Health Policy 123 (2019) 373–378

Contents lists available at ScienceDirect

Health Policy

journal homepage: www.elsevier.com/locate/healthpol

A community pharmacist home visit project for high utilizers under a universal health system: A preliminary assessment

Yu-Ying Huang [a,c], Shou-Hsia Cheng [a,b,*]

[a] Institute of Health Policy and Management, College of Public Health, National Taiwan University, Taipei, Taiwan
[b] Population Health Research Center, National Taiwan University, Taipei, Taiwan
[c] Medical Affair Division, National Health Insurance Administration, Ministry of Health and Welfare, Taiwan

ARTICLE INFO

Article history:
Received 20 September 2018
Received in revised form
28 December 2018
Accepted 24 January 2019

Keywords:
Community pharmacists
High utilizer
Home visit
Diseases management
Taiwan

ABSTRACT

Due to the increasing prevalence of multimorbidity, the percentage of heavy users of health care services increased rapidly. To contain inappropriate outpatient visits and improve better medication management of high utilizers, the National Health Insurance Administration in Taiwan launched a community pharmacist home visit (CPHV) project for high utilizers in 2010. We employed a natural experimental design to evaluate the preliminary effects of the CPHV project. The intervention group consisted of patients enrolled in the CPHV project during 2010 and 2013. Patients in the comparison group were non-enrollees selected via a propensity score matching technique. A difference-in-differences analysis was conducted by using multilevel models to examine the effects of the project. The average number of physician visits decreased from 130.0 to 98.9 visits (23.8%) among the CPHV project enrollees, while the average number decreased from 99.5 to 89.5 visits (10.1%) among the non-enrollees, with a net effect of a 21.0-visit reduction. The CPHV project also led to modest reductions in the number of medication items used per day, the probability of hospital admission and yearly healthcare expenses. The CPHV project seems promising for decreasing health care utilization and costs of the patients with high-needs.

1. Introduction

Along with the fast growth of the aged population in developed countries, health authorities are facing the challenge of escalating health care expenditure. Health resources consumptions are unevenly contributed by a group of high-need heavy users or high utilizers. High utilizers generally have multiple chronic conditions and functional limitations [1–3]; therefore, these patients tend to use more services or have developed doctor-shopping behaviors, which result in repeated procedures, repeated prescriptions and conflicting recommendations for complicated health needs [4,5]. Better disease management for high utilizers is an important issue for health authorities around the world.

Due to the complex health conditions of high-need patients, most intervention programs applied hybrid models with various approaches. For instance, in the U.S., intervention programs include primary care model, hospital discharge model, emergency department-based model, home-based model, and community-based model etc. for high utilizers [6]. These intervention programs are usually care management programs and usually contain medication management, disability assessments, health education, telephone or e-mail consultations, and social and economic support. There is no standard composition of care management teams; most of the programs involve registered nurses or social workers, while some include psychiatrists, pharmacists, and non-professional personnel together. Evidence shows that these programs resulted in substantial reductions in hospital admissions, length of hospital stay, emergency department (ED) visits, and even all-cause mortality rate. [6–10]. Several Canadian project had involved community pharmacists into primary care model and found positive effects on safety and cost-effectiveness of care [11], reduced medication related problems [12], and improved coordination between pharmacists and physicians but no effect on asthma control [13].

In Taiwan, patients are free to visit physicians at community clinics or hospital outpatient departments for each episode without referral [14]. Taiwan implemented a compulsory National Health Insurance (NHI) program in 1995; empirical studies have found that the NHI has significantly improved people's healthcare utilization [15]. In recent years, the average number of physician consultation is about 15 visits per year among the general population and 28 visits among the elderly, which is around the highest in the world.

* Corresponding author at: 17, Xu-Zhou Road, Taipei, Taiwan.
E-mail address: shcheng@ntu.edu.tw (S.-H. Cheng).

https://doi.org/10.1016/j.healthpol.2019.01.011
0168-8510/

Therefore, patients are often criticized for their doctor-shopping behavior [16]. The features of having free choice of providers for each visit and a very high number of physician visits under the NHI program might make it more difficult for health authorities to contain the inappropriate use of health care services among high utilizers.

1.1. The community pharmacist home visit program

The single payer of Taiwan's universal health coverage, the NHI administration, introduced a program in 2001 to monitor and guide individuals with an excessive number of physician visits for more appropriate healthcare consumption. Activities adopted in the program included reminder letters, in-person or telephone consultations, referral for social services, or physician on-site counseling to guide these high utilizers seeking proper treatment. To further assist high utilizers in proper health service consumption and safe medication intake, the NHI administration activated and utilized abundant community pharmacists and introduced an intervention program entitled Community Pharmacist Home Visit (CPHV) project in 2010. This project was executed by NHI-contracted community pharmacists and the NHI provided payment directly to participating pharmacists for their home visit services. Patients who had conducted 100 or more outpatient visits in the previous year were defined by the NHI administration as high utilizers. Among the high utilizers, patients with more than two chronic diseases and a high number of refillable prescriptions (> 13 prescriptions) from multiple medical institutes, with high drug expenditures (annual expenses above the 50th percentile of the total high utilizers) or those who had visited more than 8 medical institutions (6 medical institutions after 2012) in the previous year were eligible for enrollment in this project.

A list of eligible high utilizers with various priorities would then be provided to the Taiwan Pharmacist Association, the project coordinator, and distributed to participating community pharmacists nationwide, who had been trained to provide counseling services via home visits. Participating community pharmacists would be assigned patients who resided in their nearby communities and received all NHI medication records of these patients as references for designing personal care plans. Patients were invited to join this project voluntarily; the community pharmacist should obtain written consent from the patient when he/she made the first contact with the patient. The community pharmacists provided home-visit services including medication review, medication consultation, and health education. They could write down medication recommendations to patient's physicians when there were repeated medications. Moreover, they could accompany patients to their physician's office and discuss medication prescription with the physicians when necessary.

When the pharmacists started providing home visit services to enrolled patients, they submitted reimbursement claims to the NHI administration per month for one year. A pharmacist could provide home visits up to 8 times per year for an enrolled patient. Each home visit could be reimbursed 1000 points (approximately 1000 NT dollars with 1 US dollar equaled 31 New Taiwan dollars in 2010) in urban and suburban areas and 1200 points in remote and mountain areas. The objective of the current study was to evaluate the impact of the CPHV project during its first 4 years.

2. Materials and methods

2.1. Data source and study sample

This is a retrospective study employed a natural experimental design. We obtained a defined list of high utilizers from 2010 to 2013 and all of their claims data on healthcare utilization from 2009 to 2014 provided by the NHI administration in Taiwan. The list allowed us to identify the project enrollment status of the high utilizers each year, while the claim dataset contains detailed records of every physician visit, such as primary and secondary diagnosis codes, medication codes, and claimed medical expenses. Patients who were less than 20 years of age, died during the observation period, or lacked information on basic characteristics and variables of interest were excluded.

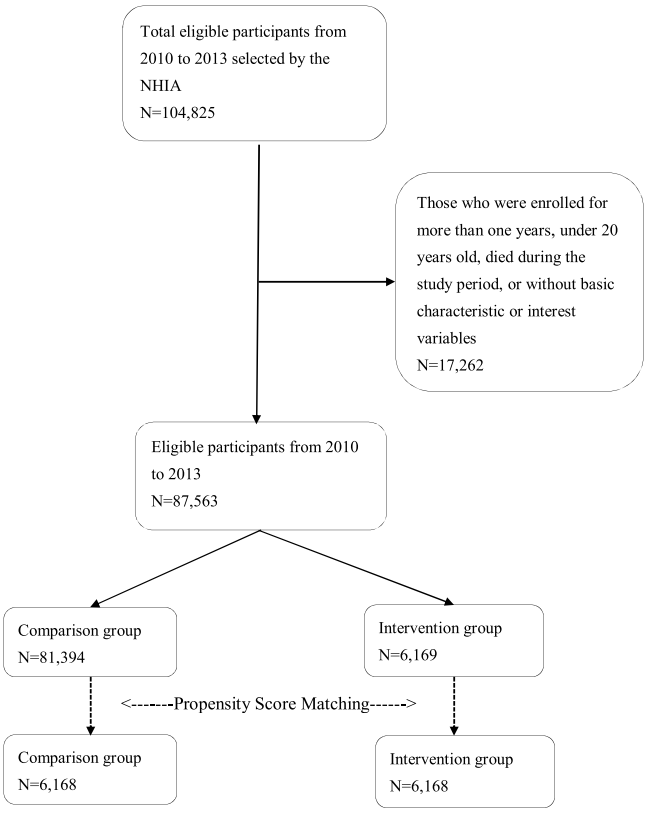

Fig. 1. Sample selection process for intervention and comparison groups.

High utilizers who had been enrolled in the CPHV project during 2010~2013 were defined as the intervention group. The majority of enrolled patients participated in the project once (for one year), and we excluded patients who had participated for more than one year. Most of the enrolled subjects were contacted by a community pharmacist and signed the consent form in January each year, and we assumed that each patient had received home visit services for one year. A total of 6169 patients composed the intervention group in this study. The potential comparison group consisted of high utilizers who had never been enrolled in the CPHV project between 2010 and 2013 (n = 81,394). The process of sample selection in this study is shown in Fig. 1.

Because the patients were invited to join the project voluntarily, a potential selection bias might hamper the comparability between the intervention and comparison groups. Therefore, we employed a propensity score matching (PSM) technique to increase the comparability between the intervention and comparison groups [17]. We created a propensity score for each patient, which estimated the probability of enrollment in the CPHV project based on the subject's characteristics using a generalized estimating equation (GEE) model with binary distribution and logit link. The characteristics included patient's age, sex, monthly premium, number of refillable prescriptions for chronic conditions, Charlson Comorbidity Index (CCI) score, residency area, and the accreditation level of the most frequently visited health care institution. The Charlson index score

Table 1
Patient characteristics in the pre- and post-matched samples in the year 2013.

Variables	Intervention Group (2013)		Comparison Group Pre-PSM (2013)		P-value	Post-PSM(2013)		P-value
	N	%	N	%		N	%	
Total	2,393	100	31,146	100		2,393	100	
Sex					0.022			0.9074
Male	1069	44.67	13,592	43.64		1073	44.84	
Female	1324	55.33	17,554	56.36		1320	55.16	
Age group					<.0001			0.9995
20-54	451	18.85	7,880	25.3		451	18.85	
55-69	811	33.89	10,294	33.05		810	33.85	
70+	1131	47.26	12,972	41.65		1132	47.3	
Charlson Comorbidity Index					<.0001			0.9986
CCI score 0	647	27.04	11,606	37.26		391	26.19	
CCI score 1	550	22.98	7,049	22.63		342	22.91	
CCI score≥2	1196	49.98	12,491	40.1		760	50.9	
Number of Refillable prescriptions for patients with chronic illnesses					<.0001			0.9934
0-1	659	27.54	10,181	32.69		662	27.66	
2-7	1036	43.29	13,257	42.56		1036	43.29	
>8	698	29.17	7,708	24.75		695	29.04	
Monthly Premium (NTD)					<.0001			0.963
<20,100	931	38.91	11,140	35.77		932	38.95	
20,100-36,300	1154	48.22	15,034	48.27		1155	48.27	
>36,300	308	12.87	4,972	15.96		306	12.79	
Level of frequently visited institution					<.0001			0.9997
Medical center hospital	1057	44.17	13,876	44.55		1057	44.17	
Regional hospital	924	38.61	11,115	35.69		925	38.65	
District hospital	283	11.83	3,451	11.08		281	11.74	
Community clinic	129	5.39	2,704	8.68		130	5.43	
Residency					<.0001			0.9980
Taipei and eastern region	237	9.9	9,966	32		237	9.9	
Northern and central region	786	32.85	9,410	30.21		784	32.76	
Southern and Kao-ping region	1370	57.25	11,770	37.79		1372	57.33	

contains 15 categories of comorbid conditions defined by ICD-9-CM codes. To ensure the accuracy of a patient's condition, only diagnoses appearing at least 3 times in a patient's annual outpatient claim records or at least 1 time in the inpatient claim records were included in the calculation of the Charlson index score [18]. The four accreditation levels (in descending order) were medical center hospital, regional hospital, district hospital and community clinic [19]. Enrollees of this project in 2010 were match with non-enrollees in 2010, those had been matched in one year would be exclude from matching process for another year. We employed the caliper matching method with 1:1 matching between the intervention and comparison groups based on their propensity scores. The PSM yielded a total of 12,336 patients in the intervention and comparison groups. The unit of analysis was patient-years in this study.

2.2. Measures of study variables

The outcome measures examined in this study included the number of outpatient visits, emergency department (ED) visits, and hospital admissions, the average number of drugs used per day, and total healthcare expenses. In the calculation of the number of outpatient visits and medical expenditures, we excluded those claims of visits and expenses in home health care and nursing home services. The number of drugs used per day was the sum of each drug item multiplied by its prescription days for a person in one year, divided by the total prescription days (up to 365). For example, a person was prescribed 365 days of a medication with 2 kinds of pills per day for treating diabetes and was prescribed 284 days of a medication with 1 pill for treating hypertension, the average number of drugs used per day would be 2.78 items [(2*365 days+1* 284 days)/365 days].

The independent variables were the enrollment status in the CPHV project of the study subjects, the dummy variables for the years of intervention (before or after the enrollment), and the interaction term for the above two variables. A number of covariates were controlled for in the regression models: the patient characteristics such as age, sex, monthly premium, Charlson Comorbidity Index and residency area and the provider characteristics such as accreditation level and location area.

2.3. Statistical analysis

This study used a difference-in-differences (DID) analysis (also called a pre- and post-design with a comparison group) to compare the outcomes between the two groups before and after the implementation of the CPHV project. Multilevel intercept models were used to account for the intra-class correlation between the subjects clustered in the same accreditation level of the most frequently visited health care institution and the repeated observations for the same patients and patients in the same matched pairs. In the regression models, proper distribution was used for each outcome variable. Log-transformation was applied to the healthcare expenses since its distribution was skewed to the right. The variable of ED visits was analyzed by Poisson distribution with a log link, while hospital admission was fitted by binary distribution with a logit link. The number of outpatient visits and the number of drug items per day were analyzed by using normal distribution with an identity link function. The analyses were performed by using SAS version 9.4 (SAS Institute, Cary, NC).

3. Results

Table 1 shows the baseline characteristics of the patients in the intervention and comparison groups before and after the PSM

Table 2
Outcome variable changes before and after the intervention between the two post-matched groups (2010–2013).

Variables	Intervention Group(N=6168)				Comparison Group(N=6168)			
	Mean(S.D.)		Pre-post Difference	P-value	Mean(S.D.)		Pre-post Difference	P-value
	Pre	Post			Pre	Post		
No. of outpatient visits	130.00(29.24)	98.93(36.99)	−31.04	<.0001	99.55(32.08)	89.53(32.82)	−10.03	<.0001
No. of ED visits	2.53(10.28)	2.11(10.07)	−0.42	1	1.49(6.41)	1.40(4.86)	−0.08	0.8456
Number of drugs used per day	24.37(17.05)	23.75(18.16)	−0.62	<.0001	19.41(14.90)	21.03(17.09)	1.62	<.0001
Total health care expenses	131,120(95,326)	126,289(123,390)	−4,831	0.9982	113,569(105,102)	117,302(108,583)	3717	0.0089
Hospitalization (N,%)	1232(19.97)	1068 (17.32)	164	0.0006	1043 (16.90)	1053 (17.07)	−10	0.8271

Note:
1. A paired *t*-test was used to test the differences in the number of outpatient visits, emergency department visits, drugs per day, and the total health care expenses before and after the intervention.
2. McNemar's test was used to test the differences in the risk of hospitalization before and after the intervention.

matching. This study consisted of 4 study groups in each year between 2010 and 2013; Table 1 shows the matching results of 2013 subjects. For the pre-matched sample, significant differences existed between the intervention and comparison groups, such as age categories and CCI scores ($P < 0.001$). The PSM process resulted in a more balanced distribution of the patient and hospital characteristics between the intervention and comparison groups.

Table 2 shows the changes in the 5 outcome variables in the intervention and comparison groups. Before the CPHV project, the average numbers of outpatient visits were different between the 2 groups, with 130.00 visits and 99.55 visits, respectively; the average number of outpatient visits decreased by 31.04 visits (-23.8%) in the intervention group while the number decreased by 10.03 visits (-10.1%) in the comparison group, both with P < 0.0001. The likelihood of hospital admissions decreased from 19.97% to 17.32% (P = 0.0006) in the intervention group, while the figures remained almost unchanged at approximately 16.90%–17.07% in the comparison group. The average numbers of ED visits were higher in the intervention group than in the comparison group, and the pre-post changes were not significant. The average number of drug items per day was higher in the intervention group (24.37 items) than the comparison group (19.41 items) before the CPHV project. After the intervention, the average number of drug items per day decreased by 0.62 items (-2.5%) in the intervention group, and the figure increased by 1.62 items (+8.3%) in the comparison group. Finally, the average medical expenses decreased 3.7% or NTD $4831 (approximately USD $156) in the intervention group, while the expense increased 3.3% or NTD $3717 (approximately USD $120) in the comparison group.

Table 3 presents the results from the multilevel random intercept models examining the effects of the CPHV project on healthcare utilization variables. With regard to the number of outpatient visits, the DID parameter, i.e., the coefficients of the interaction terms with β =-21.06; $P < 0.001$, revealed that a net 21.06 visit (16.2%) reduction effect resulted from the intervention program. The subjects enrolled in the CPHV project were less likely to be hospitalized than the comparison group with OR=0.88 ($\beta = 0.88$; $P = 0.0193$). However, the reduction in ED visits (β =-0.1263; $P = 0.1465$) was not significant.

In relation to the non-enrollees, the CPHV project resulted in a net decrease of 2.238 (9.1%) drug items per day among the patients enrolled in the project (β =-2.238; $P < 0.001$). Finally, the CPHV project also led to a reduction of approximately 5.4% (1- exp[-0.0568] with β =-0.0568; P = 0.00545; approximately USD $144) in healthcare expenses in the project enrollees compared with their counterparts. Other variables being controlled for in the regression models showed effects as expected. For example, patients with higher comorbidity scores had more physician visits, took more medications per day and had higher healthcare expenses; patients with more refilled medications took more pills and had higher healthcare expenses.

4. Discussion

Health and medication management for patients with complicated needs such as high utilizers is an emerging challenge to health authorities. Mossialos and colleagues have discussed that community pharmacists hadn't been primarily rewarded for delivering health care, thus under-utilized as public health professionals. Many countries such as Australia, Canada, the Netherlands, United Kingdom, and the United States had tried to engage community pharmacists in chronic disease management and medication safety control (Mossialos et al. 2015). Studies revealed some of these programs could contribute to the improvement in controlling chronic conditions and drug-related problem (Dolovich et al. 2008; Sellors et al. 2003; Charrois et al. 2006).

In Taiwan, due to the easy access to care and the lack of referral requirement, the average number of physician visits has reached 15 visits per year. Patients with multiple chronic conditions may undergo many more physician visits and take multiple medications. Taiwanese NHI administration activated and utilized the capacity of abundant community pharmacists and introduced the CPHV project to assist those high-utilizers in proper health care seeking and self-management.

The high utilizers included in the CPHV project were those who conducted over 100 visits in the previous year during 2010-2013. Community pharmacists who participated in the CPHV project provided services in guiding appropriate health care utilization via face-to-face consultation and prescription examination/recommendation during home visits for the high utilizers. The results showed that compared with those non-enrollees, after participating in the project for a year, the enrollees' outpatient visits, drugs used per day and outpatient care expenses significantly decreased. The CPHV projects resulted in a net reduction of 21 visits, while among the enrollees, the reduction was 31 visits out of 130 visits (23.8% reduction). Previous research has noted that high utilizers often use outpatient visits to confirm or clarify their suspicions on illness conditions [20,21]; the situation might also exist in Taiwan. Our study suggests that pharmacists may provide consultation or recommendation via home visit for needed patients, which leads to a reduction in outpatient visits.

The CPHV project resulted in a net reduction in medication items per day of 2.238 items in general. Among the program enrollees, the reduction was 0.62 items out of 24.37 items per day, which was modest compared with the reduction in the number of outpatient visits. For the CPHV enrollees, the limited effect implied that the medications that patients were taking tended to be necessary, which also reflected that the problem of medication duplication due to fragmented care might not be serious as originally expected. Of course, another possibility was that there were duplicated medications, yet the patients did not adhere to the suggestions of the pharmacists and did not ask their doctors to reduce or delete duplicated drug items. The overall effect of the CPHV project on

Table 3
Multilevel model estimations of the effects of the community pharmacist home visit project on health care utilization.

Variables	No. of Outpatient Visits		No. of ED Visits		Risk of Hospitalization		No. of Drugs Used Per Day		Health Care Expenses (Log Transformed)	
	β	S.E.	β	S.E.	β	95%CI	β	S.E.	β	S.E.
Fixed effect										
Intercept	113.38***	1.8778	0.3653	1.8778	0.16*	(0.05,0.49)	8.7126***	1.8778	4.7866***	1.8778
Program status (Ref: Comparison group)										
Intervention group	30.5632***	0.5837	0.5317***	0.5837	1.35***	(1.25,1.45)	4.948***	0.5837	0.0916***	0.5837
Period (Ref: Pre-program)										
Post-program	−9.9992***	0.492	−0.0574	0.492	1.01	(0.93,1.09)	1.6226***	0.492	0.00641	0.492
Interaction term between program and period (Ref: Comparison group*Pre-program)										
Intervention group* Post-program	−21.0673***	0.6958	−0.1263	0.6958	0.88*	(0.79,0.98)	−2.238***	0.6958	−0.0568***	0.6958
Year (Ref: 2010)										
2011	−10.1585***	1.1162	0.3365***	1.1162	1.13	(0.99,1.29)	1.2474*	1.1162	−0.0082	1.1162
2012	−9.9291***	1.1457	0.1616	1.1457	1.04	(0.91,1.19)	−0.7551	1.1457	−0.02653**	1.1457
2013	−11.9045***	1.1122	0.08749	1.1122	1.03	(0.9,1.17)	−0.6559	1.1122	−0.01331	1.1122
Sex (Ref=Men)										
Women	−0.4681	0.4746	−0.1431***	0.4746	0.95	(0.9,1.01)	−0.3312	0.4746	−0.01797***	0.4746
Age group (Ref=20-54)										
55-69	−4.752***	0.7033	−0.8266*	0.7033	1.16***	(1.06,1.26)	−0.5204	0.7033	0.01362*	0.7033
70+	−5.6194***	0.6638	−0.7336***	0.6638	1.34***	(1.24,1.45)	−0.3804	0.6638	0.01803***	0.6638
Charlson Comorbidity Index										
CCI score 1	1.4098*	0.6973	0.2287***	0.6973	1.35***	(1.24,1.48)	2.9918***	0.6973	0.04018***	0.5939
CCI score≥2	4.6168***	0.6078	0.4689***	0.6078	1.84***	(1.71,1.99)	7.2974***	0.6078	0.08321***	0.6594
Number of refillable prescriptions for patients with chronic illnesses										
2-7	−3.7528***	0.5119	−0.3844***	0.5939	0.96	(0.89,1.03)	6.6105***	0.5939	0.04018***	0.5939
>8	−2.991***	0.7749	−0.4667***	0.6594	0.92*	(0.85,0.99)	14.8598***	0.6594	0.08321***	0.6594
Monthly premium (NTD) (Ref≤20,100)										
20,100-36,300	−0.5581	0.5939	−0.2275***	0.5119	1.04	(0.98,1.1)	−0.4489	0.5119	−0.02463***	0.5119
>36,300	1.1597	0.6594	−0.3493*	0.7749	0.84***	(0.77,0.93)	−0.9344*	0.7749	−0.0177**	0.7749
Residence (Ref: Northern and central region)										
Taipei and eastern region	2.9073***	0.7502	0.1381*	0.7502	0.99	(0.91,1.08)	−1.2455**	0.7502	0.01822**	0.7502
Southern and Kao-ping region	−1.846***	0.539	−0.0774	0.539	0.97	(0.91,1.04)	−1.9623***	0.539	−0.01788***	0.539
Random effect										
Level of frequently visited institution	6.5343	5.9792	1.0827	0.9278	1.61	(1.16,1157.94)	2.3805	2.1155	0.00943	0.00774
Residuals	746.6***	9.4514	19.6768***	0.1772	2.72	(2.67,2.77)	75.3803***	0.9594	0.04578***	0.00058

Note: 1. Multilevel models with the restricted maximum likelihood method. 2. *: $p < 0.05$; *: $p < 0.01$; ***: $p < 0.001$.

healthcare cost savings was approximately 5.4%; due to the lack of the exact amount of budget spent on this project every year, we were unable to conduct a cost-benefit analysis of the project.

In this study, we found a non-significant effect of the CPHV project on ED visits and a marginal effect on hospitalization, which was different from previous studies evaluating the effects of home-visit related intervention programs for high utilizers. Bodenheimer (2013) reviewed 14 super-utilizer programs in the United States, evaluated 5 programs with reliable data, and reported substantial reductions in hospital admissions, hospital days, ED visits, and total costs of care. For example, the Geriatric Resources for Assessment and Care of Elders (GRACE) program in Indianapolis showed that ED visits were 23% lower in the second year of the project [22]. A recent study showed that the rate of ED visits decreased by 5.5% one year after a home-based primary care program and the effect diminished after three years (Schamess et al. 2017). Two studies in Singapore concerning a transitional home-care program indicated that the program can lower acute hospital utilization through the reduction of emergency department attendances [8,9]. We consider that the objectives of the current study might be different; the CPHV project mainly focused on reducing unnecessary outpatient visits among the enrollees, while most of the previous studies focused on reducing avoidable ED visits and hospitalizations after discharge. In addition, the unique features of Taiwan's health care system, such as easy access to care and a lack of referral arrangement, might also account for the different findings to some extent.

This study has several limitations. First, this study did not include unobserved (e.g., health-seeking behavior) or unavailable (e.g., income or illness severity) characteristics in the regression models. We included several proxy indicators for income and illness severity in the regression model, such as the monthly premium, number of refillable prescriptions for patients with chronic illnesses, and CCI score, which might reduce the bias related to the confounders that were not incorporated in the models. Second, although we used the propensity score to improve the comparability between intervention and comparison groups, there might be some confounders that remain uncontrolled for, since the outpatient visits differed before the intervention. However, we have included confounding variables that have been considered in previous studies, which might minimize the confounding effect to some extent. Third, Taiwan's healthcare system is unique in some aspects, such as the free choice of providers for every visit without referral requirements, which may limit the generalizability of the findings to other health systems.

5. Conclusions

Disease management is important for patients with complicated health needs and may help contain healthcare spending and improve care quality. This study revealed that home visit services by community pharmacists may decrease health service utilization, medication usage and healthcare expenses among high utilizers under a universal health system in Taiwan. Health authorities may develop programs to increase patient engagement in disease management at home.

Conflict of interest

There is no conflict of interest.

Acknowledgements

This study was supported by grants from the National Health Research Institutes (NHRI- EX107- 10616PI) and the Ministry of Science and Technology (MOST- 106-2410-H-002 -156 -MY3) in Taiwan. The authors thank the National Health Insurance Administration, Ministry of Health and Welfare in Taiwan for providing the data source for this study.

References

[1] Zulman DM, Pal Chee C, Wagner TH, Yoon J, Cohen DM, Holmes TH, et al. Multimorbidity and healthcare utilisation among high-cost patients in the US Veterans Affairs Health Care System. BMJ Open 2015;5(4):1–9, http://dx.doi.org/10.1136/bmjopen-2015-007771.

[2] Hayes SL, Salzberg CA, McCarthy D, Radley DC, Abrams MK, Shah T, et al. High-need, high-cost patients: who are they and how do they use health care? A population-based comparison of demographics, health care use, and expenditures. Issue Brief (Commonwealth Fund) 2016;26:1–14.

[3] Smits FT, Brouwer HJ, Zwinderman AH, Mohrs J, Smeets HM, Bosmans JE, et al. Morbidity and doctor characteristics only partly explain the substantial healthcare expenditures of frequent attenders: a record linkage study between patient data and reimbursements data. BMC Family Practice 2013;14:138, http://dx.doi.org/10.1186/1471-2296-14-138.

[4] Hempstead K, DeLia D, Cantor JC, Nguyen T, Brenner J. The fragmentation of hospital use among a cohort of high utilizers: implications for emerging care coordination strategies for patients with multiple chronic conditions. Medical Care 2014;52:S67–74, http://dx.doi.org/10.1097/mlr.0000000000000049.

[5] van den Bussche H, Kaduszkiewicz H, Schafer I, Koller D, Hansen H, et al. Overutilization of ambulatory medical care in the elderly German population?–an empirical study based on national insurance claims data and a review of foreign studies. BMC Health Services Research 2016;16:129, http://dx.doi.org/10.1186/s12913-016-1357-y.

[6] Thomas Bodenheimer M [August 27, 2017]. Available from: Strategies to reduce costs and improve care for high-utilizing medicaid patients: reflections on pioneering programs. Center for Health Care Strategies, Inc website; 2013 https://www.chcs.org/media/HighUtilizerReport_102413_Final3.pdf.

[7] Coburn KD, Marcantonio S, Lazansky R, Keller M, Davis N. Effect of a community-based nursing intervention on mortality in chronically ill older adults: a randomized controlled trial. PLoS Medicine 2012;9(7):1–14, http://dx.doi.org/10.1371/journal.pmed.1001265.

[8] Low LL, Vasanwala FF, Ng LB, Chen C, Lee KH, Tan SY. Effectiveness of a transitional home care program in reducing acute hospital utilization: a quasi-experimental study. BMC Health Services Research 2015;15(1):1–8, http://dx.doi.org/10.1186/s12913-015-0750-2.

[9] Wee SL, Loke CK, Liang C, Ganesan G, Wong LM, Cheah J. Effectiveness of a national transitional care program in reducing acute care use. Journal of the American Geriatrics Society 2014;62(4):747–53, http://dx.doi.org/10.1111/jgs.12750.

[10] Schamess A, Foraker R, Kretovics M, Barnes K, Beatty S, Bose-Brill S, et al. Reduced emergency room and hospital utilization in persons with multiple chronic conditions and disability receiving home-based primary care. Disability and Health Journal 2017;10(2):326–33, http://dx.doi.org/10.1016/j.dhjo.2016.10.004.

[11] Dolovich L, Pottie K, Kaczorowski J, Farrell B, Austin Z, Rodriguez C, et al. Integrating family medicine and pharmacy to advance primary care therapeutics. Clinical Pharmacology & Therapeutics 2008;83(6):913–7, http://dx.doi.org/10.1038/clpt.2008.29.

[12] Sellors J, Kaczorowski J, Sellors C, Dolovich L, Woodward C, Willan A, et al. A randomized controlled trial of a pharmacist consultation program for family physicians and their elderly patients. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne 2003;169(1):17–22.

[13] Charrois TL, Newman SC, Senthilselvan A, Tsuyuki RT. Improving asthma control in the rural setting: the BREATHE (Better respiratory education and asthma treatment in Hinton and Edson) study. Canadian Pharmacists Journal / Revue des Pharmaciens du Canada 2006;139(4):44–50, http://dx.doi.org/10.1177/171516350613900410.

[14] Cheng T-M. Taiwan's new national health insurance program: genesis and experience so far. Health Affairs 2003;22(3):61–76, http://dx.doi.org/10.1377/hlthaff.22.3.61.

[15] Shou-Hsia C, Tung-Liang C. The effect of universal health insurance on health care utilization in taiwan: results from a natural experiment. JAMA 1997;278(2):89–93, http://dx.doi.org/10.1001/jama.1997.03550020017009.

[16] Chen T-J, Chou L-F, Hwang S-J. Patterns of ambulatory care utilization in Taiwan. BMC Health Services Research 2006;6(1):54, http://dx.doi.org/10.1186/1472-6963-6-54.

[17] Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. Biometrika 1983;70(1):41–55, http://dx.doi.org/10.1093/biomet/70.1.41.

[18] D'Hoore W, Sicotte C, Tilquin C. Risk adjustment in outcome assessment: the Charlson comorbidity index. Methods of Information in Medicine 1993;32(5):382–7.

[19] Huang P, Y-HE Hsu, Kai-Yuan T, Hsueh Y-S. Can European external peer review techniques be introduced and adopted into Taiwan's hospital accreditation System? International Journal for Quality in Health Care 2000;12(3):251–4, http://dx.doi.org/10.1093/intqhc/12.3.251.

[20] Townsend A, Wyke S, Hunt K. Frequent consulting and multiple morbidity: a qualitative comparison of 'high'and 'low'consulters of GPs. Family Practice 2008;25(3):168–75, http://dx.doi.org/10.1093/fampra/cmn017.

[21] Broadbent E, Kydd R, Sanders D, Vanderpyl J. Unmet needs and treatment seeking in high users of mental health services: role of illness perceptions. Australian & New Zealand Journal of Psychiatry 2008;42(2):147–53, http://dx.doi.org/10.1080/00048670701787503.

[22] Bodenheimer T, Berry-Millett R. Follow the money—controlling expenditures by improving care for patients needing costly services. New England Journal of Medicine 2009;361(16):1521–3, http://dx.doi.org/10.1056/NEJMp0907185.