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Original Article

Evaluating A Multicomponent Chronic Disease Management Pilot Intervention among Korean Patients with Hypertension and Diabetes

Min Sook Bae [1], ****Hyunjong Song*** [2]

1. *National Health Insurance Service, Wonju, Republic of Korea*
2. *Department of Health Policy & Management, Sangji University, Wonju, Republic of Korea*

***Corresponding Author:** Email: igypop@hanmail.net

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Abstract

Background: A local clinic-based chronic disease management intervention including care planning, education about disease management, monitoring, and evaluation of the achievement of objects was introduced in Korea in 2019. We evaluated the effect of the intervention on medication adherence in patients with hypertension and diabetes.

Methods: In 2019, a one-year retrospective case-control group study design was performed using data from the National Health Insurance Service in Korea. Propensity score matching was used to control for selection bias. Medication adherence, calculated by medication possession rate, was the dependent variable. We conducted multivariate logistic regression analyses to examine the association between participation in the intervention and medication adherence, adjusting for covariates. A control group was set as a reference for participation in the full/partial component intervention.

Results: The proportions of participants in the full component intervention in the experimental group were 43.2% and 42.6% for patients with hypertension or diabetes, respectively. Both these groups tended to be more medication adherent than their counterparts (hypertension OR: 1.23, 95% CI 1.03-1.45, diabetes OR: 1.64, 95% CI: 1.24-2.17).

Conclusion: Institutionalizing a comprehensive chronic disease management program using multidisciplinary teams in the primary care context is crucial. Also, it is necessary to refine reimbursement payment systems.

Keywords: Primary care; Hypertension; Diabetes mellitus; Medication adherence; Patient education

Introduction

The prevalence of chronic diseases is placing greater demands on healthcare systems and health policymakers worldwide (1). In Korea, people with chronic diseases accounted for 35.3% of the total population in Korea (18.01 million), and the cost of treatment was US $2.22 billion, accounting for 40% of the total medical expenses in 2018 (2). Chronic disease is problematic as the number of target patients has increased and are often poorly controlled (3). Only 67.1% of hypertensive patients receive treatment, and of these, more than 26% have uncontrolled blood

pressure (4). DM has a lower level of control than high blood pressure; thus, only 60.8% of them are treated, and only 25.5% of them have blood glucose control (4).

For chronic disease care, disease management has been applied in the US and several European countries. Definitions of disease management emphasize continuity, comprehensiveness, and a multidisciplinary approach (5,6). Primary care plays contributes to chronic disease management if actualized in practice. Primary care is suitable for managing chronic diseases and most patients with major chronic diseases receive care from primary clinicians (7). Policymakers have become increasingly interested in high-quality primary care to address chronic disease challenges (8).

Over 90% of the medical care facilities in Korea are privately run. Physicians can own a private clinic regardless of their medical specialty, and 92.4% of physicians operating their clinics were qualified specialists in 2021 (9). Patients can visit any specialty clinic or hospital without referrals from regular physicians (10). In Korea, primary care is not well established (11) because of the absence of a gatekeeping function, a lack of general practitioners, dominance of the private sector (12), and insufficient incentives for physicians to provide disease prevention services under the fee-for-service payment system (13).

Owing to these circumstances, the Korean government has launched several chronic disease management programs for patients with hypertension and diabetes in local clinics (14). From January 2019, a local clinic-based chronic disease management pilot program was conducted by the National Health Insurance Service (NHIS), which is the single insurer of national health insurance in Korea. This program aimed to improve blood pressure or glucose level control rate and delay or prevent complications through continuous treatment (15). Moreover, it is designed using four multicomponent interventions provided in a primary care clinic (16). This program features primary care physicians and care coordinators, such as nurses and nutritionists.

Thus far, there has been little evidence of the effectiveness of this pilot program. To evaluate program effectiveness, using indicators such as the control rate of hypertension/diabetes and the incidence of complications is appropriate. However, since this program is in its early stages, there are limited data to analyze these indicators. Therefore, medication adherence was used as the outcome variable in this study. Medication adherence is not the final outcome variable of disease management programs; however, several researchers have reported that medication adherence is associated with control of blood pressure, blood glucose level, hospitalization, and death caused by cardiovascular diseases (17,18).

We aimed to evaluate the short-term effect of the chronic disease management pilot program by examining the improvement of medication adherence among patients with hypertension and diabetes.

Materials and Methods

Study design and data sources

In 2019, we performed a one-year retrospective propensity-matched case-control study using two datasets from the NHIS in Korea. First, national health insurance claims data, which are national-level administrative data that include information on the diagnosis, procedures, prescription drugs, and medical services utilized by patients, were utilized. Second, data about the services delivered and the monitoring results while conducting the local clinic-based chronic disease management pilot program were collected.

Intervention overview

Patients with hypertension or diabetes who were willing to participate in the pilot program completed the application and consent forms. A maximum of 300 people were registered with a local clinic to participate in the pilot program. If a patient died or expressed an intention to discontinue, their participation was terminated.

The implementation period of the program was one year and comprised care planning, educational counseling, patient management, and evaluation. A local clinic physician established an in-

dividual care plan through a comprehensive evaluation that included a questionnaire, along with physical and clinical examinations. A physician or care coordinator (nurse or nutritionist) performed patient management through offline or online (phone, letter, e-mail, mobile devices, etc.) contact and provided standardized educational content on disease and complication management and lifestyle modification (16). According to the patient management status, the degree of achievement of the care plan goal was periodically monitored and evaluated within at least six months. Based on the clinical test and evaluation results, the care plan was revised.

A care plan was established for all patients participating in the program; however, educational counseling, patient management, and evaluation were provided differently depending on doctors' recommendations and the patients' situations (15). Patients paid about US $4 for care plans, a minimum of US $3 and a maximum of US $19 for education, and US $2 for an evaluation as a co-shared cost.

Study sample

To select the study sample, patient criteria for chronic disease management pilot intervention were first considered, and exclusion criteria were applied per our study purpose. All patients aged 30 years or older with hypertension (I10–I13, I15) and diabetes (E10–E14) who completed care planning in February 2019 and participated in the pilot program for at least one year were selected as the experimental group. Patient exclusion criteria included 1) patients who were abandoned in the follow-up owing to death, and those admitted in hospitals and nursing homes; 2) patients with DM who used insulin injections; and 3) patients who had only one claim for hypertension or diabetic medicine or less than 14 days of prescription use before and during the intervention period. Among the 12 751 patients in the experimental group, 8135 were selected and 4616 patients were excluded. We restricted the potential control sample that included patients aged 30 years or older with hypertension (I10–I13, I15) and diabetes (E10–E14) who visited local clinics that were in the same area as where the pilot program was conducted in February 2019. Control group selection was based on the same exclusion criteria as used for case selection. Among 523 469 patients, 320 036 were extracted after exclusions. To minimize the effects of potential confounding factors, propensity score matching (PSM) was used. After PSM (1:1, nearest-neighbor matching), two new groups were obtained, each with 8044 patients.

Staff working at the local clinics participating in the pilot program explained the intention of the survey to the participants and obtained informed consent from each participants. This study was approved by Sangji University Institutional Review Board (approval number: 1040782-200427-HR-07-65).

Variables

The dependent variable in this study was medication adherence, which measured as the medication possession ratio (MPR): calculated as the ratio of the total number of days supplied with medication during the study period to the total number of days in the study period (19–21). Previous researchers (22,23) reported that the MPR method is the best available measurement of medication adherence using administrative data. Based on previous studies (24–26), medication adherence was defined as an MPR of ≥ 80%, and non-adherence was defined as an MPR <80%. We used the 80% cutoff point to classify patients as adherent or non-adherent since this cutoff point helps to easily identify patients who are managed appropriately (21). To calculate MPR, for the experimental group, the date of making of the care plan was used as the index date, and the visit date was used as the index date for the control group. One year before the index date was used as the baseline and one year after the index date was used as the experimental period.

The independent variable was participation in the pilot program, which was divided into the control group (usual care), partial intervention participation group, and full intervention participation group. Among the experimental group, patients who received all four components of a care plan,

education, management, and evaluation were considered the full intervention participation group, and those who received only one to three of the four components were considered the partial intervention participation group.

Based on a review of the literature related to medication adherence (27–29), sex, age, medical insurance, income level, residential area, comorbidity index, and medication adherence were selected as confounding factors at baseline for PSM.

Statistical analysis

To investigate the effects of the pilot program, a PSM strategy was used to construct a control group. Descriptive statistics were analyzed as mean with standard deviation and numbers of proportions (%). The differences between groups were tested using chi-square tests, *t*-tests, and analyses of variance. We conducted multivariate logistic regression analyses to examine the association between participation in the pilot program and medication adherence after adjusting for potential confounders. In this analyses, odds ratios and 95% confidence intervals were calculated. All analyses were conducted using SAS Enterprise Guide 7.1 (Cary, NC: SAS Institute Inc.), and two-tailed *P*-values less than 0.05 were considered significant.

Results

Participants' baseline characteristics

Table 1 presents participants' baseline characteristics before and after PSM. Before PSM, there were significant differences between the experimental and control groups.

Table 1: Homogeneity test on baseline characteristics of study subjects

Characteristics	***Pre-Matching***			***Post-Matching***		
	Intervention group n(%)	Control group n(%)	*P*-value*	Intervention group n(%)	Control group n(%)	*P*-value*
Sex						
Male	4,054 (49.8)	159,560 (49.9)	0.001	4,015 (49.9)	4,015 (49.9)	1.000
Female	4,081 (50.2)	160,476 (50.1)		4,029 (50.1)	4029 (50.1)	
Age (yr)						
<55	1,401 (17.2)	60,705 (19.0)		1,383 (17.2)	1,375 (17.1)	
≤55-<65	2,542 (31.2)	98,661 (30.8)	0.001	2,515 (31.3)	2,542 (31.6)	0.968
≤ 65-<75	2,369 (29.2)	91,709 (28.7)		2,340 (29.1)	2,339 (29.1)	
≥75	1,823 (22.4)	68,961 (21.5)		1,806 (22.5)	1,788 (22.2)	
Mean (SD)	65.7 (11.2)	64.8 (11.5)	0.001	65.3 (11.2)	65.3 (11.2)	0.878
Insurance type						
National Health Insurance	7,414 (91.9)	302,472 (94.5)	0.001	7,328 (91.1)	7,328 (91.1)	1.000
Medical Aid	721 (8.9)	17,564 (5.5)		716 (8.9)	716 (8.9)	
Income rank						
0	786 (9.7)	20,955 (6.6)		716 (8.9)	716 (8.9)	
1	1,423 (17.5)	49,411 (15.4)		1,226 (15.2)	1,226 (15.2)	
2	1,080 (13.3)	38,904 (12.1)	<0.001	973 (12.1)	973 (12.1)	0.807
3	1,264 (15.5)	49,054 (15.3)		1,218 (15.1)	1,218 (15.1)	
4	1,595 (19.6)	59,869 (18.7)		1,503 (18.7)	1,503 (18.7)	
5	1,987 (24.4)	101,843 (31.8)		2,408 (29.9)	2,408 (29.9)	
Living area						
Metropolitan	7,258 (89.2)	234,241 (73.2)		7,183 (89.3)	7,183 (89.3)	

Table 1: Continued…

City	877 (10.8)	79,810 (24.9)	< 0.0001	861 (10.7)	861 (10.7)	1.000
Rural area	0 (0.0)	5,985 (1.9)				
CCI						
0	5,488 (67.5)	218,244 (68.2)	< 0.0001	5,433 (67.5)	5,433 (67.5)	1.000
1	1,433 (17.6)	50,844 (15.9)		1,412 (17.6)	1,412 (17.6)	
2+	1,214 (14.9)	50,948 (15.9)		1,199 (14.9)	1,199 (14.9)	
Baseline MPR						
Hypertension						
≥80%	6,008 (84.5)	239,494 (84.8)	0.475	5,963 (84.5)	5,964 (84.5)	0.981
<80%	1,103 (15.5)	42,939 (15.2)		1,093 (15.5)	1,092 (15.5)	
Diabetes Mellitus						
≥80%	2,433 (81.4)	93,236 (83.5)	0.003	2,410 (81.5)	2,422 (81.9)	0.687
<80%	555 (18.6)	18,454 (16.5)		548 (18.5)	536 (18.1)	

Abbreviations: CCI, Charlson Comorbidity Index; MPR, Medication Possession Ratio
Note: * Chi-square (level of significance *P*=0.05)

Baseline characteristics of participants by program participation

The proportion of participants in the full component intervention in the experimental group with hypertension and diabetes were 43.2% and 42.6%, respectively. Tables 2 and 3 show the baseline characteristics of participants in the pilot program. Among patients with hypertension and diabetes, the distribution of sex and residence indicated significant differences by intervention participation. The proportion of men and metropolitan residents who participated in the full component intervention was higher than that of other groups. The results were the same among the patients with hypertension and diabetes.

Table 2: Baseline characteristics of subject by intervention participation after matching (Hypertension)

Characteristics	***Intervention group***		***Control group n(%)***	***P-value****
	Full component intervetion n(%)	Partial component intervention n(%)		
Sex				
Male	1,551 (50.9)	1,921 (47.9)	3,472 (49.2)	0.046
Female	1,496 (49.1)	2,088 (52.1)	3,584 (50.8)	
Age (years)				
<55	483 (15.8)	630 (15.7)	1,111 (15.7)	
≤55-<65	922 (30.3)	1,239 (30.9)	2,187 (31.0)	
≤65-<75	907 (29.8)	1,203 (30.0)	2,089 (29.6)	0.987
≥7	735 (24.1)	937 (23.4)	1,669 (23.7)	
Mean (SD)	65.9 (11.1)	65.7(11.1)	65.8(11.2)	0.787
Insurance type				
National Health Insurance	2,804 (92.0)	3,640 (90.8)	6,444 (91.3)	0.192
Medical Aid	243 (8.0)	369 (9.2)	612 (8.7)	
Income rank				
0	243 (8.0)	369 (9.2)	612 (8.7)	
1	540 (17.7)	707 (17.6)	1,276 (18.1)	
2	413 (13.6)	525 (13.1)	910 (12.9)	
3	476 (15.6)	635 (15.8)	1,131 (16.0)	0.883

Table 2: Continued…

4	614 (20.1)	779 (19.4)	1,363 (19.3)	
5	761 (25.0)	994 (24.8)	1,764 (25.0)	
Living area				
Metropolitan	2,894 (95.0)	3,418 (85.3)	6,312 (89.5)	<0.0001
Small city	153 (5.0)	591(14.7)	744 (105)	
CCI				
0	2,052 (67.4)	2,698 (67.3)	4,750 (67.3)	
1	537 (17.6)	697 (17.4)	1,234 (17.5)	0.997
2+	458 (15.0)	614 (15.3)	1,072 (15.2)	
MPR				
≥80%	2,591 (85.0)	3,372 (84.1)	5,964 (84.5)	0.569
<80%	456 (15.0)	637 (15.9)	1,092 (15.5)	

Note: * Chi-square (level of significance p=0.05)

Table 3: Baseline characteristics of subject by intervention after matching (DM**)**

Characteristics	***Intervention group***		***Control group n(%)***	***P-value****
	Full Component intervention n(%)	Partial Component intervention n(%)		
Sex				
Male	658 (58.2)	948 (51.9)	1,606 (54.3)	0.004
Female	473 (41.8)	879 (48.1)	1,352 (45.7)	
Age (years)				
<55	188 (16.6)	319 (17.5)	489 (16.5)	
≤55-<65	364 (32.2)	586 (32.1)	961 (32.5)	0.980
≤65-<75	328 (29.0)	537 (29.4)	869 (29.4)	
≥75	251 (22.2)	385 (21.1)	639 (21.6)	
Mean (SD)	65.2(10.7)	65.0(11.2)	65.1(11.0)	0.863
Insurance type				
National Health Insurance	1,025 (90.6)	1,609 (88.1)	2,634 (89.0)	0.096
Medical Aid	106 (9.4)	218 (11.9)	324 (11.0)	
Income rank				
0	106 (9.4)	218 (11.9)	324 (10.9)	
1	220 (19.5)	320 (17.5)	546 (18.5)	
2	136 (12.0)	242 (13.3)	368 (12.4)	0.514
3	181 (16.0)	259 (14.2)	458 (15.5)	
4	223 (19.7)	366 (20.0)	564 (19.1)	
5	265 (23.4)	422 (23.1)	698 (23.6)	
Living area				
Metropolitan	1,051 (92.9)	1,609 (88.1)	2,660 (89.9)	0.000
Small city	80 (7.1)	218 (11.9)	298 (10.1)	
CCI				
0	782 (69.1)	1,242 (68.0)	2,024 (68.4)	
1	191 (16.9)	332 (18.2)	523 (17.7)	0.939
2+	158 (14.0)	253 (13.8)	411 (13.9)	
MPR				
≥80%	925 (81.8)	1,485 (81.3)	2,422 (81.9)	0.869
<80%	206 (18.2)	342 (18.7)	536 (18.1)	

Note: * Chi-square (level of significance p=0.05)

Effect of multicomponent chronic disease management pilot program

Table 4 presents the multiple logistic regression analysis results regarding pilot intervention with medication adherence adjusted by confounding variables. The analysis results were similar in patients with hypertension and diabetes. Compared with the control group, patients who participated in the full components program were more likely to be medication adherents. However, patients in the experimental group who participated in the partial program and control group did not significantly differ in medication adherence.

Table 4: Multiple logistic regression models to predict the medication adherent at 1-year follow up

Variables	*Hypertension*	*Diabetes Mellitus*
	OR [95% CI]	OR [95% CI]
Full component intervention group	1.23 [1.03-1.45] *	1.64 [1.24-2.17]**
Partial component intervention group	1.08 [0.93-1.25]	1.23 [0.98-1.53]
Control group (Ref.)	1.00	1.00
-2Log Likelihood	6734.10	1763.94
Hosmer-Lemeshow χ^2	6.16	14.50

Notes: Adjusted by sex, age, insurance type, income rank, living area, CCI, baseline MPR
* $P < 0.05$, ** $P < 0.001$

Discussion

Based on our results, the possibility of medication adherence in patients with hypertension and diabetes who participated in the full component program was significantly higher than compared to other groups. The results are similar to those of previous studies conducted in Korea (12) and previous international studies (30,31). These findings support of the results of previous studies (32,33) that indicated that multicomponent interventions were more effective than single interventions in improving medication adherence. However, among the experimental group, the number of patients who participated in the full component program was less than 50%, indicating that the pilot program was effective in less than half of the targeted patients.

To establish a national chronic disease management program for improving medication adherence in primary care settings, several considerations should be addressed. First, the low participation rate in the full component program can be explained by patients' perception and the burden of co-payment under the fee-for-service system for each component. Korean patients take it for granted that they receive a prescription for drugs and pay for medical treatment; however, if only education or counseling is implemented, the rejection response of patients to co-payment is considerable (16). Consequently, the participation rate in the full component program is low, and it is difficult to achieve the goals of chronic disease management. Previous studies reported that patients with a low-cost burden continue to participate in chronic care (34), and that co-payment reduction is effective in managing chronic disease (18,35). Therefore, considering financial incentives for patients as an additional component of the pilot program is crucial.

Second, there are issues regarding the quality and reimbursement system of primary care in Korea. In previous studies, for high-quality management of patients with chronic diseases in primary care, several measures were suggested: productive interactions between the practice team and patients that consistently provide the assessments; support for self-management, optimization of therapy, and follow-up (36,37) payment reform (38); physicians taking sufficient time to manage patients (3); patient-team partnerships; and prompt access to care (39). In the context of physician–patient interactions in ordinary Korean local clinic settings, primary care physicians cannot care-

fully assess noncompliance with antihypertensive drugs and inform patients about hypertension management because of time shortages (40). Additionally, regarding the role or composition of the coordinated multidisciplinary care team, a previous study (41) reported that an ideal way to deliver services at the primary care level involves a team of providers, and our results showed that team-based comprehensive services were effective in chronic disease management. However, in Korea, the private sector dominates healthcare services, which is also the case in the primary care sector. Nevertheless, primary care physicians are reimbursed by their outpatients on a fee-for-service basis. Under this system, physicians are incentivized to increase the volume and intensity of service (42). Accordingly, providing team-based comprehensive chronic disease management initiated by local clinic physicians is practically difficult without any financial compensation in Korean primary care settings.

This study has several limitations. First, medication adherence was calculated using MPR; however, MPR has a limitation in that it is not possible to determine whether the patient took the medication. Second, the number of local clinics included in the experimental group was 324, which is only 1.03% of the Korean local clinics in 2019, and no local clinics located in rural areas participated. Thus, the generalization of the results is limited. A follow-up study with a sufficient number of local clinics is required in the future.

Conclusion

To operate clinic-based interventions effectively as a national system, an incentive system should be established so that patients can comprehensively receive all four types of services (care planning, education and counseling, patient management, and checkup and evaluation). Education and counseling, as well as patient management protocols, should be improved and efficiently managed to support self-care—a key component in the chronic disease management model—and the reimbursement system should be advanced to efficiently support chronic disease management in clinics.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by authors.

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Conflicts of Interest

All the authors declare that they have no relevant conflicts of interest.

References

1. Dennis SM, Zwar N, Griffiths R, et al (2008). Chronic disease management in primary care: from evidence to policy. *Med J Aust,* 188(S8):S53–S6.
2. National Health Insurance Service (2020). *2019 Statistics of National Health Insurance*. NHIS. Wonju.
3. Østbye T, Yarnall KSH, Krause KM, et al (2005). Is there time for management of patients with chronic diseases in primary care? *Ann Fam Med*, 3:209–14.
4. Ministry of Health and Welfare, Korean Disease Control and Prevention Agency (2020). *Korean Health Statistics 2019*. Korean Health Statistics, KDCA. Cheongju.
5. Rijken M, Bekkema N, Boeckxstaens P, et al (2014). Chronic disease management programmes: an adequate response to patients' needs? *Health Expect*, 17:608–21.
6. Reynolds R, Dennis, S, Hasan I, et al (2018). A systematic review of chronic disease management interventions in primary care. *BMC Fam Pract*, 19:11.
7. Rothman AA, Wagner EH (2003). Chronic illness management: what is the role of primary care? *Ann Intern Med*, 138:256–261.

8. Russell GM, Dahrouge S, Hogg W, et al (2009). Managing chronic disease in Ontario primary care: the impact of organizational factors. *Ann Fam Med*, 7:309–18.
9. Statistics of Korea (2021). *Annual Report of Healthcare*. Statistics of Korea. Sejong.
10. Lee JY, Eun SJ, Kim HJ, Jo M (2016). Finding the primary care providers in the specialist-dominant primary care setting of Korea: A cluster analysis. *PLoS One*, 11:e0161937.
11. Cho Y, Chung H, Joo H, et al (2020). Comparison of patient perceptions of primary care quality across healthcare facilities in Korea: a cross-sectional study. *PLoS One*, 15:e0230034.
12. Choi YJ, Kim YT, Yi HS, et al (2021). Effects of community-based interventions on medication adherence and hospitalization for elderly patients with type 2 diabetes at primary care clinics in South Korea. *Int J Environ Res Public Health*, 18:3396.
13. Sung NJ, Choi YJ, Lee JH (2018). Primary care comprehensiveness can reduce emergency department visits and hospitalization in people with hypertension in South Korea. *Int J Environ Res Public Health*, 15:272.
14. Kim HS, Yoo B, Lee EW (2018). Evaluation of the national chronic diseases management policy: performance and future directions. *Public Health Aff*, 2:105–20.
15. Ministry of Health and Welfare (2019). *Guide of Primary Care Based Chronic Disease Management Pilot Program*. MOHW. Sejong,
16. Song E, Kim Y, Ji S (2021). Impact of a primary health care chronic diseases management pilot program. *Korean J Med*, 96:7–12.
17. Dimatteo MR, Giordani PJ, Lepper HS, et al (2002). Patient adherence and medical treatment outcomes: a meta-analysis. *Med Care*, 40:794–811.
18. Kim JA, Kim ES, Lee EK (2017). Evaluation of the chronic disease management program for appropriateness of medication adherence and persistence in hypertension and type-2 diabetes patients in Korea. *Medicine (Baltimore)*, 96: e6577.
19. Andrade SE, Kahler KH, Frech F, et al (2006). Methods for evaluation of medication adherence and persistence using automated databases. *Pharmacoepidemiol Drug Saf*, 15:565–74.
20. Hong JS, Kang HC (2011). Relationship between oral antihypergliycemic medication adherence and hospitalization, mortality, and healthcare costs in adult ambulatory care patients with type 2 diabetes in South Korea. *Med Care*, 49:378–84.
21. Shin S, Song H, Oh SK, et al (2013). Effect of antiyhypertensive medication adherence on hospitalization for cardiovascular disease and mortality in hypertensive patients. *Hypertens Res*, 36:1000–5.
22. Cramer JA, Benedict A, Muszbek N, et al (2008). The significance of compliance and persistence in the treatment of diabetes, hypertension and dyslipidemia: a review. *Int J Clin Pract*, 62:76–87.
23. Karve S, Cleves MA, Helm M, et al (2008). An empirical basis for standardizing adherence measures derived from administrative claims data among diabetic patients. *Med Care*, 46:1125–33.
24. Halpern MT, Khan ZM, Schmier JK, et al (2006). Recommendations for evaluating compliance and persistence with hypertension therapy using retrospective data. *Hypertension*, 47:1039–48.
25. Karve S, Cleves MA, Helm M, et al (2009). Good and poor adherence: optimal cut-point for adherence measuring using administrative claims data. *Curr Med Res Opin*, 25:2303–10.
26. Hansen RA, Kim MM, Song L, et al (2009). Comparison of methods to assess medication adherence and classify nonadherence. *Ann Pharmacother*, 43:413–22.
27. Park JH, Shin Y, Lee SY, Lee SI (2008). Antihypertensive drug medication adherence and its affecting factors in South Korea. *Int J Cardiol*, 128:392–398.
28. Sung SK, Lee SG, Lee KS, et al (2009). First-year treatment adherence among outpatients initiating antihypertensive medication in Korea: results of a retrospective claims review. *Clin Ther*, 31:1309–20.
29. Kim S, Shin DW, Yun J, et al (2016). Medication adherence and the risk of cardiovascular mortality and hospitalization among patients with newly prescribed antihyper-

tensive medications. *Hypertension*, 67:506–12.
30. Magid DJ, Ho PM, Olson KL, et al (2011). A multimodal blood pressure control intervention in 3 healthcare systems. *Am J Manag Care*, 17:e96–103.
31. Wu JR, Cummings DM, Li Q, et al (2018). The effect of a practice-based multicomponent intervention that includes health coaching on medication adherence and blood pressure control in rural primary care. *J Clin Hypertens (Greenwich)*, 20:757–64.
32. Viswanathan M, Golin CE, Jones CD, et al (2012). Interventions to improve adherence to self-administered medications for chronic diseases in the United States: a systematic review. *Ann Intern Med*, 157:785–95.
33. Conn VS, Ruppar TM, Chase JA, et al (2015). Interventions to improve medication adherence in hypertensive patients: systematic review and meta-analysis. *Curr Hypertens Rep*, 17:94.
34. Mackey K, Parchman ML, Leykum LK, et al (2012). Impact of the chronic care model on medication adherence when patients perceive cost as barrier. *Prim Care Diabetes*, 6:137–42.
35. Asch DA, Troxel AB, Stewart WF, et al (2015). Effect of financial incentives to physicians, patients, or both on lipid levels: a randomized clinical trial. *JAMA*, 314:1926–35.
36. Wagner EH (2000). The role of patient care teams in chronic disease management. *BMJ*, 320:569-72.
37. Wagner EH, Austin BT, Davis C, et al (2001). Improving chronic illness care: translating evidence into action. *Health Aff (Millwood)*, 20:64–78.
38. Bodenheimer T, Wagner EH, Grumbach K (2002). Improving primary care for patients with chronic illness: the chronic care model, part 2. *JAMA*, 288:1909–14.
39. Bodenheimer T, Ghorob A, Willard-Grace R, et al (2014). The 10 building blocks of high-performing primary care. *Ann Fam Med*, 12:166–71.
40. Kim JH, Lee WY, Hong YP, et al (2014). Psychometric properties of a short self-reported measure of medication adherence among patients with hypertension treated in a busy clinical setting in Korea. *J Epidemiol*, 24:132–40.
41. Jimenez G, Matchar D, Koh GC, Car J (2020). Multicomponent interventions for enhancing primary care: a systematic review. *Br J Gen Pract*, 71:e10–e21.
42. Kwon S (2003). Payment system reform for health care providers in Korea. *Health Policy Plan*, 18:84–92.