

Motivational Counseling to Reduce Sedentary Behaviors and Depressive Symptoms and Improve Health-Related Quality of Life Among Women With Metabolic Syndrome

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Background: Motivational interviewing, as a counseling approach, could promote not only behavioral changes but also individuals' psychological adaptation. Previous studies provide evidence that motivational interviewing focused on increasing physical activity decreases the risk of metabolic syndrome in women. Its effects on sedentary behaviors, depressive symptoms, and health-related quality of life (HRQL) remain unknown. **Objectives:** The aim of this study was to evaluate whether a 12-week motivational counseling program reduces sedentary behaviors and depressive symptoms and improves HRQL in Taiwanese women. **Methods:** A randomized controlled study was conducted. Participants ($n = 115$) were randomly assigned into 3 groups: experimental group (received a brochure on lifestyle modification combined with 12 weeks of motivational counseling), comparison group (received a lifestyle modification brochure), and usual care group (UCG). Outcome variables were measured at baseline and at 12 weeks post intervention by the International Physical Activity Questionnaire, Beck Depression Inventory, and Medical Outcomes Short Form-36 Health Survey. Generalized estimating equations were applied to analyze the intervention effects of groups by interaction of group and time. **Results:** Women in the experimental group not only reduced ($P < .001$) weekly sitting time by 374 minutes but also decreased ($P < .05$) depressive symptoms, as well as had greater overall HRQL including 8 subscales as compared with the UCG. As compared with the UCG, the women in the comparison group had no change in sedentary behaviors, but they had reduced depressive symptoms and improvement on some HRQL subscales. **Conclusions:** Motivational counseling that incorporates behavioral change principles is effective in reducing sedentary behaviors and depressive symptoms and improving HRQL for women with metabolic syndrome.

KEY WORDS: depression, health-related quality of life, motivational interviewing, sedentary behavior, women

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There is substantial evidence to support the high prevalence of metabolic syndrome (MetS) and its associated health consequences (ie, diabetes, cardiovascular disease, mortality from coronary heart disease).¹⁻³ Despite proposed effective treatment modalities to reverse the trajectory of MetS,^{4,5} people with MetS continue to experience negative mood state (ie, depressive symptoms) and poor health-related quality of life (HRQL).^{6,7} Therefore, it is important to implement strategies that improve psychological health and HRQL for this population.

Active lifestyles contribute to better HRQL and less depressive symptoms.⁸⁻¹⁰ Unfortunately, most people with MetS, particularly middle-aged and older women, do not consistently adhere to the recommended guidelines for modifying their lifestyles and tend to maintain sedentary lifestyles.¹¹⁻¹³ There is limited research on whether strategies focused on decreasing sedentary behaviors and depressive symptoms and improving HRQL are effective in adults with MetS. In a previous report of an individualized, 12-week, behavior-based motivational interviewing program, we described the effectiveness of this intervention on increasing physical activity and reducing metabolic risks in middle-aged and older Taiwanese women.¹⁴ However, because physical activity is not synonymous with sedentary behavior, in this study, we tested the effects of the motivational interviewing intervention on sedentary behaviors. At the same time, we further examined the impact of the intervention on depressive symptoms and HRQL in this population with MetS.

People with MetS are at an increased risk for having depression;¹⁵ middle-aged people with MetS who at baseline are not depressed are twice as likely at 7-year follow-up to report depression.¹⁶ Among middle-aged women, depressive symptoms can predict MetS.^{15,17} This suggests that the relationship between MetS and depression is bidirectional.

People with MetS who have multiple cardiovascular risk factors carry an increased physical and psychological burden, leading to impaired HRQL.^{6,18} The US National Health and Nutrition Examination Survey indicated that adults with MetS experience worse HRQL than those without MetS after adjusting for sociodemographic covariates and smoking status.⁷ Although the reason is unknown, women have lower HRQL as compared with men.¹⁹⁻²¹ Bingefors and Isacson¹⁹ found that one possible contributing factor is that women have a higher prevalence of somatic pain and pain-related conditions. This may account for the lower HRQL reported by women.^{18,20,21} Because of the multiple family and social roles of women in Taiwan,¹³ middle-aged and older women with MetS may experience further reductions in psychological health and HRQL.

The development of MetS is multifactorial. Genetics and lifestyle factors are clear contributors.²² A sedentary lifestyle is considered a risk factor for cardiovascular

morbidity and mortality, after adjusting for performance of moderate and vigorous physical activity.^{23,24} A sedentary lifestyle is defined as more hours of behaviors such as lying down, sitting, watching television, and using the computer and other forms of screen-based entertainment than hours of physical activity including exercise during waking hours.²⁵ Sedentary behaviors can be quantified as "sitting time" and can be measured using objective and subjective approaches, such as accelerometers and questionnaires.²⁶ Evidence is accumulating about the relationship between sedentary behaviors and health outcomes.²⁷⁻³⁰ In a study of Swedish middle-aged women, Frisman and Kristenson¹⁸ found that the observed association between MetS and HRQL was lost after adjustment for lifestyles (level of physical activity). Reducing sedentary behaviors or promoting physical activity level for middle-aged and older women with MetS may increase HRQL.^{8-10,30}

Although programs to promote active lifestyles have become popular in primary care settings, low adherence has been reported,³¹ particularly among women.³² Motivational interviewing as a counseling approach, first proposed by Miller,³³ has been widely applied as an effective method in promoting behavior changes such as smoking cessation, problem drinking, diabetes management, and engagement of active lifestyles.³⁴⁻³⁶ Motivational counseling places emphasis on encouraging people to consider their current behaviors and to explore them in relation to their values, interests, aspirations, and self-efficacy.³⁷ On the basis of a systematic review of 72 randomized controlled trials in patients with obesity/diabetes/asthma/mental illness, individuals with alcohol abuse/drug addiction, or those who smoke, motivational counseling was found to have a significant and clinically relevant effect on both physical and psychological health.³⁸ When applying motivational counseling in brief encounters of 15 minutes, more than half of the studies (64%) showed a positive effect, and more than 1 individualized encounter with the patients confirmed the effectiveness of motivational counseling.³⁸ In studies that included an estimated median follow-up period of 12 months (range, 2 months to 4 years), the positive benefits of motivational counseling persisted.³⁸ We previously described that a motivational interviewing program aimed at lifestyle modification had positive benefits, namely, increased physical activity and reduced the percentage of middle-aged and older women in the sample who met the criteria for MetS.¹⁴ Women with MetS increased their physical activity amount by 283 MET-min/wk after the 12-week program.

An increase in physical activity does not necessarily equate to a reduction in sedentary behaviors. As shown by Grontved and Hu²³ (2011) and Ford and Caspersen²⁴ (2012), a reduction in sedentary behavior has positive health benefits, such as decreases in cardiometabolic morbidity and mortality, after adjustment for physical activity.

Yet, evidence is limited that examines the effectiveness of motivational counseling on reduction of sedentary behaviors and depressive symptoms and improvement of HRQL among middle-aged and older women with MetS after controlling for physical activity.

Using our previously described cohort, we examined the effectiveness of a 12-week, individually tailored, motivational counseling–based lifestyle modification intervention on sedentary behaviors, depressive symptoms, and HRQL, compared with a single brief lifestyle modification counseling session plus an educational brochure, and usual care for middle-aged and older women with MetS after adjusting for physical activity.

Method

Study Design

A randomized controlled trial with a 3 parallel intervention group design was conducted in northern Taiwanese women to compare the differences in effectiveness on weekly sitting time, depressive symptoms, and HRQL among experimental group (EG), comparison group (CG), and usual care group (UCG) participants. Eligible women were randomly assigned to 3 parallel groups: (1) EG, received a brochure on lifestyle modification, combined with individual 12-week motivational counseling; (2) CG, received only the lifestyle modification brochure; and (3) UCG, received usual care with regular outpatient follow-up. Sealed, opaque envelopes were used, following computer-generated random serial numbers. Sedentary behaviors (ie, weekly sitting time), depressive symptoms, and HRQL were compared among the 3 groups at baseline and after 12 weeks.

Participants and Setting

A purposive sample of urban-dwelling middle-aged and older women (older than 40 years) in northern Taiwan was recruited from an urban community health center. Those potentially eligible women who agreed to participate and gave their informed consent were then referred to an endocrinology/metabolism physician at the local medical center for screening for eligibility before randomization. Inclusion criteria were able to speak and understand Mandarin; without a history of cancer, end-stage renal disease with dialysis, or confirmed psychiatric diseases; and able to walk without assistance. Of those initially approached ($N = 328$), 115 eligible women with confirmed MetS were randomly assigned: 38 (33%) to the EG, 38 (33%) to the CG, and 39 (34%) to the UCG. MetS is defined as having 3 or more of the following 5 risk factors for women according to the National Cholesterol Education Program Adult Treatment Panel III: (1) elevated fasting plasma glucose of 100 mg/dL or use of antidiabetic medicines, (2) elevated blood pressure of 130/85 mm Hg or higher or use of antihypertensive medicines, (3) elevated triglyceride

level of 150 mg/dL or higher, (4) reduced high-density lipoprotein cholesterol level less than 50 mg/dL, and (5) central obesity, with a waist circumference of 80 cm or greater.³⁹ Exclusion criteria included not meeting the criteria for MetS, declining to participate, and having a history of cancer, confirmed psychiatric disease, and moderate to severe physical disability. All eligible participants, approached consecutively for 4 months, were given thorough information about participation, and written informed consent was obtained before final inclusion. The 12-week follow-up assessments were conducted by a research nurse blinded to group assignment. Ethical approval (reference number: 1-101-05-073) was obtained from the institutional review board of the local medical center.

Sample size estimation was based on a previous study with a medium-to-small effect size.⁴⁰ With an α of .05 and a power of 0.8, each group required at least 34 participants.⁴¹

Study Intervention

Among the EG, participants were given individually tailored, 12-week, telephone-based motivational counseling for modifying lifestyles that focused on decreasing sedentary activities including sitting, watching television, and using mobile devices, computers, or other forms of screen-based entertainment and increasing the frequencies of breaks in those sedentary behaviors, except for physical activity promotion.¹⁴ In addition, the EG also received an educational brochure about lifestyle modification and stress coping. The CG received the educational material similar to the EG, whereas the UCG only underwent routine outpatient clinical follow-up. The intervention consisted of individualized promotion of active physical activity behaviors and enhancement of self-efficacy^{32,42} based on the principles of motivational interviewing and aimed to reduce participants' sedentary behaviors. The telephone-based motivational counseling was delivered by an experienced nurse in a medical center at Taipei city in northern Taiwan, details of which were previously reported.¹⁴

Measures

Sedentary Behaviors

Sedentary behaviors can be referred to as “sitting time.”²⁵ The sedentary behaviors in this study presented as weekly sitting time (minutes per week)²⁶ were assessed for the past 7 days at pre and post 12-week intervention by the International Physical Activity Questionnaire-Short Form, which has well-established reliability and validity.⁴³ Participants with more weekly sitting time had more sedentary behaviors.

Depressive Symptoms

The Beck Depression Inventory, with good reported reliability and validity in various populations,^{44,45} was

used to measure depressive symptoms. This 21-item scale, scored from 0 to 63, comprising emotional, cognitive, and somatic categories, measured participants' depressive symptoms.⁴⁶ Higher scores on the Beck Depression Inventory represented more depressive symptoms. The total scores were used to screen depressive symptoms: none to minimal (0–9) and mild to severe (10–63).

Health-Related Quality of Life

Health-related quality of life was assessed by the well-validated and reliable Medical Outcomes Short Form-36 Health Survey, a widely used scale, with scores ranging from 0 to 100, composed of 36 self-administered items and 8 subscales: physical function, role function limits due to physical problem (role-physical), role function limits due to emotional problem (role-emotional), social functioning, bodily pain, vitality, mental health, and general health.^{47,48} Higher scores reflect higher HRQL.

Data Analysis

Data were collected at baseline and after the 12-week intervention. Analysis of variance and χ^2 test were used to compare the background variables including sociodemographic characteristics, lifestyle covariates (ie, alcohol consumption, smoking status, weekly amounts of physical activity, and dietary patterns presented as habit of weekly breakfast and late-night snack), and preintervention and postintervention. The intervention effects were evaluated after adjusting for sociodemographic characteristics and lifestyle covariates by generalized estimating equations. Differences of interventional effect between groups were analyzed and presented via the interaction variables (group \times time).

Results

Baseline Characteristics

Of the 115 randomized participants, 100 (87%) completed the study: 34 in the EG, 32 in the CG, and 34 in the UCG. During the study, 1 participant withdrew and 14 were lost to follow-up at the 12-week assessment. An intention-to-treat analysis was used. A flow diagram with this sample was previously published.¹⁴ The participants' sociodemographic characteristics (age, educational level, married status, employment, menopausal status) and lifestyle patterns (alcohol consumption, smoking status, physical activity, dietary patterns) were similar in the 3 groups, as shown in previous study.¹⁴

Outcome Evaluation

Table 1 shows the weekly sitting time, depressive symptoms, and HRQL of the 3 groups at baseline and at 12 weeks. The mean differences between baseline and

12 weeks within the EG, CG, and UCG were significantly ($P < .001$) different for weekly sitting time, depressive symptoms, HRQL, and all of the 8 HRQL subscales. Weekly sitting time decreased in the EG, whereas it increased in the UCG and remained unchanged in the CG. Participants in the EG had reduced depressive symptoms and improved HRQL at 12 weeks, whereas those in the UCG had more depressive symptoms and worse HRQL.

Table 2 shows the generalized estimating equation analyses and adjustment for sociodemographic characteristics and lifestyle covariates for the effectiveness of the motivational interviewing on weekly sitting time, depression, and HRQL. The significant group \times time interaction for weekly sitting time revealed that women in the EG had a greater decrease in weekly sitting time at 12 weeks than did those in the UCG ($\beta = -374$, $P < .001$) and CG ($\beta = -272$, $P = .013$); however, there was no difference between women in the CG and UCG. Women in the EG and CG had less depressive symptoms compared with those in the UCG at 12 weeks ($\beta = -4.21$, $P < .001$, and $\beta = -1.36$, $P = .037$, respectively). Women in the EG also had less depressive symptoms compared with those in the CG ($\beta = -2.8$, $P < .001$).

Women in the EG had a greater increase in mean HRQL scores ($\beta = 19.9$, $P < .001$) and all 8 subscales than did those in the UCG. However, women in the CG improved only in the HRQL mean scores, general health, mental health, role-emotional, and social function, as compared with the UCG. As compared with women in the CG, those in the EG also had a greater increase in mean scores of the HRQL ($\beta = 14.7$, $P < .001$) and all 8 subscales at 12 weeks.

Discussion

A tailored lifestyle modification intervention based on a motivational interviewing strategy had significant beneficial effects on reduction of weekly sitting time and depressive symptoms, and improved HRQL scores for middle-aged and older Taiwanese women with MetS after controlling for changes in physical activity. Our intervention facilitated successful health promotion for this population of Taiwanese middle-aged and older women from an urban community.

Our study results reveal that overall weekly sitting time was reduced by 12.2% in the EG as compared with the UCG. Women in the CG also had reduced weekly sitting time; however, this difference did not reach significance when compared with those in the UCG. We found a greater reduction (12.2%) in sitting time as compared with a previous study (2.9%) conducted with 166 sedentary community-dwelling Danish adults that used 4 individual theory-based motivational interviewing sessions without physical activity promotion included.⁴⁹ Several demographic characteristics may account for the differences between samples. Our

TABLE 1 Comparison of Weekly Sitting Time, Depressive Symptoms, and Health-Related Quality of Life Between Baseline and 12-Week Follow-up

Variable	Group	Baseline	12-wk	Mean difference	F	P
Weekly sitting time	UCG	2526 ± 673	2705 ± 803	179.1	7.01	.001
	CG	2592 ± 980	2592 ± 893	0.0		
	EG	2631 ± 746	2310 ± 761	-321.2		
Depressive symptoms	UCG	7.4 ± 5.4	9.1 ± 6.9	1.7	21.6	<.001
	CG	6.3 ± 2.8	6.4 ± 2.9	0.1		
	EG	6.8 ± 3.9	3.8 ± 1.5	-3.0		
Health-related quality of life	UCG	53.5 ± 13.3	47.6 ± 15.5	-5.9	45.3	<.001
	CG	59.2 ± 13.9	60.1 ± 13.4	0.9		
	EG	55.8 ± 10.5	74.6 ± 11.3	18.8		
Bodily pain	UCG	59.7 ± 21.1	59.5 ± 19.9	-0.2	18.8	<.001
	CG	65.7 ± 17.6	64.9 ± 16.5	-0.8		
	EG	65.2 ± 22.6	78.7 ± 14.3	13.5		
General health	UCG	58.8 ± 14.9	45.6 ± 18.6	-13.2	23.6	<.001
	CG	65.6 ± 7.0	63.9 ± 8.9	-1.7		
	EG	59.3 ± 17.6	67.4 ± 6.4	8.1		
Mental health	UCG	60.8 ± 13.9	56.0 ± 14.5	-4.8	19.2	<.001
	CG	65.9 ± 9.7	65.9 ± 9.6	0.0		
	EG	61.9 ± 10.9	68.7 ± 9.6	6.8		
Physical function	UCG	70.7 ± 15.8	68.2 ± 16.7	-2.5	21.8	<.001
	CG	71.3 ± 12.4	70.8 ± 14.8	-0.5		
	EG	72.1 ± 13.6	82.8 ± 11.8	10.7		
Role-emotional	UCG	47.1 ± 50.6	18.6 ± 36.8	-28.4	18.7	<.001
	CG	50.0 ± 50.8	55.2 ± 49.8	5.2		
	EG	45.1 ± 51.8	84.3 ± 34.1	39.2		
Role-physical	UCG	8.8 ± 28.7	19.1 ± 36.9	10.3	18.0	<.001
	CG	25.0 ± 43.9	30.5 ± 46.1	5.5		
	EG	17.7 ± 38.7	72.8 ± 40.9	55.1		
Social functioning	UCG	70.8 ± 17.6	64.0 ± 16.2	-6.9	18.4	<.001
	CG	73.4 ± 8.8	72.7 ± 8.0	-0.8		
	EG	72.1 ± 14.1	80.9 ± 11.6	8.8		
Vitality	UCG	51.2 ± 11.0	49.7 ± 13.3	-1.5	13.2	<.001
	CG	56.7 ± 10.2	57.3 ± 10.3	0.6		
	EG	53.5 ± 10.5	61.5 ± 12.1	7.9		

P values were from analysis of variance between the mean differences of the 3 groups. A P value of .05 or less indicated statistical significance. CG, comparison group; EG, experimental group; UCG, usual care group.

sample was older (63.1 vs 52.2 years), and Taiwanese, and had a lower percentage of employment (9% vs 60%) and perhaps more leisure time, increased baseline weekly sitting time (2631.0 vs 2229.6 min/wk), and a decreased follow-up period (3 vs 6 months) assessment.⁴⁹

Several authors of recent intervention studies have tested strategies to reduce sedentary behaviors.^{49–51} None of them used a randomized controlled trial approach. On average, they found a 2.9% to 4.3% reduction of objectively (ie, accelerometer-derived, activPAL, ActiGraphy) measured sitting time among older adults or adults who are overweight/obese.^{49–51} Authors of other studies only used 1 face-to-face counseling session^{50,51} or 4 individual theory-based counseling sessions with at least 30 minutes per session,⁴⁹ with either a 7-day^{50,51} or 6-month follow-up.⁴⁹ We postulate that a 12-week, nurse-led, individually tailored motivational counseling program with a weekly telephone call for 15 to 30 minutes has a greater impact on reducing sitting time.

In our study, we used a self-reported questionnaire (International Physical Activity Questionnaire-Short Form),

to assess participants' sitting times instead of an objective accelerometer-based device as applied in the study by Aadahl et al⁴⁹ (2014). Although there is potential for subjective bias, we selected the International Physical Activity Questionnaire-Short Form because it can be used for global comparisons across different geographic populations.¹² In addition, our subjective assessment was found to have similar results with the objective measures of a triaxial accelerometer-based device among adults with 63% women aged 52.2 years in the previous study by Aadahl et al.⁴⁹ Self-report of sedentary behaviors might serve as an easier and simpler instrument for evaluating participants' sedentary behaviors in a clinic population.

In the current study of middle-aged and older Taiwanese women with MetS, the intervention improved depression and HRQL scores. It may be that effectively tailored approaches are better remembered and perceived as more credible compared with nontailored communication.⁵² Granger et al⁹ (2011) found that enhanced counseling increases participants' confidence and self-efficacy in their

TABLE 2 Evaluation of the Intervention's Effectiveness on Weekly Sitting Time, Depressive Symptoms, and Health-Related Quality of Life Based on Generalized Estimating Equation Analysis

Variable	Estimate (β)	SE	95% CI		Z	P
			Lower	Upper		
Weekly sitting time						
Group (EG) x Time ^a	-374.2	101.7	-174.9	-573.5	13.5	<.001
Group (CG) x Time ^a	-102.5	102.2	-97.9	302.9	1.0	.316
Group (EG) x Time ^b	-271.7	109.6	-56.8	-486.6	6.1	.013
Depressive symptoms						
Group (EG) x Time ^a	-4.21	0.9	2.5	5.9	23.5	<.001
Group (CG) x Time ^a	-1.36	0.7	0.1	2.6	4.4	.037
Group (EG) x Time ^b	-2.8	0.6	-1.7	-4.0	22.9	<.001
Health-related quality of life						
Group (EG) x Time ^a	19.9	2.8	-25.4	-14.4	51.0	<.001
Group (CG) x Time ^a	5.2	1.8	-8.7	-1.7	8.4	.004
Group (EG) x Time ^b	14.7	2.8	20.1	9.3	28.3	<.001
Bodily pain						
Group (EG) x Time ^a	11.5	2.9	17.1	5.8	15.9	<.001
Group (CG) x Time ^a	0.6	1.7	-2.7	3.8	0.1	.736
Group (EG) x Time ^b	12.0	2.4	16.7	7.4	25.7	<.001
General health						
Group (EG) x Time ^a	18.2	3.4	25.0	11.5	28.3	<.001
Group (CG) x Time ^a	9.7	2.5	14.6	4.8	15.0	<.001
Group (EG) x Time ^b	8.6	2.7	13.8	3.3	10.3	.001
Mental health						
Group (EG) x Time ^a	10.3	2.1	14.4	6.2	24.5	<.001
Group (CG) x Time ^a	4.5	1.3	7.0	1.9	11.6	.001
Group (EG) x Time ^b	5.8	1.7	9.2	2.5	11.7	.001
Physical function						
Group (EG) x Time ^a	10.6	2.3	15.0	6.2	22.2	<.001
Group (CG) x Time ^a	-1.7	1.7	-5.1	1.7	1.0	.328
Group (EG) x Time ^b	8.9	1.7	12.3	5.5	26.1	<.001
Role-emotional						
Group (EG) x Time ^a	53.3	10.5	74.0	32.7	25.6	<.001
Group (CG) x Time ^a	26.6	8.6	43.5	9.7	9.5	.002
Group (EG) x Time ^b	26.7	8.9	44.1	9.2	9.0	.003
Role-physical						
Group (EG) x Time ^a	36.8	8.8	53.9	19.6	17.6	<.001
Group (CG) x Time ^a	5.8	6.1	-6.2	17.8	0.9	.346
Group (EG) x Time ^b	42.5	9.2	60.6	24.5	21.4	<.001
Social functioning						
Group (EG) x Time ^a	11.6	2.5	16.4	6.7	21.7	<.001
Group (CG) x Time ^a	4.5	1.9	8.1	0.8	5.6	.018
Group (EG) x Time ^b	7.1	1.9	10.8	3.4	14.2	<.001
Vitality						
Group (EG) x Time ^a	7.9	2.1	12.1	3.7	13.5	<.001
Group (CG) x Time ^a	-1.6	1.3	-4.1	1.0	1.5	.225
Group (EG) x Time ^b	6.3	1.8	9.8	2.8	12.2	<.001

P values were from generalized estimating equation under adjustment for sociodemographic characteristics and lifestyle covariates. A P value of .05 or less indicated statistical significance.

Abbreviations: CG, comparison group; CI, confidence interval; EG, experimental group; UCG, usual care group.

^aReference group: group (UCG) x time. ^bReference group: group (CG) x time.

self-care, resulting in less depressive symptoms, better health status, and an overall HRQL.

Although the CG did not change their sedentary behaviors, they did report improvements in depressive symptoms and some domains of HRQL, as compared with the UCG. As such, the brief lifestyle counseling with educational material does seem to have beneficial effects on depressive symptoms and HRQL in women with MetS. This is consistent with the findings of

Marshall et al⁵³ in their study among Australian adults. However, significant differences in depressive symptoms and HRQL between the CG and the UCG may be because women in the CG had similar scores in depressive symptoms and HRQL between baseline and 12 weeks. This suggests that brief lifestyle counseling with educational material may stabilize psychological health and HRQL in Taiwanese women with MetS. Whether these effects would have persisted remains unknown.

The low-cost, generalizable intervention in the CG can be a practical and population-based health promotion strategy, as compared with the multisession EG intervention. However, more intensive coaching with weekly follow-up, particularly via technology (ie, mobile apps, internet-delivered approaches), might still be recommended, because only the women in the EG increased physical activity¹⁴ and reduced their sedentary behaviors. Thus, when adding telephone reminders based on motivational interviewing, this individual intensive strategy may ensure its effectiveness on active lifestyles, and depressive symptoms and HRQL, as it did in our study population.¹⁰ A larger study of community-based clinics is needed to support the implementation of such an intervention.

Whether the improvement of depressive symptoms and HRQL is because of the reduction of sedentary behaviors, we cannot make this conclusion using our study results. However, to deepen the understanding of the role of sedentary behaviors in this hypothesis, we have used Pearson correlation analysis to evaluate the relationships between sedentary behavior (weekly sitting time), depressive symptoms, and HRQL, and found that weekly sitting time did positively correlate with depressive symptoms and negatively associated with HRQL. Therefore, we postulate that reducing weekly sitting time may lead to reduced depressive symptoms and improved HRQL. Further research testing whether reducing sedentary behaviors is a mediator of interventions that result in improvement of depressive symptoms and HRQL is required.

Generalizability of our findings is limited because of (1) a short-term (12-week) follow-up, (2) a selection bias caused by a lack of randomization in the selection of participants, and (3) a sample only from a single geographical region of Taiwan. However, strengths exist in this study, including a random allocation and a relatively low dropout rate (13%). Furthermore, multiple comparisons with 3 groups, as used in this study, provide considerations for future designs of health promotion interventions and strategies to increase patients' adherence to lifestyle behavioral changes. In the future, more rigorous sampling strategies with larger samples from multiple sites are recommended. Further studies are suggested to investigate the long-term effect of adherence to active lifestyles and psychological health as well as HRQL among middle-aged and older women with MetS. Important mediators such as self-efficacy and family or peer support that may influence women's participation in active lifestyles and contribute to improved psychological health and HRQL should be identified. In addition, the testing of this intervention with other geographically diverse groups is suggested for future study.

Conclusion

A 12-week motivational counseling strategy, incorporating lifestyle modification, is effective for behavioral

What's New and Important

- Motivational counseling incorporated with behavioral change in lifestyle modification programs can be an effective model to significantly reduce weekly sitting time for middle-aged and older women with MetS.
- Individualized, telephone-based, motivational counseling to reduce sedentary behaviors is effective for improving depression and HRQL among middle-aged and older women with MetS.

changes to reduce sedentary behaviors and improve depressive symptoms as well as HRQL for middle-aged and older Taiwanese women with MetS. It could be an effective model for community-based approaches to promote health among middle-aged and older women with other chronic health conditions including obesity, type 2 diabetes, and cardiovascular disease. Future studies are required to examine the effects of this intervention among other geographically diverse groups and patients with different chronic conditions.

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