



Community Primary Care-Based Hypertension and Diabetes Management Program in Korea: Evaluation of Participating Patients and Doctors

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Abstract

Background: This study was conducted to examine the effectiveness of a community-based primary care program focused on hypertension and diabetes in Korea.

Methods: We selected patients and doctors who participated in the community-based primary care program as study subjects from Aug 2015 to Jan 2016. Patients and physicians completed a survey, and medical records were reviewed to obtain information regarding clinical variables. Change in the baseline recognition of diseases, motivation for changing health behavior, medical services utilization, doctor-patient relationship were assessed after participation in the program.

Results: Both patients and physicians indicated there was improvement in recognition of disease, motivation for changing health behavior, medical services utilization, and doctor-patient relationship (All of recognition scores were above the median point). Patient health behavior such as exercise, smoking, drinking and diet and clinical variables (blood pressure and blood glucose and cholesterol level) also showed significant improvement.

Conclusion: The community-based primary care program was found to be helpful in improving hypertension and diabetes patients' overall outcomes and their healthcare providers' behavior.

Keywords: Hypertension; Diabetes; Primary care; Chronic disease; Community medicine

Introduction

In Korea, the prevalence of hypertension and diabetes, were 29.1% (5.9 million patients) and 11.3% (2.7 million), respectively, in 2016. As the medical costs of hypertension and diabetes patients continue to increase (1), the associated socioeconomic costs of in Korea are also rising.

Provision of additional attention to disease prevention and health promotion are essential in order to reduce the risk of chronic diseases such as hypertension and diabetes and to increase patient quality of life, and consequently reduce medical costs. Previous studies have shown changes in behavioral factors influencing overall health, such



as smoking, drinking, exercising, eating habits and similar factors, can reduce disease risk and mortality by half (2). A primary care system has a positive effect on preventing and managing chronic diseases such as hypertension (3) and diabetes (4), and therefore reduces medical costs. However, a recent Organization for Economic Cooperation and Development (OECD) report has pointed out that the vulnerability of primary care is one of the problems faced by Korea's healthcare system (5); Absence of a gatekeeping function for primary care and transfer to tertiary care as problems in Korea. Accordingly, the OECD advised Korea to systematize the structure of clinics and to design community-based primary care models to prepare for a rapidly aging population and to manage chronic diseases appropriately (6). To tackle this problem, the WHO has proposed the Innovative Care for Chronic Conditions model which places "informed, activated patients" and "prepared, proactive practice teams" at the core of chronic disease management (7).

As a result, the Korean government adopted the Community-based Primary Care Program as a national task, and launched a program in Oct 2014. One previous study investigated the effectiveness of this program using medical claim data and showed that medication adherence was increased among the program participants compared to control group (8). However, that study has limitation, it did not use patients survey or doctor survey, did not measure clinical measurements, such as blood pressure and blood sugar and cholesterol concentrations.

The objective of this program was to develop comprehensive logic model for the effectiveness of the program and analyzed its effects according to the causality of outcomes, and evaluated comprehensive aspects of effects by measuring not only the patient but also the physician's perceived effects especially of hypertension and diabetes care as a result of their participation in the program.

Methods

The Community-Based Primary Care Program

The core content of the program was to reinforce the role of primary care physicians and to establish a self-management support system tailored to regional conditions. Additional health-related education and consultations (e.g., regarding nutrition, exercise, and smoking cessation) were conducted by physicians or provided by community-based primary care support centers.

Analysis Model, Study Subjects and Research Methods

Fig. 1 illustrates the analysis model used to investigate the effects of the program. The analysis model was designed using evaluation indices summarized by Kim et al (9) based on the logic model of the program. The logic model was developed through review of previous studies and logic models, focus group interview and Delphi study of primary care physician and researchers.

The survey was completed by patients visiting primary care institutions from Aug 2015 to Jan 2016 who participated in the program (duration of follow-up: 6 months). Among 117 clinics participating in the program, 22 (18.8%) clinics with at least 50 patients participating in the program monthly for six months between Aug 2015 and Jan 2016 were selected. Of these 22 clinics, 18 consenting clinics participated in the survey. Of all patients visiting these participating clinics, 9722 participated in the program and 868 answered the survey (response rate of 8.9%). Five participants with unclear disease status were excluded. Thus, 863 participants were included in the final analyses. A self-administered structured questionnaire was completed by the participants at each clinic between Apr 4 and Apr 29, 2016. In addition, patient blood pressure and blood glucose and cholesterol concentrations were obtained from the medical records of each clinic.

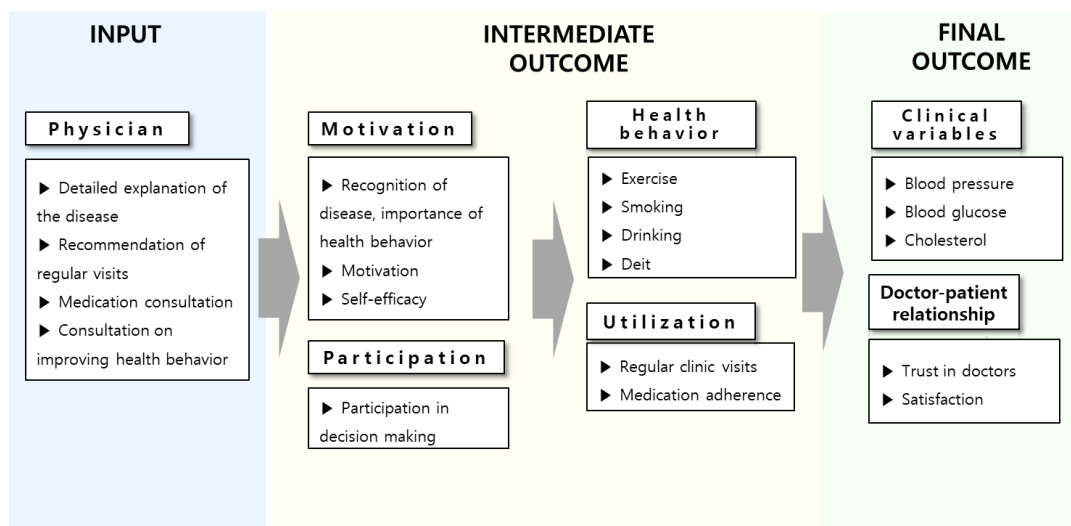


Fig. 1: Impact analysis model

Physician experience surveys were conducted for all 117 registered clinics (as of Apr 30, 2016). Postal surveys using structured questionnaires were conducted from May 17 to 31, with 49 doctors responded (response rate 41.9%).

Survey Instrument

The patient questionnaires addressed general patient characteristics, changes in recognition of disease, awareness, motivation for improvement of health behaviors (such as self-efficacy) health behaviors (such as exercise, smoking, drinking and diet), utilization of medical services (such as regular clinic visit and adherence to medication protocols), and evaluation of the patient's trust in their physician and satisfaction with the physician-patient relationship. The physician questionnaires examined whether a patient was encouraged to improve their health behaviors after participating in the program, and whether the program helped to build trust with the patient and improve the physician-patient relationship. Questionnaires also included items such as changes in practice and counseling behaviors, physician's perception of their patient's practical effort in disease management, persistence of medication use, and in continuous clinic visits. For questionnaire items asking for agreement with respect to changes in motivation, health behavior, satisfac-

tion and consultation time, a four-point Likert scale (strongly agree, agree, disagree, and strongly disagree) was used.

Statistical Analysis

For questionnaire items addressing agreement with changes, the Chi-square test was used. Change in baseline scores for health behaviors after participation in the program were analyzed using the paired *t*-test. Clinical measurements were analyzed using the paired *t*-test or Wilcoxon signed rank test to assess the differences between values measured six months before and after the program. All analyses were performed using SAS ver. 9.4 (SAS Institute, Gary, NC, USA).

Ethical approval

Ethical issues were reviewed and approved by the Institutional Review Board of National Evidence-based Collaborating Agency (approval No. NE-CAIRB16-006).

Results

Patient Experience Participating in the Program

General Characteristics of Patients

Table 1 presents the general characteristics of the study participants upon registration in the pro-

gram. Of the participating patients, 511 were women (60.2%) and 338 were men (39.8%). The majority of the patients were 70 to 80 yr of age. The most common disease was hypertension,

diagnosed in 524 patients (60.7%), followed by diabetes mellitus (134 patients; 15.5%) and comorbid hypertension and diabetes mellitus (205 patients; 23.8%).

Table 1: General characteristics of participating patients and doctors

| <i>Variable</i> | | <i>N</i> | <i>%</i> |
|----------------------|------------------------------|----------|----------|
| Patients | | | |
| Sex | Male | 338 | 39.8 |
| | Female | 511 | 60.2 |
| Age(yr) | <50 | 89 | 10.5 |
| | 50-59 | 228 | 27 |
| | 60-69 | 282 | 33.4 |
| | ≥70 | 245 | 29 |
| Disease | Hypertension | 524 | 60.7 |
| | Diabetes | 134 | 15.5 |
| | Hypertension+Diabetes | 205 | 23.8 |
| Job | Professional | 26 | 3.2 |
| | Office job | 42 | 5.1 |
| | Sales and service | 45 | 5.5 |
| | Agriculture/forestry/fishery | 58 | 7 |
| | Simple labor | 64 | 7.8 |
| | Student | 1 | 0.1 |
| | Housemaker | 304 | 36.9 |
| | Unemployed | 125 | 15.2 |
| | Other | 159 | 19.3 |
| Doctors | | | |
| Sex | Male | 40 | 83.3 |
| | Female | 8 | 16.7 |
| Age | 30-49 | 15 | 32.6 |
| | 50-59 | 27 | 58.7 |
| | ≥60 | 4 | 8.7 |
| Specialties | Internal medicine | 34 | 69.4 |
| | Family medicine | 7 | 14.2 |
| | General practice | 4 | 8.2 |
| | Other | 4 | 8.2 |
| Duration of practice | 1-5 yr | 8 | 16.3 |
| | 6-15 yr | 12 | 24.5 |
| | 16-20 yr | 20 | 40.8 |
| | ≥21 yr | 9 | 18.4 |

Increase in Disease Recognition and Motivation to Change Behavior after Participation in the program

Changes in patients' recognition of their disease and motivation to change their behavior are presented in Table 2. Mean scores for all items were

greater than 2.5 points (median=2.5), indicating that participants perceived that their recognition of their disease and motivation to improve their health behaviors had increased after participating in the program.

Table 2: Increase in recognition of disease and motivation for changing health behavior, medical services utilization, and doctor-patient relationship (median point = 2.5)

| <i>Survey items</i> | <i>Scores (mean ± SD)</i> |
|---|---------------------------|
| Recognition and motivation | |
| Recognition of hypertension | 3.52 ± 0.52 |
| Recognition of blood pressure | 3.51 ± 0.53 |
| Importance of changing health behaviors | 3.53 ± 0.53 |
| Motivation to change health behaviors | 3.53 ± 0.52 |
| Confidence in changing health behaviors | 3.46 ± 0.57 |
| Medical services utilization | |
| Regular clinic visits | 3.58 ± 0.53 |
| Subjective medication adherence | 3.64 ± 0.49 |
| Doctor-patient relationship | |
| Trust in doctor | 3.56 ± 0.51 |
| Service satisfaction | 3.57 ± 0.51 |

Changes in Health Behaviors after Participation in the program

As shown in Table 3, there were significant changes in the participants' health behaviors after participating in the program in both hypertension

and diabetes patients. Smoking and drinking rates decreased significantly, while exercise behavior improved significantly in both hypertension and diabetes patients.

Table 3: Health behavior changes before and after participating in the program (unit: %, mean ± SD)

| <i>Survey items</i> | <i>Before</i> | <i>After</i> | <i>P-value^a</i> |
|-------------------------------------|---------------|--------------|----------------------------|
| Total | | | |
| Smoking (Yes) | 111 (13.7%) | 92 (13.4%) | 0.001 |
| Smoking amount (cigarettes per day) | 17.03 ± 8.64 | 12.08 ± 6.85 | 0.001 |
| Drinking (Yes) | 244 (30.4%) | 225 (28.1%) | 0.001 |
| Drinking frequency (per week) | 3.12 ± 1.99 | 2.34 ± 1.65 | 0.001 |
| Participation in exercise (Yes) | 546 (68.9%) | 661 (83.5%) | 0.001 |
| Exercise frequency (per week) | 3.73 ± 0.25 | 4.39 ± 2.74 | 0.001 |
| Hypertension patients | | | |
| Smoking (Yes) | 56(11.4%) | 42(8.5) | 0.001 |
| Smoking amount (cigarettes per day) | 17.05±8.49 | 12.34±6.15 | 0.001 |
| Drinking (Yes) | 155(32.0%) | 147(30.4%) | 0.021 |
| Drinking frequency (per week) | 3.28±2.01 | 2.52±1.69 | 0.001 |
| Participation in exercise (Yes) | 330(69.5%) | 404(85.1%) | 0.001 |
| Exercise frequency (per week) | 3.70±2.03 | 4.23±1.90 | 0.001 |
| Diabetes patients | | | |
| Smoking (Yes) | 24(19.7%) | 22(18.0%) | 0.5 |
| Smoking amount (cigarettes per day) | 16.55±9.00 | 12.27±6.85 | 0.001 |
| Drinking (Yes) | 27(22.3%) | 22(18.2%) | 0.063 |
| Drinking frequency (per week) | 2.67±1.85 | 1.87±1.41 | 0.011 |
| Participation in exercise (Yes) | 78(63.4%) | 98(79.7%) | 0.001 |
| Exercise frequency (per week) | 3.89±2.00 | 4.72±4.36 | 0.007 |

^a Chi-square test or paired t-test

Changes in Utilization of Medical Services after Participation in the Program

The scores assessing whether participation led to an increase in regular clinic visits and better subjective medication adherence were both over 2.5 points. Participants perceived that their regular clinic visits and subjective medication adherence had improved after enrollment (Table 2).

Changes in Physician-Patient Relationships after Participation in the Program

The results of survey items addressing changes in the participants' trust in doctor and satisfaction with service were presented Table 2. All scores for these items were greater than 3 points (median = 2.5), indicating that after participating in the program, the program participants' trust in their physician increased and service satisfaction improved.

Changes in Clinical Variables after Participation in the Program

Changes in blood pressure and blood glucose and cholesterol concentrations were evident six months after participating in the program. In hypertensive participants, mean systolic blood pressure decreased significantly from 133.26 mmHg prior to enrolment to 129.98 mmHg after 6 months of participation ($P=0.0015$; Fig. 2a). Diastolic blood pressure also decreased from 79.42 mmHg to 77.86 mmHg, although the difference was not statistically significant ($P=0.052$) (Fig. 2b). In hypertension and diabetes patients, HbA1c concentrations in decreased significantly from 7.02 mg/dl before participation to 6.64 mg/dl after the program ($P=0.0225$), and the mean fasting blood glucose concentrations decreased from 142.15 mg/dl to 135.00 mg/dl, although the difference was not statistically significant ($P=0.4555$; Fig. 2c and d). In diabetic partic-

ipants, changes in total and LDL cholesterol concentrations were not statistically significant ($P=0.07$ and $P=0.1665$, respectively), although the mean concentrations decreased to 183.04 mg/dl (versus 203.14 mg/dl prior to the program) and 95.09 mg/dl (versus 102.07 mg/dl), respectively after six months' participation in the program (Fig. 2e and f).

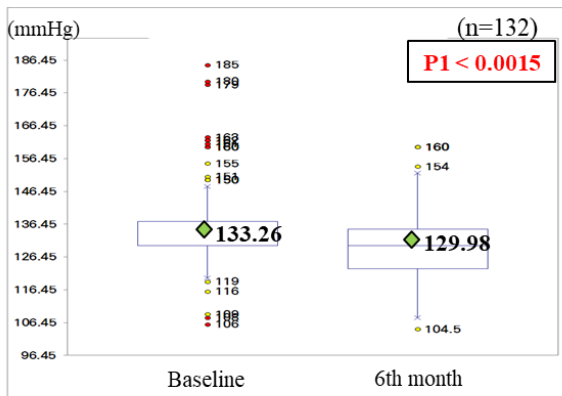
General Characteristics

The general characteristics of the physicians who responded to the survey are presented in Table 1. Among the participating physicians, 40 (83.3%) were male and 8 were female (16.7%).

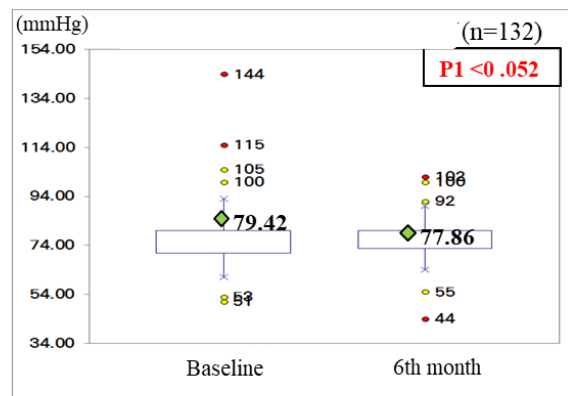
Change in Practice Pattern, Recognized Patient Health Behavior, Relationship with Patients, and Satisfaction with Practice after Participation in the Program

The participating physicians agreed that there were improvements in all aspects of their practice pattern (all scores were over the median of 2.5 points; Table 4). A substantial improvement was reported in the physician responses regarding "Encouraging patients to improve their lifestyle" (3.37 ± 0.60), while relatively little improvement was found in "Paying attention to and accepting the patient's opinion" (2.80 ± 0.74).

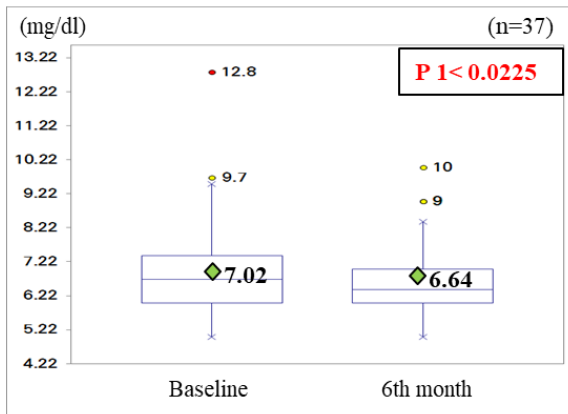
The physicians also agreed that there were improvements in all aspects of patient health behaviors (all scores were over the median of 2.5 points). A substantial improvement in the physician response regarding "Patient efforts to improve lifestyle" (3.14 ± 0.46) was reported, while relatively little improvement in "Regularity of patient visits" (2.60 ± 0.71) was noted. Finally, the physicians agreed that there were improvements in their relationships with their patients and satisfaction with practice.



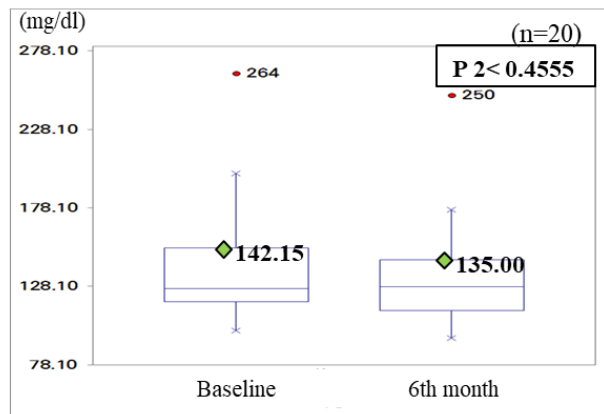
(a) Systolic blood pressure in hypertension patients



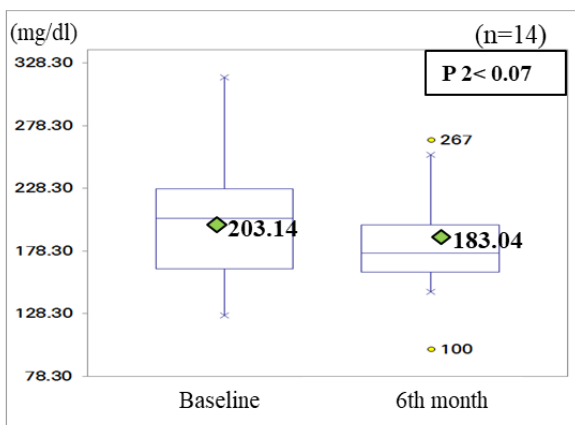
(b) Diastolic blood pressure in hypertension patients



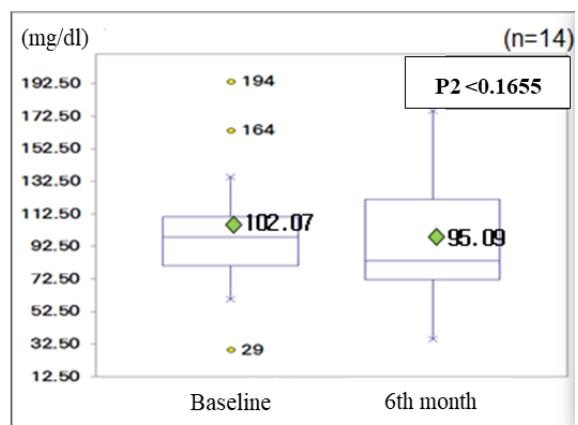
(c) HbA1c in hypertension and diabetes patients



(d) Fasting blood glucose in hypertension and diabetes patients



(e) Total cholesterol in diabetes patients



(f) LDL cholesterol in diabetes patients

Fig. 2: Change in clinical variables prior to participation in the program and after six months

P 1: Paired *t*-test, P2: Wilcoxon signed rank test

Table 4: Change in practice pattern, patient health behaviors, doctor's relationship with patients, and patient satisfaction with their doctors (median point = 2.5)

| <i>Survey items</i> | <i>(mean ± SD)</i> |
|--|--------------------|
| Practice pattern | |
| Encouraging patients to improve their lifestyle | 3.37 ± 0.60 |
| Helping patients to understand their disease easily and in detail | 3.24 ± 0.60 |
| Conducting essential tests | 2.90 ± 0.68 |
| Follow-up and continuity of care | 2.88 ± 0.70 |
| Paying attention and accepting patient opinions | 2.80 ± 0.74 |
| Assessing patient clinical problem/s comprehensively and considering it/them | 2.96 ± 0.71 |
| Patient health behaviors (as recognized by doctors) | |
| Medication adherence of patients | 2.91 ± 0.64 |
| Patient efforts to improve lifestyle | 3.14 ± 0.46 |
| Controlling blood pressure and glucose concentration | 2.78 ± 0.55 |
| Regularity of patient visits | 2.60 ± 0.71 |
| Doctor-patient relationship and satisfaction | |
| Trust and relationship between doctor and patient | 3.24 ± 0.72 |
| Patient satisfaction with doctors' practice | 3.10 ± 0.71 |

Discussion

Primary care is the core of a country's healthcare system. Several countries are making efforts to strengthen the foundations of primary care in their national healthcare systems (10, 11). Similar to our study results, most of these efforts to manage chronic diseases based on community and primary care have shown successful results. A study of low- and middle-income countries also reported that community-based lifestyle intervention programs led to a significant decrease in the blood pressure of patients with hypertension (12). In Canada, multidisciplinary primary care-based intervention programs have been found to be able to significantly increase the rate of reaching blood pressure goals in one year (13). When home-based interventions are provided for patients admitted for uncontrolled hypertension in the US (14), a randomized controlled trial conducted on patients with cardiovascular disease diagnosed <6 months ago revealed that the intervention program could lead to significant decrease in blood pressure levels and improvement

in blood pressure management (15). Primary care can promote continued care and outpatient visits (16, 17), physical exercise (18), and awareness of blood pressure levels (19).

The strength of this study compared to other previous studies was that the effectiveness of the program was analyzed using an impact analysis logic model that encompassed intermediate to final outcomes. Participating patients agreed that their recognition of their disease, motivation for changing the health behaviors, regular clinic visits, subjective medication adherence, and physician-patient relationship were improved. This study also found improvements in health-related behaviors such as smoking, drinking and exercise. As final outcomes, clinical variables such as blood pressure and blood glucose and cholesterol and HbA1c concentrations improved significantly. Within the context of our model, the improvements in the final outcomes might have been achieved through the achievement of intermediate outcomes. This possibility is supported by the findings of previous studies. For instance, motivating patients through intervention, provi-

sion of education by physicians, and physician consultation have influenced the improvement of patient motivation for self-management (20, 21). Such measures to promote motivation have led to improvement of health behaviors and adherence to medication protocols (22-24), the latter of reported to be better when health literacy and self-efficacy are high (25). Moreover, patients who believed that life habits influence hypertension were reported to be more likely to attempt to change their habits (24). Further, those with positive attitudes toward health have greater adherence to medication protocols and those with larger knowledge scores had better adherence to changing life habits (22). Improvement of health behaviors and medication adherence have led to reductions in blood pressure (26, 27) and positively influence satisfaction with the physician-patient relationship (20). The effects of the present study can be explained effectively according to the impact analysis logic model, in concordance with previous study results.

Our study also assessed the effectiveness of our program not only from the viewpoint of patients, but also from that of their doctors. Like the patients, their doctors also agreed that there was improvement in all aspects of their practice pattern, their patient health behaviors, doctor-patient relationships and satisfaction with practice. The symmetrical beliefs between patients and doctors can be interpreted to indicate the effectiveness of chronic disease management. For example, symmetry between patient and provider with respect to health locus of control (HLOC) beliefs was associated with objectively derived medication refill adherence in patients with comorbid diabetes and hypertension (28).

On the other hand, the perceived improvements were lower in physicians than in patients in all matched survey questions. The following reasons can be considered; first, as presented in a previous study (29), physicians tend to respond conservatively when assessing their patient's satisfaction with their care; second, because rather than measuring the direct changes of each patient, the physician's response was dependent upon their patient's descriptions of changes in their own

health behaviors, the physicians may have had little confidence in patient beliefs, health behavior changes, and satisfaction, etc.. Nevertheless, the most improved item in the physician's responses was "Encouraging patients to improve their lifestyle", which reflects the fact that the program focused on changing the patient's health behaviors.

The present study has several limitations. First, since the survey was conducted as a cross-sectional study, the degree of change after participating in the program as perceived by patients and physicians may be influenced by recall bias. In the survey, we asked patients to self-report their degree of change or improvement. Therefore, there might be a possibility of bias due to "generous" responses. Second, it is possible that patients who responded positively regarding the effectiveness of the program may have self-selected to participate in the survey, which could result in a selection bias. Therefore, it is possible the reported effects of the program could have been overestimated to some extent. Third, there was no control group for comparison with participating patients and physicians.

Conclusion

The present study is meaningful in that it developed a comprehensive logic model for the effectiveness of the program and analyzed its effects according to the causality of outcomes, and evaluated comprehensive aspects of effects by measuring not only the patient but also the physician's perceived effects. This study results imply that chronic diseases can be successfully controlled through community based primary care in other countries. In the future, it will be necessary to conduct further research to increase the internal and external validity of the results, such as comparing control groups, selecting representative subjects through random sampling, and expanding the geographic study area.

Journalism Ethics considerations

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

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Conflict of interest

The authors declare that there is no conflict of interests.

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