The difference between prevention and control strategies of different areas is small, even less between different socio-economic levels of the same area [30]. Communities are aggregations of people from the same socio-economic levels, so it should be preferred to adopt targeted strategies to prevent and control chronic diseases in specific communities as per their own characteristics, and carry out related interventions with the support of local neighborhood committees. All community doctors must be incorporated into the prevention and control services for chronic diseases so that continuing health care guidance could be assured on the premise that the overall condition of patients with chronic diseases and high-risk residents of the specific community is perfectly procured.

Second, more local residents should be encouraged to participate in community strategy that helps to prevent and control chronic diseases. Whether or not a prevention and control strategy could be realized mainly depends on the participation and acceptance of community residents. Hence, local residents should take part in the development of community strategies and action plans to prevent and control chronic diseases, and pass on to others the scientific health concepts which would prove conducive to implementing prevention and control strategies, as well as the health care management service at the community level. Comparatively, community residents could be better motivated to carry out a "self-made" health care action plan than a set of regulations "imposed" by the outside.

This study is a preliminary investigation on community management services for chronic diseases. Although the study does provide evidence to avail future service improvements, the study is limited in sample size, especially with respect to the sample size of diabetic patients, thus the results still have some limitations. More research on this topic needs to be conducted in the future to formulate a better improved management service system that tackles chronic diseases.

Conflict of interest

The authors declare no conflict of interest.

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