

Exploring Changes in Attitudes, Behaviors, and Self-Measured Health Data Through Lifestyle Modification Support by Community Pharmacists: Suito-Ogaki Selfcare (SOS) Trial

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Purpose: Contributing to public health by supporting people's health is the social mission of community pharmacists. This multi-center, prospective case series study aimed to evaluate changes in people's behavior and health states through community pharmacists' self-care support for healthy lifestyles.

Methods: The participants were recruited from voluntary adults aged ≥ 20 years who agreed to participate in the study, at community pharmacies in Gifu, Japan, between June and September 2021. Participants self-managed their lifestyles for six months while recording their health data, including blood pressure (BP), daily using devices (home BP monitor, body composition monitor, and activity meter) and a diet-recording app. They received lifestyle modification support at pharmacies at least once per month. Participants' subjective health status, attitudes, and behavioral changes were evaluated using self-report questionnaires. Due to the exploratory nature of this study, data were primarily analyzed descriptively.

Results: Fifty-four participants aged 20 to 77 (mean age: 49.6 years; female participant proportion: 55.6%) participated in this study. Their mean weekly BP shifted almost horizontally from baseline to week 24 (systolic BP: 118.8 to 121.5 mmHg; diastolic BP: 76.1 to 77.5 mmHg). At six months, 38.9% and 35.2% of the participants reported better overall health and mental health, respectively, than at baseline. Over 85% of the participants became more proactive in improving their lifestyles regarding salt intake, diet, weight loss, and exercise, although drinking and smoking habits were more challenging to change. All the participants reported that they intended to continue to improve their lifestyle.

Conclusion: The participants' responses suggested that community pharmacists' support helped increase participants' health awareness and promote their health-enhancing behaviors. However, its impact on health parameters should be further examined in future studies. More vigorous, tailored self-care support may be worth considering in developing a more effective, community-fitted health/well-being support system in Japan.

Keywords: community pharmacies, self-care, behavioral change, lifestyle modification, blood pressure, Japan

Introduction

With the global increase in life expectancy, accompanied by years of ill health or disability,¹ increasing healthy life years (ie, a period without health problems limiting daily life) has become the focus of public health. Notably, a support system that promotes health is essential for increasing healthy life years. In Japan, the super-aging society requires a community-based, integrated care system to ensure that people can live longer and independently in their familiar communities, receiving diverse life support.² Contributing to public health by supporting the maintenance and improvement of people's

health is a social mission of community pharmacists.³ Therefore, we aspire to build a community-fitted health and well-being support system centered on community pharmacies by promoting health literacy, which will contribute to prolonging healthy life expectancy and revitalizing the entire community.⁴ Community pharmacists can play an important role in increasing people's health awareness and supporting positive behavior change in them, which are necessary for health promotion.⁵

Japan is one of the top countries in the world in terms of longevity.¹ However, healthy life expectancy is around ten years (8.73 years in men and 12.06 years in women) shorter than life expectancy.⁶ Living with diseases or disabilities burdens individuals, their families, and society. It also accelerates the increase in healthcare expenditure, coupled with population aging.⁷ Therefore, shrinking this gap by prolonging healthy life years is one of the greatest priorities for improving public health and achieving a sustainable social security system in Japan.⁸

Noncommunicable diseases (NCDs) constitute major causes of unhealthy life years,⁹ among which hypertension is a leading risk factor for global deaths,¹⁰ and its reduction is the global target for the prevention of NCDs.¹¹ Hypertension is also a national health problem in Japan; it is estimated to be prevalent among 43 million people.¹² Hypertension is not only the leading risk factor for cardiovascular deaths in Japan,¹³ but it can also cause other conditions such as renal failure and dementia.¹² National Health-Promotion Project in the 21st Century (Health Japan 21 (II)), announced by the Ministry of Health, Labour and Welfare, aims to reduce the average systolic blood pressure (BP) of the entire Japanese population by 4 mmHg within 10 years by promoting antihypertensive measures in terms of such as diet, physical activity, and alcohol drinking.⁸ The goal of this population strategy is to lower the BP distribution of the entire nation. Lifestyle modifications, often led by healthcare professionals, can significantly reduce BP and are recommended regardless of the BP level.¹²

Recently, even in Japan, frailty among older adults has received attention as a priority for prolonging healthy life expectancy.¹⁴ Social support for individuals' health promotion may help prevent frailty, positively affecting the physical, psychological, and social aspects of people's life—the three domains of frailty.¹⁵ Frailty substantially increases the risk of disability, long-term care, and death.¹⁶ Therefore, its prevention, which should be started earlier instead of targeting only older adults,¹⁷ is an important mission of community care for extending healthy life expectancy.¹⁸

Facilitating self-care among community residents to contribute to public health is an important role of community pharmacies.¹⁹ The effectiveness and challenges of health-promoting interventions by community pharmacists have been well reported, primarily overseas,^{20–22} but they have recently been explored in Japan as well.^{23–26} However, inconsistent findings of previous studies²⁰ warrant further research on the effectiveness of pharmacist support for various purposes and methods. Additionally, most previous studies in Japan targeted people at risk for particular conditions,^{24,26} studies on self-care promotion among people, including healthy individuals, are scarce. Moreover, the reported behavioral changes or improvements in previous studies mainly depended on self-reporting; quantitative assessments using objective measures are rare.^{26,27} Furthermore, the intervention effects may vary in community settings. Thus, additional studies on community pharmacies' self-care support using both qualitative and quantitative assessments would provide helpful information for developing a community-fitted health support system by community pharmacies in Japan.

Therefore, this study aimed to explore the impact of community pharmacists' self-care support for lifestyle modifications on pharmacy visitors' behaviors and health parameters, particularly BP.

Materials and Methods

Study Design

This multicenter, prospective case series study (Suito-Ogaki selfcare [SOS] trial; UMIN000044881) aimed to observe changes in individuals' behaviors and health states through lifestyle modification and behavior change support provided by community pharmacists. The study was conducted in community pharmacies in Gifu, Japan, belonging to the Ogaki Pharmacists Association. The participants were recruited from pharmacies between June and September 2021. The target sample size was set to 60 to ensure feasibility (approximately 30 pharmacies would participate in the study, and two persons could be recruited at each pharmacy during the recruitment period). The study was approved by the Academic Research Ethical Review Committee of the Gifu Prefecture Pharmacists Association (approval reference number:

21070501). This study was conducted in accordance with the provisions of the Declaration of Helsinki and the Ethical Guidelines for Medical and Health Research Involving Human Subjects in Japan.

Participants

This study included individuals who met the following inclusion criteria: (1) provided written informed consent, (2) were adults (aged 20 years or older), and (3) were able to manage themselves using devices and smartphone apps at home, according to instructions. People were excluded if they were under treatment for chronic disease and attending physicians did not permit their study participation or if pharmacists judged their participation to be inappropriate. Physicians submitted written permission if their patients were allowed to participate despite hypertension.

Self-Care and Pharmacists' Lifestyle Modification Support

At enrollment, participants received detailed instructions on how to use the devices and apps (described below) to measure their health data at home. The necessary devices were provided to the participants. The participants managed their lifestyles for six months and recorded their daily health data using devices and apps. They were asked to visit the pharmacy at least once per month to receive lifestyle modification support. During the participants' visit, pharmacists provided advice on lifestyle modifications regarding salt intake, diet, weight, exercise, alcohol intake, and smoking in reference to the guidelines for the management of hypertension,¹² based on self-measured health data. Pharmacists were gathered and instructed on how to provide advice before the study.

Assessments and Measures

Data were collected at the pharmacies or at home. Registration and other data collected at the pharmacies using questionnaires were sent to the study office. The study office kept track of the progress and regularly updated the participating pharmacies accordingly.

Baseline Assessment

At baseline, data on patient attributes (age and sex) and use of antihypertensive agents were collected. Additionally, baseline health state and lifestyle habits were assessed using the Questionnaire for Medical Checkup of Old-Old (QMCOO).^{28,29} This questionnaire was developed by the Ministry of Health, Labour and Welfare to comprehensively assess the health state of older adults in light of frailty and comprises 15 items covering ten aspects, including overall and mental health state, exercise and fall, and social participation.

Self-Measurements During the Study

During the study, the participants measured and recorded the following data themselves: (1) BP using a home BP monitor (HCR-7501T; OMRON Healthcare Co., Ltd., Kyoto, Japan); (2) weight using a body composition monitor (HBF-227T; OMRON Healthcare); (3) step count using an activity meter (HJA-405T; OMRON Healthcare); and (4) contents of meals using the health app *CALO mama Plus* (Link & Communication Inc., Tokyo, Japan). Data measured using devices (1) to (3) were transferred to smartphone apps, enabling participants to self-monitor their health data.

CALO mama Plus is a health app for recording health data (diet, exercise, mood, and sleep), and it also provides dietary advice using artificial intelligence. In this study, the app was only used for diet recording. The automated image recognition technique enabled participants to record meals by photography, although manual input or adjustment was also possible.³⁰

The participants were instructed to record BP every morning and night, weight every morning, step count from waking up to bedtime, and diet at every meal. Self-recorded data were stored in the cloud, and the study office sent the data of the respective participants to their pharmacies.

Assessment at Six Months

At the six-month visit, the participants' health state and lifestyle habits were re-assessed using the QMCOO. Additionally, participants' attitudes toward lifestyle modification were evaluated using a self-report questionnaire on each lifestyle (salt intake, diet, weight, exercise, alcohol intake, and smoking), interest in lifestyle or health enhancement,

and pharmacist support. Participants responded to each item by selecting one of four response choices (yes, somewhat yes, somewhat no, or no).

Finally, pharmacists' support was qualitatively evaluated by both participants and pharmacists using four questions: (1) whether participants could ask about something they did not understand (whether pharmacists could ask participants about something they did not understand), (2) whether participants felt they were listened to by pharmacists (whether pharmacists felt they could listen to participants), (3) whether the guidance length was appropriate, and (4) whether a trusting relationship with pharmacists (participants) was deepened through lifestyle modification support. Each item had four response choices: yes, somewhat yes, somewhat no, or no.

Statistical Analyses

This study was exploratory in nature, and descriptive statistics were primarily used. For objective health parameters, where appropriate, summary statistics (weekly mean values \pm standard deviation [SD]) were calculated using the weekly median value of each participant as their data for the week. Additionally, the number of measurements was counted per device or app.

The results of the self-report questionnaires were summarized descriptively. If available, the responses between baseline and six months (last visit) were cross-tabulated and compared using McNemar's test or Wilcoxon signed rank test. A two-sided p-value of <0.05 was considered statistically significant. Weighted kappa coefficients, ranging from 0 to 1, were calculated to assess agreement in evaluations of pharmacists' support between participants and pharmacists. Kappa coefficients were interpreted as follows: values <0.2 represented poor agreement; 0.21–0.40 fair agreement; 0.41–0.60 moderate agreement; 0.61–0.80 good agreement; and 0.81–1.00 very good agreement.³¹ All analyses were performed using SAS release 9.4 (SAS Institute, Cary, NY, USA).

Results

Participant Characteristics

In total, 54 individuals aged 20–77 years who met the eligibility criteria were enrolled from 21 community pharmacies. The mean age was 49.6 years, and 55.6% were women (Table 1). Nine participants used antihypertensive agents at baseline, of whom one experienced a dose increase during the study period. During the six-month follow-up, no participant dropped out of the study. The participants visited the pharmacy an average of 6.7 times during the follow-up.

Weekly Mean Values of BP and Other Health Parameters

In the overall population (n=54), the weekly mean BP shifted almost horizontally from baseline to week 24 (systolic BP: 118.8 to 121.5 mmHg; diastolic BP: 76.1 to 77.5 mmHg). By the use of antihypertensive medications, a similarly horizontal shift was observed among 45 participants without antihypertensive medications (systolic BP: 115.3 to 118.9 mmHg; diastolic BP: 75.1 to 76.4 mmHg) and eight participants with antihypertensive medications but without dose

Table 1 The Baseline Characteristics of the Participants Recruited for This Study

	Total (n = 54)
Age, years	
Mean \pm SD	49.6 \pm 14.0
Median [range]	50.5 [20–77]
Women, n (%)	30 (55.6)
Weight ^a , kg	59.8 \pm 12.7
BMI ^a	22.4 \pm 4.0
Use of antihypertensive agents, n (%)	9 (16.7)

Notes: Data are expressed as mean \pm SD, median [range], or n (%).

^aThe values of initial measurements (on the next day of enrollment) were used (n = 44). BMI was measured using a body composition monitor.

Abbreviations: BMI, body mass index; SD, standard deviation.

increase (systolic BP: 130.6 to 131.1 mmHg; diastolic BP: 78.4 to 82.1 mmHg) (Figure 1). Both systolic and diastolic BP declined in one participant with a dose increase in antihypertensive medications, from 165.0 to 138.0 mmHg and from 95.0 to 80.5 mmHg, respectively (Figure 1). The participants measured BP, on average \pm SD, 13.7 \pm 9.2 times per week, with almost constant frequency throughout the study (Figure 2a).

Figure 3 displays the weekly mean weight, daily step count, and daily calorie intake over six months. There was little change in the weekly mean weight from 61.8 kg at baseline to 60.1 kg at week 24 (Figure 3a). The participants measured their weight, on average, 7.5 \pm 3.6 times per week (Figure 2b). The weekly mean daily step count was approximately 4500 until week 16 but then gradually decreased to below 4000 (Figure 3b). The step count was measured, on average, 6.8 \pm 0.9 days per week (Figure 2c). The mean daily calorie intake fluctuated weekly, but there was no clear decreasing or increasing trend at roughly around 1600 kcal (Figure 3c). The weekly mean days of diet recording was 6.4 \pm 1.3 (Figure 2d).

Self-Reported Health State

Table 2 cross-tabulates the results of QMCOO at baseline and six months. Compared to the baseline, 38.9% and 35.2% rated better overall health and mental health states, respectively, at six months. Sixteen (29.6%) participants became to walk at least once a week, even though they did not have such a walking habit at baseline. The number of participants who reported walking slower than before decreased from 17 (31.5%) at baseline to 6 (11.1%) at six months. Furthermore, 18 (33.3%) participants, who did not report weight loss at baseline, reported losing more than 2 to 3 kg. These five items all showed statistically significant results, with all p-values <0.001. In terms of social aspects, most of the participants already had social participation at baseline, which remained unchanged at six months.

Lifestyle Behaviors

Table 3 summarizes the participants' attitudes toward lifestyle modifications at the end of the follow-up period. Over 85% of the participants considered that they have become more proactive in improving their lifestyles regarding salt intake, diet, weight loss, and exercise (combined proportion of "yes" and "somewhat yes": 85.2–96.3%). However, alcohol consumption and smoking habits seemed more challenging to change, with 28.6% and 66.7% of the participants with drinking and smoking habits, respectively, responding "somewhat no" to their behavioral change. All participants answered "yes" or "somewhat yes" to have the intention to continue improving their lifestyles.

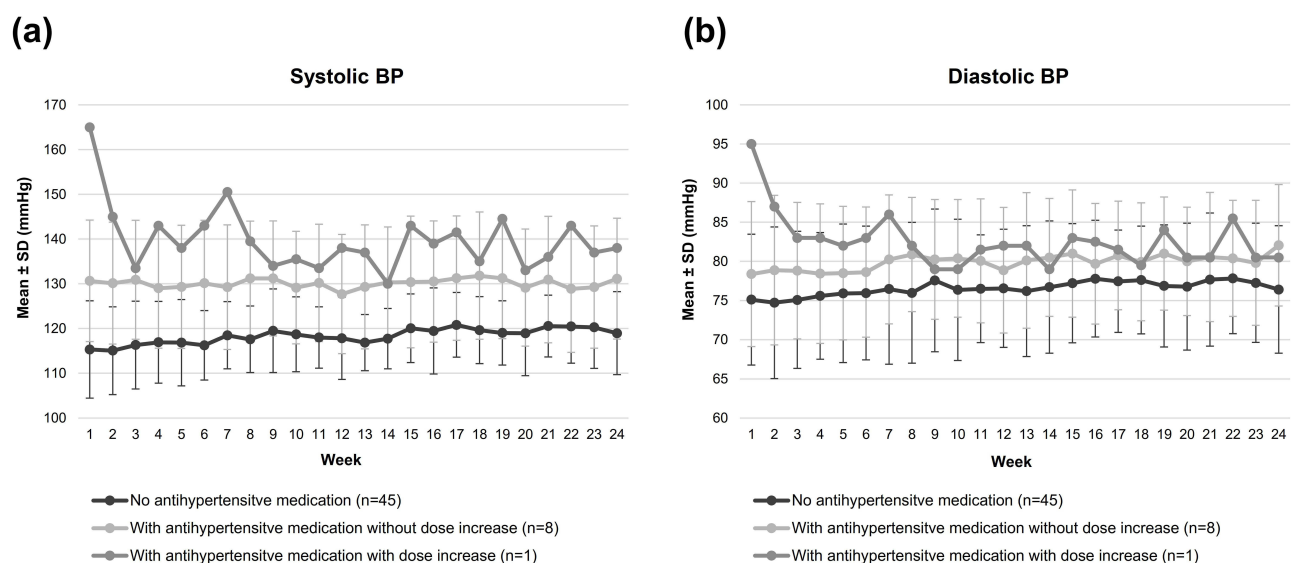


Figure 1 Mean weekly BP over the six-month follow-up period (by the use of antihypertensive medications): (a) systolic BP and (b) diastolic BP. **Abbreviations:** BP, blood pressure; SD, standard deviation.

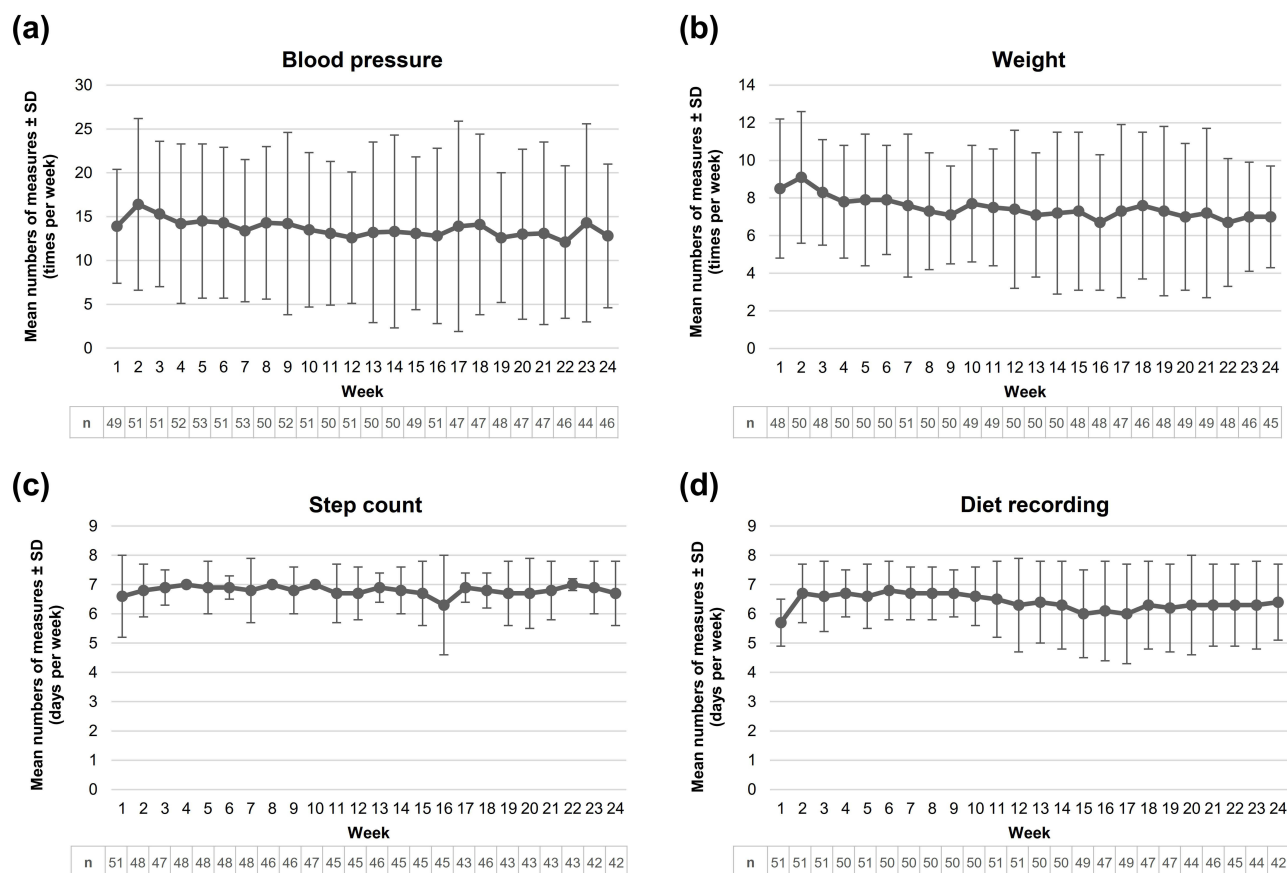


Figure 2 Weekly mean numbers of measures of each health parameter over the six-month follow-up period: (a) blood pressure, (b) weight, (c) step count, and (d) diet recording.

Abbreviation: SD, standard deviation.

Evaluation of Pharmacists' Lifestyle Modification Support

Table 4 summarizes the evaluations by the participants and pharmacists of pharmacist support. The participants' responses were favorable for all four questions. There was no notable discrepancy in trends; the majority (64.8–75.9%) chose the same response choices between the participants and pharmacists. However, overall, pharmacists rated items less positively than participants, resulting in poor to fair agreement between pharmacists and participants (weighted kappa coefficients: 0.01–0.34). Both participants and pharmacists predominantly reported that the trusting relationship had deepened through support (yes: 81.5% and 70.4%; somewhat yes: 18.5% and 24.1%, respectively). However, 12 pharmacists (22.2%) rated lower than the participants, with 3 (5.6%) rating “somewhat no” or “no.”

Illustrative Cases

Here, two illustrative cases of improved health parameters are introduced. The first case was a 58-year-old man with spinal canal stenosis who did not take antihypertensive medication. He was unable to change his lifestyle behaviors before the study, despite his awareness of insufficient exercise. However, in this study, he set his own goals and continued self-care for six months. Consequently, his step count increased, and his systolic BP and weight were reduced. He was satisfied with his participation in this study and reported that it was a good motivation for behavioral change. The other case was a 72-year-old man who did not take antihypertensive medication. He had stomach cancer nine years prior and wanted to increase his weight. He reported that participation in this study increased his interest in dietary habits, which also motivated his wife, leading to an improvement in their dietary balance. Consequently, his caloric intake and weight increased.

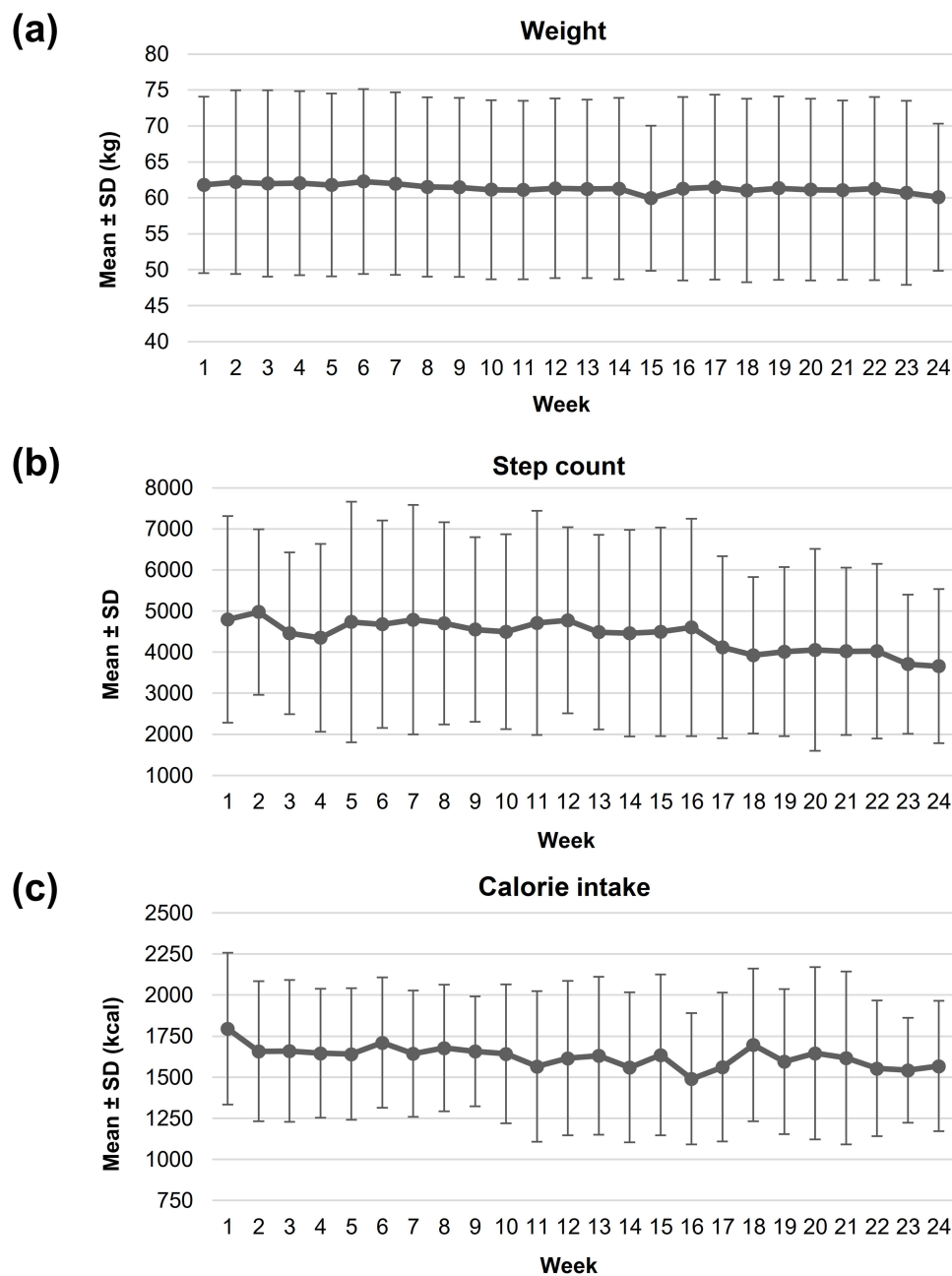


Figure 3 Weekly mean values of (a) weight, (b) daily step count, and (c) daily calorie intake over the six-month follow-up period.

Abbreviation: SD, standard deviation.

Discussion

This study explored whether community pharmacies' self-care support was feasible for health promotion among community residents. It was not limited to people at a higher risk of lifestyle diseases but included healthy individuals. We observed nearly stable mean BP levels in the study population. However, the participants became more interested in their lifestyles and proactive in their improvement through the support of community pharmacists. The results of this study not only showed the potential of this type of pharmacy support but also provided insights into future improvements.

This study used several digital devices to measure and record health data. Digital devices can help effectively improve lifestyle behaviors,³² involving or enabling behavior change techniques, such as goal setting, self-monitoring, self-motivation, and self-evaluation.³³ Healthcare professionals' feedback constitutes an important element in lifestyle

Table 2 A Cross-Tabulation of Participant's Health States and Lifestyle Habits at Baseline and Six Months (n = 54)

QMCOO Items, n (%) ^a	Baseline Choices	At 6 Months' Choices					p-value ^b
Overall health		Excellent	Good	Fair	Poor	Very poor	
How is your health condition?	Excellent	17 (31.5)	2 (3.7)	2 (3.7)	0 (0.0)	0 (0.0)	0.0063
	Good	8 (14.8)	7 (13.0)	1 (1.9)	0 (0.0)	0 (0.0)	
	Fair	4 (7.4)	9 (16.7)	4 (7.4)	0 (0.0)	0 (0.0)	
	Poor	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
	Very poor	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Mental health		Satisfied	Moderately S	Moderately DS	Dissatisfied		
Are you satisfied with your daily life?	Satisfied	18 (33.3)	2 (3.7)	0 (0.0)	0 (0.0)		<0.0001
	Moderately S	16 (29.6)	11 (20.4)	1 (1.9)	0 (0.0)		
	Moderately DS	0 (0.0)	3 (5.6)	3 (5.6)	0 (0.0)		
	Dissatisfied	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		
Diet		Yes	No				
Do you eat three times a day?	Yes	48 (88.9)	2 (3.7)				0.5637
	No	1 (1.9)	3 (5.6)				
Oral function		Yes	No				
Do you have any difficulties eating tough foods compared to six months ago?	Yes	2 (3.7)	3 (5.6)				0.0833
	No	0 (0.0)	49 (90.7)				
Have you choked on your tea or soup recently?	Yes	3 (5.6)	2 (3.7)				0.1573
	No	0 (0.0)	49 (90.7)				
Exercise/falls		Yes	No				
Have you lost 2 kg or more in the past six months?	Yes	5 (9.3)	5 (9.3)				0.0067
	No	18 (33.3)	26 (48.1)				
Do you think you walk slower than before?	Yes	5 (9.3)	12 (22.2)				0.0023
	No	1 (1.9)	36 (66.7)				
Have you experienced a fall in the past year?	Yes	3 (5.6)	4 (7.4)				1.0000
	No	4 (7.4)	43 (79.6)				
Do you go for a walk for your health at least once a week?	Yes	24 (44.4)	4 (7.4)				0.0073
	No	16 (29.6)	10 (18.5)				
Cognitive function		Yes	No				
Do your family or friends point out your memory loss?	Yes	2 (3.7)	3 (5.6)				0.0833
	No	0 (0.0)	49 (90.7)				
Do you find yourself not knowing today's date?	Yes	3 (5.6)	3 (5.6)				0.0833
	No	0 (0.0)	48 (88.9)				
Smoking		Every day	Sometimes	Not for >1 m ^a	No		
Do you smoke?	Every day	3 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)		1.0000
	Sometimes	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)		
	Not for >1 m ^b	0 (0.0)	0 (0.0)	1 (1.9)	2 (3.7)		
	No	0 (0.0)	0 (0.0)	2 (3.7)	46 (85.2)		

(Continued)

Table 2 (Continued).

QMCOO Items, n (%) ^a	Baseline Choices	At 6 Months' Choices					p-value ^b
Societal participation		Yes	No				
Do you go out at least once a week?	Yes	52 (96.3)	0 (0.0)				-
	No	2 (3.7)	0 (0.0)				
Do you keep regular communication with your family and friends?	Yes	54 (100.0)	0 (0.0)				-
	No	0 (0.0)	0 (0.0)				
Social support		Yes	No				
When you are not feeling well, do you have anyone you can talk to?	Yes	54 (100.0)	0 (0.0)				-
	No	0 (0.0)	0 (0.0)				

Notes: ^aThe QMCOO, developed by the Ministry of Health, Labour and Welfare, is publicly available.²⁸ The questionnaire is in Japanese, but this table describes the items in English. ^bUsed to smoke but not smoke for >1 month. ^cThe McNemar's test was performed for paired binary data (2 x 2 matrix) and the Wilcoxon signed rank test for others.

Abbreviations: DS, dissatisfied; QMCOO, the questionnaire for medical checkup of old-old; S, satisfied.

Table 3 The Participants' Perception of Lifestyle Modification at Six Months

	Responses, n (%) (n = 54)			
	Yes	Somewhat Yes	Somewhat No	No
1. Do you think you have become more proactive in improving your lifestyle through the support of pharmacists?				
– Reducing salt intake	21 (38.9)	29 (53.7)	3 (5.6)	1 (1.9)
– Diet	28 (51.9)	24 (44.4)	2 (3.7)	0 (0.0)
– Losing weight	22 (40.7)	24 (44.4)	7 (13.0)	1 (1.9)
– Exercise	27 (50.0)	21 (38.9)	5 (9.3)	1 (1.9)
– Reducing alcohol intake (among 14 participants who drink)	4 (28.6)	6 (42.9)	4 (28.6)	0 (0.0)
– Smoking cessation (among 3 participants who smoke)	0 (0.0)	1 (33.3)	2 (66.7)	0 (0.0)
2. Do you think you have become more interested in your lifestyle through the support of pharmacists?	34 (63.0)	20 (37.0)	0 (0.0)	0 (0.0)
3. Do you intend to continue to work on improving your lifestyle?	36 (66.7)	18 (33.3)	0 (0.0)	0 (0.0)
4. Do you think continued pharmacist support will help you continue working on improving your lifestyle?	38 (70.4)	15 (27.8)	1 (1.9)	0 (0.0)
5. Do you want to recommend this type of pharmacist support to others?	34 (63.0)	19 (35.2)	1 (1.9)	0 (0.0)

intervention, but they are mostly provided based on people's self-reports rather than objective data.³⁴ However, in this study, active data tracking enabled pharmacists to provide more accurate, individualized advice based on objective performance data. The availability of such tailored feedback may have somewhat motivated the participants' continuous engagement in self-measurements, such as twice-a-day BP and daily weight measurements. However, other factors may also have been responsible for such active engagement or high self-care continuation rate (no dropout) in this study, such as better physical and psychological accessibility to community pharmacies than to hospitals or the possibility of seeking social interaction arising from a feeling of loneliness due to the coronavirus pandemic.³⁵

Despite active engagement, the mean values of BP and other parameters remained almost constant over the study period. There was even a decrease in the mean number of steps taken in the later study period. There are several possible explanations for this result. First, this study included many healthy individuals with normal BP and body mass index at baseline. Thus, some may not have targeted a drastic behavioral change but instead pursued maintaining health. Second, seasonal variation in BP may have offset the decline in BP due to lifestyle improvements. There is an inverse association

Table 4 Evaluation of Pharmacists' Support from the Perspective of Participants and Pharmacists (n = 54 for Each)

Questions	Participants' Responses	Pharmacists' Responses				Kappa ^a
		Yes	Somewhat Yes	Somewhat No	No	
1. Were you able to ask pharmacists about something you did not understand? (Were you able to ask participants about something they did not understand?)	Yes Somewhat Yes Somewhat No No	32 (59.3) 5 (9.3) 0 (0.0) 0 (0.0)	11 (20.4) 3 (5.6) 0 (0.0) 0 (0.0)	1 (1.9) 1 (1.9) 0 (0.0) 0 (0.0)	1 (1.9) 0 (0.0) 0 (0.0) 0 (0.0)	0.0959
2. Did you feel you were listened to by pharmacists? (Did you feel you could listen to participants?)	Yes Somewhat Yes Somewhat No No	39 (72.2) 5 (9.3) 0 (0.0) 0 (0.0)	4 (7.4) 2 (3.7) 0 (0.0) 0 (0.0)	2 (3.7) 1 (1.9) 0 (0.0) 0 (0.0)	0 (0.0) 1 (1.9) 0 (0.0) 0 (0.0)	0.2258
3. Do you think the guidance length was not too long and appropriate?	Yes Somewhat Yes Somewhat No No	34 (63.0) 2 (3.7) 0 (0.0) 0 (0.0)	9 (16.7) 2 (3.7) 0 (0.0) 0 (0.0)	2 (3.7) 2 (3.7) 1 (1.9) 0 (0.0)	1 (1.9) 1 (1.9) 0 (0.0) 0 (0.0)	0.2765
4. Do you feel a trusting relationship with pharmacists (participants) was deepened through lifestyle modification support?	Yes Somewhat Yes Somewhat No No	35 (64.8) 3 (5.6) 0 (0.0) 0 (0.0)	9 (16.7) 4 (7.4) 0 (0.0) 0 (0.0)	0 (0.0) 2 (3.7) 0 (0.0) 0 (0.0)	0 (0.0) 1 (1.9) 0 (0.0) 0 (0.0)	0.3354

Note: ^aWeighted kappa coefficients were calculated for the agreement between participants and pharmacists.

between home BP and temperature, with an approximately 7 mmHg difference between the summer and winter seasons in Japan.³⁶ Since the study started in the summer, the participants would have had higher BP toward the end of the study in winter. However, there was no such increase in BP. Lifestyle modifications may have prevented the seasonal rise in BP to some extent. This seasonal factor may also explain the reduced step count in the later study period, that is, the winter season.³⁷ Given these, our results may not necessarily indicate the insufficient effect of pharmacists' support. Its impact on health parameters should be further examined in future comparative studies.

Another aspect to consider is that each participant had different motivations and goals. As previously illustrated, some individuals intended to lose weight, but there were also individuals who wished to increase their weight. Some participants may have aimed to improve food balance or increase muscle training; however, such an improvement may not have been adequately captured in our measurements. Thus, even if there were some improvements at the individual level, lumping them together may have obscured improvements in the parameters at the population level. In real-world practice, it is crucial to provide tailored health support considering individual situations, using effective behavior change techniques such as goal setting and action planning.^{38,39}

The participants evaluated pharmacist support positively. Almost all participants reported that they became more proactive in improving their lifestyles, such as salt intake, diet, weight control, and exercise, although changing their smoking and drinking habits appeared to be more challenging. Not only did they become more conscious about each lifestyle habit, but many participants also felt improvement in well-being; more than one in three participants improved their overall health state (38.9%) and mental health state (35.2%) from baseline. Moreover, all the participants responded that they intended to continue improving their lifestyles. In addition to previous reports,^{23,40} our results demonstrate that community pharmacies have tremendous potential for promoting health and facilitating self-care among community residents.

In line with a previous report,⁴¹ the participants in this study appreciated the usefulness of pharmacist support, and almost all reported that they wanted to recommend it to others. Given their potential and people's demands, these activities of community pharmacies should be facilitated and prevail across Japan. However, there seems to be much room for improvement in such health support programs. For example, devices and apps may pose a hurdle for older

adults. Too many devices may be burdensome, hindering continuation, as suggested by the slight decrease in the number of participants who measured step count or recorded diet. Therefore, pharmacists should tailor the method depending on people's goals and accessibility to devices. It may also be worth establishing a cooperative support system between pharmacies and health device providers.

Public health promotion is essential for achieving a sustainable health system in Japan. Improving people's health so that citizens can play an active role in improving their own health is the foundation for health promotion among the public, and proper education is essential for its improvement.⁴² The Japanese government considers communities as the foundation of the health system that should play an important role in health promotion.⁴³ Community pharmacists should play a significant role in public health and health literacy promotion in their communities through education or active involvement in people's self-care support, as in our attempt.

This study was unique and significant in that it used objective measures in addition to subjective evaluations and was not exclusive to people at high risk of certain conditions. However, it also has certain limitations. First, the generalizability of the results may be limited due to selection bias. For example, participants who voluntarily participated in the study were more likely to be health conscious, which probably underlies their overall active engagement. Second, the self-measured data may not be accurate; participants may have taken repeated measurements or recorded arbitrarily to submit favorable data. Additionally, the overall too-low caloric intake (around 1600 kcal) for the estimated energy requirement of the Japanese⁴⁴ suggests improper data input, let alone limited accuracy.³⁰ Finally, the lack of a control group restricted us from examining the causal association between self-care and health parameters, which should be determined in future comparative studies. However, this type of exploratory and descriptive study is extremely important to help generate hypotheses to be tested in further analytic research.^{45,46}

Conclusions

The results of this study suggest that community pharmacists' support helped increase health awareness among pharmacy visitors and promote their health-enhancing behaviors. The participants' overall well-being improved, and they appreciated the pharmacists' support. However, its impact on objective parameters should be further examined in future research. Also, more vigorous, tailored self-care support may be worth considering in the future. We believe that the promising results and challenges highlighted in this study will help community pharmacies develop a more practical, effective, and community-fitted health/well-being support system by promoting health literacy in Japan.

Acknowledgments

We thank all the participants and participating pharmacies belonging to the Ogaki Pharmacists Association. Statistical analyses and medical writing support were provided by Clinical Study Support, Inc., with funding from the Japan Selfcare Promotion Association.

Author Contributions

YH, HN, TN, YK, TI, and MH contributed to the conception of the study. YH and SM significantly contributed to the study design, execution, data acquisition, and data analysis/interpretation. YH and SM primarily drafted the manuscript, and the others critically reviewed or revised it. All authors agreed 1) to the journal to which they would submit the manuscript, 2) to the final version of the manuscript for submission, and 3) to take responsibility and be accountable for the contents of the manuscript.

Funding

This study was funded by the Japan Selfcare Promotion Association. The sponsor had no involvement in the study design, data collection and analysis, and preparation of the manuscript.

Disclosure

Takamasa Nakamura is an employee of Clinical Study Support, Inc. Yoshihito Kato is an employee of Kowa Company, Ltd. Tatsuya Isomura is a board member of Clinical Study Support, Inc. Michiko Hori is a board member of SIC Co., Ltd. The other authors have no conflicts of interest to declare.

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