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ORIGINAL RESEARCH

Effects of the Stanford Chronic Conditions Model on Behavioral and Clinical Indicators in Saudi Arabia: A Prospective Quasi-Experimental Study

Ghareeb Bahari[1], Ali Kerari[1], Ahmed Alsadoun[2], Muhanna Alnassar[2]

[1]Nursing Administration and Education Department, College of Nursing, King Saud University, Riyadh, Saudi Arabia; [2]Medical Surgical Department, College of Nursing, King Saud University, Riyadh, Saudi Arabia

Correspondence: Ghareeb Bahari, Nursing Administration and Education Department, College of Nursing, King Saud University, P.O. Box 642, Riyadh, 11421, Saudi Arabia, Tel +966118054381, Email gbahari@ksu.edu.sa

Purpose: This study aimed to evaluate the 6-month impact of the Chronic Disease Self-Management Program based on the Stanford chronic condition model on behavioral and clinical indicators in individuals with chronic illnesses.

Patients and Methods: This prospective, quasi-experimental study was conducted in primary healthcare centers located in Riyadh, Saudi Arabia. A total of 110 adults aged 18 years or older, living with at least one chronic disease, and receiving treatment at a primary healthcare center were included. We compared patients who received the Chronic Disease Self-Management Program with those who received the usual care from primary healthcare centers. Data analysis included analysis of descriptive and covariance statistics.

Results: The analysis of covariance indicated that individuals who received the Chronic Disease Self-Management Program had significantly lower systolic ($F=5.60$, $p<0.05$) and diastolic blood pressure ($F=7.60$, $p<0.01$). These patients were more likely to adopt healthy behaviors to manage their chronic illnesses ($F=11.17$, $p<0.01$). However, no significant differences were observed in the HbA1c values of the patients.

Conclusion: We recommend incorporating the Stanford Chronic Disease Self-Management Program into patient education to foster peer support for effective chronic disease management.

Keywords: blood glucose, blood pressure, chronic disease, health personnel, health status indicators

Introduction

Chronic conditions, which are considered the primary causes of disability, death, and high healthcare costs, are the main challenge for global healthcare systems.[1] Frequent management efforts support the development and implementation of effective prevention strategies, tools for early disease detection, educational and awareness programs, and appropriate healthcare plans for individuals with chronic conditions.[2] International healthcare systems must establish integrated models prioritizing the prevention and comprehensive management of chronic conditions to achieve optimal outcomes and alleviate the burden on healthcare systems. One globally recognized model that has demonstrated effectiveness in managing chronic diseases is the Chronic Disease Self-Management Program of Stanford University.[3]

The Chronic Disease Self-Management Program was designed to empower individuals with chronic diseases to manage their health effectively and enhance their quality of life. The program offers patients a range of strategies and skills to successfully improve disease symptoms and management.[4] Interactive workshops were conducted to teach participants about symptom control, medication adherence, adopting a healthy dietary lifestyle, problem-solving techniques, stress management, and fostering effective communication with healthcare providers.[5] The Chronic Disease Self-Management Program prioritizes a patient-centered approach that encourages active engagement in healthcare decision-making and promotes support and self-efficacy. By imparting the necessary knowledge and skills for the optimal management of chronic conditions, this program can help improve health behaviors and reduce healthcare utilization.[6]

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The Chronic Disease Self-Management Program has a significant impact on various health indicators, including blood glucose, as evaluated through the HbA1c, systolic blood pressure, and diastolic blood pressure levels.[7] The program provided the participants with valuable insights into effective management strategies for these health markers and guidance for maintaining them within normal ranges. In terms of HbA1c control, the Chronic Disease Self-Management Program provides the necessary knowledge and skills to monitor and regulate HbA1c levels through various means, such as improving medication adherence, adopting healthy eating habits, engaging in appropriate physical activity, monitoring HbA1c regularly, and recognizing and modifying lifestyle patterns to maintain stable HbA1c levels.[3] By taking a comprehensive approach to HbA1c management, the Chronic Disease Self-Management Program empowers individuals with diabetes to effectively control their HbA1c levels, thereby reducing the risk of complications and promoting better overall health outcomes.[8]

The program not only emphasizes HbA1c control but also addresses the importance of managing systolic blood pressure and diastolic blood pressure levels, which are significant indicators of cardiovascular health.[9] Through comprehensive workshops, the Chronic Disease Self-Management Program emphasizes the importance of achieving a balance between blood pressure and cardiovascular health. This provides participants with valuable educational tools to effectively manage and improve the levels of these key indicators, leading to better cardiovascular and overall health outcomes. It also prioritizes the adoption of a healthy lifestyle that includes a balanced low-sodium diet, regular exercise, weight management, and effective stress-reduction techniques.[10] The focus of the Chronic Disease Self-Management Program on self-management and behavioral changes empowers individuals to take ownership of their health and make sustainable choices that positively impact these health indicators.

In Saudi Arabia, there are significant concerns regarding high HbA1c levels and blood pressure, which require effective management to mitigate health complications.[11] Low physical activity, unhealthy eating habits, and rapid urbanization contribute to elevated clinical indicators. Genetic factors can also increase the susceptibility to health conditions, such as diabetes, hypertension, and obesity.[12] Thus, the Saudi government has implemented various health initiatives to address elevated HbA1c and blood pressure levels and prevent the further spread of these conditions. These efforts include enhancing the healthcare infrastructure, implementing health awareness activities, and promoting programs aimed at improving the quality of life and preventing chronic conditions among the Saudi population.[13]

Currently, there is no evidence of a positive health impact brought upon by the Chronic Disease Self-Management Program on HbA1c, systolic blood pressure, and diastolic blood pressure levels in the context of Saudi Arabia and its unique cultural setting. Therefore, this study was conducted to determine the 6-month impact of the Stanford Chronic Condition Model on enhancing specific health indicators for patients with chronic conditions in Saudi Arabia and to determine the effectiveness of the Chronic Disease Self-Management Program in improving the HbA1c and blood pressure levels of individuals with chronic diseases. The secondary outcome of the study was to assess the participants' perceptions regarding the impact of the Chronic Disease Self-Management Program on their self-management behaviors, evaluated at 6 months following the completion of the training workshop. Additionally, we aimed to evaluate the feasibility and implementation of the Chronic Disease Self-Management Program. Given the cultural and lifestyle context of Saudi Arabia, the findings from this study would provide valuable insights that can inform the development of more effective approaches for managing chronic conditions in the region.

Materials and Methods

Study Design and Setting

A prospective, quasi-experimental intervention study was conducted to compare patients who received the Chronic Disease Self-Management Program with those who received the usual care from primary healthcare centers over 6 months. This design enabled the tracking of a group of participants over a specific period of time while implementing an intervention. It also facilitated multiple data collections and provided various outcomes.[14] The study was conducted in primary healthcare centers located in Riyadh, the capital of Saudi Arabia, and one of the largest and fastest-growing cities in all aspects, including healthcare. In Riyadh, more than 430 primary healthcare centers provide health services to

citizens.[15] These centers primarily focus on delivering appropriate healthcare to individuals with chronic conditions. When health conditions deteriorate, patients are transferred to hospitals for enhanced healthcare services.

Participants

Saudi adults aged 18 years or older, living with at least one chronic disease, and receiving treatment at a primary healthcare center were included in this study. Patients with severe cognitive impairment were excluded from participation because this could affect their ability to understand the Chronic Disease Self-Management Program instructions and provide accurate information. The G*Power 3.1 software (Hein-rich Heine Universität, Düsseldorf, Germany) was used for sample size estimation, with a computed minimum sample size of 98 participants.

Demographics

Demographic data, such as age, sex, education, income, and comorbidities, were collected at baseline for all participants. The Chronic Disease Self-Management Program workshop facilitators tracked attendance and recorded the reasons for their absences.

Program Feasibility

Participants were asked to complete a 5-item survey developed to report their views after completing the Chronic Disease Self-Management Program workshop. Three items assessed the opinions of the participants regarding the Chronic Disease Self-Management Program and the extent of their adherence to the instructions. The measurement scale ranged from "strongly disagree" to "strongly agree", with higher scores indicating greater satisfaction with and commitment to the instructions of the program. The remaining two questions pertained to their thoughts on the duration and number of the training workshops conducted. Participants were asked whether they felt that the number and duration of workshops should decrease, which helped evaluate the subjective experiences of the participants in the Chronic Disease Self-Management Program workshops.

Clinical Measures

Pre- and post-tests were conducted to assess three clinical indicators.[7] Before the first workshop, we requested that the participants provide their most recent HbA1c readings, which were taken within no more than 2 weeks. Similarly, we asked the participants to provide the reading again within 2 weeks of the 6-month follow-up. The same process was used to measure the blood pressure levels.

Self-Care Behaviors

We employed an Arabic-validated Self-Care Profile instrument to assess the participants' self-management behaviors.[16] This instrument consists of 19 items measured on a 4-point Likert scale, with response options ranging from 1 (rarely/never) to 4 (always). Higher scores indicate more frequent engagement in self-management behaviors. The original Self-Care Profile assessed self-management behaviors covering common treatment behaviors, such as medication adherence, physical activity, healthy eating, smoking cessation, weight management, self-monitoring, regular healthcare visits, stress reduction, and alcohol moderation.[17] However, the validated Arabic version of the instrument excluded the alcohol consumption item as it is inappropriate given the cultural context and prohibition of alcohol in Saudi Arabia.[18] The Cronbach's alpha of the validated version of the scale and that of this study was 0.84.

Intervention and Data Collection Procedures

Participants were recruited through flyer distribution, word of mouth, and referrals from health and local organizations. The study implementation involved a 6-week training workshop, with each session lasting 2.5 hours and conducted once a week. The workshops were led by certified Chronic Disease Self-Management Program trainers, who followed the program's implementation guidelines and utilized a reference book. Because Saudi society is not mixed in terms of gender, the training sessions were delivered by two male trainers for the male participants and two female trainers for the female participants. The Chronic Disease Self-Management Program workshops were conducted in a community-based

setting. In terms of program fidelity, one master's trainer and three lay leaders, who attended the required four-day training program, facilitated the workshops. On the other hand, participants in the control arm received usual care for chronic diseases at primary care clinics.

During the workshop, strategies for maintaining appropriate HbA1c and blood pressure levels through healthy eating, regular exercise, and other preventive measures were discussed. Important approaches for maintaining a healthy body weight have also been discussed. Furthermore, we provided medical instructions to enhance the management of the chronic conditions of the participants. The workshops and questionnaires were conducted in Arabic, which is the official language of Saudi Arabia. The questionnaire was translated into Arabic to ensure a better understanding by the participants.

Data Analysis

Statistical analyses were conducted using SPSS version 29 software (IBM Corp., Armonk, NY, USA). Descriptive statistics are presented as frequencies and percentages. The normal distribution and statistical test assumptions were met. Chi-square tests and independent t-tests were performed to compare baseline demographic characteristics and outcome measures between the two groups. At the 6-month follow-up, we evaluated the changes in outcomes between the groups using a one-way analysis of covariance. Baseline scores of outcome measures were used as covariates in the analysis of the covariance model. Missing data were handled using listwise deletion. Statistical significance was set at $p<0.05$.

Ethics

This study was conducted following the Declaration of Helsinki and approved by the Institutional Review Board of King Fahad Medical City (Ref number: 22–598E; approved on January 8, 2023). All patients completed the consent form and were informed that their participation was voluntary and that they could select not to participate if desired. To maintain anonymity, each participant was assigned a unique numerical identifier. They were also assured that their responses would be kept confidential and accessed only by the research team members.

Results

Enrollment and Demographics

The study was conducted between October 2022 and April 2023. Four trained bilingual leaders from a public university facilitated three Chronic Disease Self-Management Program workshops, with the class sizes ranging from 12 to 18 participants. Overall, the study achieved satisfactory response rates for this community-based program, with a 78% (n=135) response rate at baseline and an 81% (n=110) response rate at the 6-month follow-up assessment. The mean age of the 110 participants included in the study was 47.20 years (Table 1). Most participants had type two diabetes (75%, n=83) and other chronic illnesses, such as hypertension (84%, n=93), heart disease (9%, n=10), and arthritis (4%, n=5). More than half of the participants reported having less than a bachelor's education level (45.5%).

Program Feasibility and Attendance

The program feasibility, which was measured using the three items, namely the application of learned self-management skills, self-management skills contribution to better disease management, and Chronic Disease Self-Management Program recommendation and invitation to other individuals with chronic diseases, was perceived by the majority of the participants to be "strongly agree". The overall mean program feasibility was 3.68/4, suggesting a greater satisfaction with and commitment to the program's instructions. Accordingly, most participants reported that the number and duration of the program sessions were appropriate (Table 2). All participants (n=45) attended four or more of the six sessions; attending at least four sessions is the minimum requirement to be regarded as a program completer. The participants attended a mean of 5.7 sessions. The research team reported different reasons for missing sessions, such as clinical appointments (45%), work commitment (27%), travel (18%), and others (10%).

Table 1 Participants' Demographics

Variables	Intervention (n=45)	Control (n=65)	p-value
Mean Age, years (SD)	43.76 (7.22)	49.58 (14.62)	<0.001
Sex			<0.05
Female (%)	50	50	
Male (%)	28.3	71.7	
Education			<0.01
Higher Education (%)	53.3	46.7	
Lower Education (%)	74	26	
Income			<0.001
<2400 US Dollars (%)	20.6	79.4	
>2400 US Dollars (%)	73.8	26.2	
Comorbidity			0.123
Living with one chronic disease (%)	45.9	54.1	
Living with more than one chronic disease (%)	30.6	69.4	

Notes: Independent *t*-test or chi-square test procedures were conducted to compare baseline differences in demographic variables between intervention and control groups.
Abbreviation: SD, standard deviation.

Table 2 Perspectives Towards the Program's Feasibility and Structure

	Responses	
Program feasibility and structure	Options	n (%)
I applied any of the skills that I learned from the program.	Strongly agree	28 (62.2)
	Agree	17 (37.8)
The skills that I learned from the program helped me manage my condition.	Strongly agree	29 (64.4)
	Agree	16 (35.6)
I recommend the program to other patients with chronic illnesses.	Strongly agree	35 (77.8)
	Agree	10 (22.2)
Session's duration (2.3 hrs for each session)	It's appropriate	36 (80)
	I prefer each session lasts less than 2.3 hrs	9 (20)
Session's number (six sessions)	It's appropriate	40 (88.9)
	I prefer that we have less than six sessions	3 (6.7)
	I prefer that we have more than six sessions	2 (4.4)

Baseline Characteristics

Participants in the intervention group were statistically significantly younger than those in the control group, with a mean age of 43.76 years versus 49.58 years in the control group ($p<0.01$). Additionally, the intervention group had a higher

proportion of participants with higher education levels (53.3% vs 46.7%, p<0.01), and fewer participants reported low-income levels. No statistically significant differences in comorbidities were observed between groups. No statistically significant differences were also found in the clinical indicators of chronic diseases, such as in the HbA1c values (9.24% vs 6.47%, p=0.18), systolic blood pressure (135.24 vs 131.42 mmHg, p=0.25), and diastolic blood pressure (81.27 vs 80.71 mmHg, p=0.70), between the groups. Further, no statistically significant differences in self-management behaviors were found between the groups at baseline (Table 3).

Comparison Between the Groups at the 6-month Follow-up

After controlling for covariates, the effectiveness of the Chronic Disease Self-Management Program was examined for the following outcomes: (1) HbA1c, (2) systolic blood pressure, (3) diastolic blood pressure, and (4) self-management behaviors at 6-months post-intervention. Using the analysis of covariance, the intervention group showed statistically significant reductions in the systolic and diastolic blood pressures compared with the control group (p<0.001 and p<0.01, respectively). In addition, self-management behaviors significantly increased in the intervention group. However, there was no statistically significant difference in the HbA1c values between the two groups (Table 4).

Table 3 Baseline Mean Values of HbA1c, Systolic and Diastolic Blood Pressure, and Self-Management Behaviors

Outcomes	Mean (SD)		p-value
	Intervention (n= 45)	Control (n= 65)	
Mean HbA1c (SD)	6.40 (1.32)	8.83 (6.53)	0.19
Mean Systolic Blood Pressure (SD)	131 (16.13)	135 (15.32)	0.25
Mean Diastolic Blood Pressure (SD)	81	82	0.70
Self-Management Behaviors (19–76) (SD)	47.93 (10.29)	49.84 (9.72)	0.324

Notes: Independent *t*-test analyses were performed to compare baseline mean scores between intervention and control groups. The brackets indicate the range of score.
Abbreviation: SD, standard deviation.

Table 4 Comparison of Outcomes Between the CDSMP and Usual Care Groups Using ANCOVA

Outcomes	Group	Mean	S.E.	95% CI	p-value
HbA1c	CDSMP Usual	5.94 8.77	1.31 1.14	5.28–8.51 5.85–10.40	0.49
Systolic Blood Pressure	CDSMP Usual	126 132	1.59 1.33	123–130 129–135	<0.001
Diastolic Blood Pressure	CDSMP Usual	78 82	0.86 0.73	77–80 81–84	<0.01
Self-Management Behaviors (19–76)	CDSMP Usual	53.71 49.66	0.93 0.77	51.86–55.55 48.12–51.19	<0.01

Notes: Analysis of covariance (ANCOVA) was conducted to compare the mean changes of scores at 6 months, controlling for baseline scores of outcome measures. The brackets indicate the range of score.
Abbreviations: CDSMP, Chronic Disease Self-Management Program; SE, standard error; CI, confidence interval.

Discussion

In this study, we aimed to assess the effectiveness of the Chronic Disease Self-Management Program on the management of HbA1c levels, systolic blood pressure, diastolic blood pressure, and self-management behaviors among patients with chronic diseases that were not well controlled. We found statistically significant differences in the clinical and behavioral outcomes (systolic blood pressure and diastolic blood pressure levels, and self-management behaviors) between the Chronic Disease Self-Management Program intervention and usual care groups. To the best of our knowledge, this is the first quasi-experimental study to evaluate the impact of the Chronic Disease Self-Management Program on specific clinical and behavioral indicators in Saudi Arabia. This study provides substantial evidence that can help shape our understanding of the factors contributing to successful chronic disease self-management and improved clinical indicators. In addition, this information is valuable for implementing future Chronic Disease Self-Management Program interventions to achieve better outcomes and quality of life in diverse patient populations.

Six-month reunions are an effective approach for collecting follow-up data, which resulted in an 81% completion rate in the study. Regarding the views of the participants regarding the program, the sessions provided opportunities for the participants to share their success in managing chronic conditions and achieving better health outcomes. The results from program feasibility and fidelity monitoring indicated acceptance within the target population and increased participant engagement in the workshops. Utilizing a collaborative partnership for this study was imperative, as the Chronic Disease Self-Management Program facilitators were fully oriented toward the program protocol and its fidelity because of their long-term affiliation with the Self-Management Resource Center.

In terms of the impact of the program on the HbA1c levels, the results were promising. First, the participants in the intervention group with a baseline HbA1c of 6.5% or less did not have significant changes at 6 months. Second, it is important to note that the HbA1c of the participants in the intervention group declined by 0.46% at 6 months. Our results need to be validated because of the probability of methodological confounding factors, including the baseline HbA1c scores and small sample sizes. Participants in the intervention group had lower HbA1C values (less than 6.50%) than those in the control group, suggesting the importance of glycemic control. Similarly, a Chronic Disease Self-Management Program study found that participants with baseline HbA1c levels of less than 7% reported no significant improvements.[19] In another study that employed a self-management program among 1242 participants with type 2 diabetes, patients with a baseline HbA1c level of greater than 7% showed statistically significant glycemic improvements at 6 months.[20] The Chronic Disease Self-Management Program may significantly lower HbA1c levels than good routine care, especially for individuals with high baseline HbA1C scores (>7%).[7,19,20] In Saudi Arabia, a randomized controlled trial can confirm the positive impact of the Chronic Disease Self-Management Program on lowering the HbA1c level of individuals with high values.

Another observation in this study was the reduction in systolic and diastolic blood pressure, which may have resulted from the direct influence of the Chronic Disease Self-Management Program intervention. This program emphasized the importance of developing weekly action plans and problem-solving skills, which enable the participants to set appropriate goals to improve disease self-management and adherence to pharmacological medications.[21] Our findings corroborate the results of other studies showing that participation in the Stanford program may be associated with improved blood pressure control.[7] In contrast, control participants who received usual care in primary care units maintained their usual visits and traditional individual appointments but had worsened blood pressure levels. In a prior study, a decline in adherence to antihypertensive medications in the control group was reported due to the lack of self-management skills and complexity of treatment plans.[22] Person-centered programs, such as the Stanford Chronic Disease Self-Management Program, can help patients develop effective communication with their healthcare providers, contributing to greater trust, increased compliance with treatment regimens, and the achievement of recommended blood pressure targets.[21,23]

In this study, we also found that the Chronic Disease Self-Management Program group showed significant improvements in the adoption of various self-management behaviors. The improvement observed in the Chronic Disease Self-Management Program group may be attributed to the integration of the self-efficacy theory by Bandura into the program. Self-efficacy, or the belief of individuals in their ability to achieve a specific task, has a noticeable impact on the self-

management of chronic conditions.[24] Patients with high self-efficacy are more likely to engage in self-management activities and report better health outcomes than patients with low self-efficacy.[25–27] In this study, the Chronic Disease Self-Management Program sessions helped participants living with chronic diseases learn various skills that increased their self-efficacy and self-management of chronic diseases, such as techniques for dealing with stress and negative symptoms, managing eating habits, making effective decisions, adhering to medication regimens, and incorporating physical exercise into their daily lives. The Chronic Disease Self-Management Program participants were also motivated to apply these techniques, which helped boost their confidence and led to successful chronic disease self-management.

Limitations

This study had some limitations. First, this was a quasi-experimental study, wherein no participant randomization was conducted, and may have led to potential biases influenced by patient preferences or decisions made by the research team members who implemented the study intervention and data collection. Second, the quasi-experimental study design limited the control over confounding factors, which made it challenging to isolate the effects of the experiment on the outcomes.[28] Furthermore, this study was conducted only in Riyadh, and a nationwide study would be warranted to enhance the generalizability of the findings.

Conclusion

The Chronic Disease Self-Management Program is an effective intervention for improving specific behavioral and clinical outcomes, such as blood pressure levels, among individuals with chronic health conditions. This program could also effectively support people to develop specific action plans, participate in problem-solving activities, and take responsibility for the daily management of their illnesses. These factors increased their self-efficacy levels, allowing them to better mitigate the physical and emotional impacts of their disease with and without the assistance of healthcare providers. While our study reported a lack of significant changes in HbA1c levels, possible factors such as patient adherence, the duration of our intervention, or variability in individual responses to the program may have contributed to this outcome. Future research should explore how the principles of the Stanford program can be adapted to meet the unique needs of diverse populations, thereby enhancing its applicability and effectiveness in different settings.

Practice Implications

Traditional health education focuses on providing disease-specific information about diet, exercise, and medication in a way that is not patient-centered. Providing disease-specific information is insufficient to ensure the successful self-management of chronic diseases. Healthcare professionals should address motivational interview strategies, coping mechanisms, and other necessary behavioral skills that contribute to better disease self-management. Person-centered programs, such as the Stanford Chronic Disease Self-Management Program, foster peer support in learning strategies for managing life with chronic diseases. These kinds of programs can be regularly implemented in primary care settings to support patients with chronic diseases in Saudi Arabia, play an active role in their health, and select appropriate healthcare services for intervention. However, it is important to discuss the feasibility of scaling the Stanford program within the local primary healthcare system. Factors including resource availability, sufficient training for healthcare providers, or cultural acceptance should be addressed.

Primary healthcare professionals can work as program facilitators to help people adopt the self-management skills needed to manage their chronic illnesses successfully.

Data Sharing Statement

Data are not shared due to privacy and ethical restrictions.

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Disclosure

Dr. Ghareeb Bahari and Dr. Ali Kerari contributed equally as first-joint authors. The authors report no conflicts of interest in this work.

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