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Impact of Behavioral Interventions on Patient Activation in Adults with Hypertension: A Systematic Review and Meta-Analysis

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Abstract

Introduction: Behavioral interventions assist patients in maintaining optimal self-management of their health, especially in those at risk of certain conditions. Little is known about the effects of self-management interventions on patient activation in adults with hypertension. Therefore, this systematic review and meta-analysis aimed to evaluate how self-management strategies affect changes in activation levels in adults with hypertension. **Methods:** We searched online databases: PubMed, CINAHL, and Cochrane Central Register of Controlled Trials for studies published between January 2004 and May 2021. We included randomized controlled trials that assessed the effects of self-management interventions on patient activation in adults with hypertension and reported patient activation using the patient activation measure (PAM). **Results:** 4 Four studies (N = 1415 participants) met the inclusion criteria. In adults with hypertension, self-management interventions improved patient activation with moderate strength of evidence. A community-based self-management program, motivational interviewing strategies, and home-based patient-activated care were associated with better PAM scores than usual care. **Conclusion:** Our findings reinforce the need for healthcare providers to incorporate these interventions into primary care to support the adoption of recommended hypertension self-management behaviors. Future studies must focus on tailoring support to the patient's level of activation in hypertension self-management.

Keywords

adults with hypertension, self-management, behavioral intervention, patient activation

What is already known about the topic?
In the management of chronic diseases, higher levels of patient activation contribute considerably to enhanced patient self-management and health outcomes.

How does your research contribute to the field?
This systematic review and meta-analysis contributes to our understanding of the relevance of patient activation, particularly in the context of hypertension self-management.

What are your research's implications towards theory, practice, or policy?
Improving patient activation may result in reduced rates of health service utilization and, as a result, lower healthcare expenditures.

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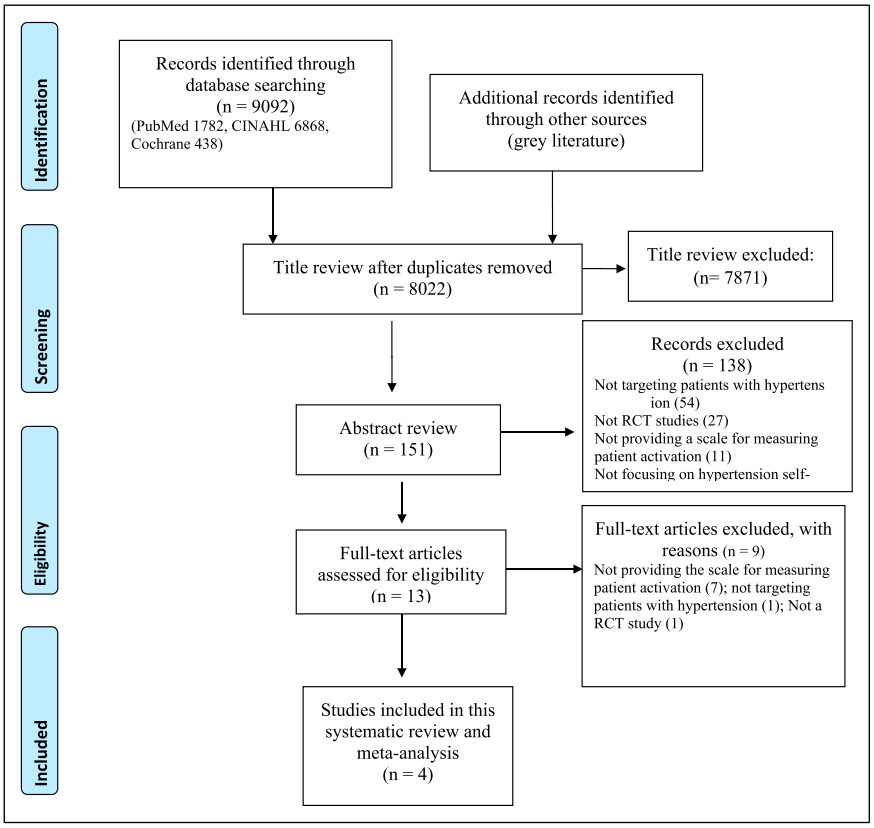

Figure 1. PRISMA flow diagram for included and excluded studies.

The Impact of Behavioral Interventions on Patient Activation in Adults with Hypertension

Across the world, rates of hypertension are soaring. Since 2000, hypertension has affected around 26.4% of the adult population worldwide—an estimated 972 million individuals.[1,2] In light of the high cost of treating hypertension, a number of research studies have addressed the importance of hypertension self-management interventions, which contribute to improved health outcomes and cost-effectiveness.[1]

The concept of self-management relates to how patients maintain their health status.[3] In chronic disease management, self-management was conceptualized to include 4 stages: (1) adequate knowledge regarding signs and symptom changes related to the illness; (2) change assessment and evaluation; (3) implementation of an appropriate treatment regimen; and (4) evaluation of the effectiveness of the therapy. Behavioral interventions aim to assist patients in maintaining optimal self-management of their health—especially those at risk of certain conditions. Little is known about a subset of novel behavioral interventions grounded in the concept of patient activation: patients' willingness and ability to take an active role in managing their health condition.[4] Many patients do not realize that this can result in better health outcomes and prevent complications.[4] Research has shown that higher levels of patient activation in the management of chronic conditions contribute significantly to improved patient self-management and health outcomes. Additionally, researchers have indicated that high levels of activation in disease management help patients achieve the best possible quality of life and diminish the risk factors of their chronic disease.[5,6]

It is imperative for adults with hypertension and for those who develop, implement, and fund hypertension self-management programs to understand the impact of self-management interventions on the relationship between changes in activation and health outcomes. They must also design appropriate interventions to encourage activation. To our knowledge, no prior systematic reviews of behavioral interventions have focused on the significance of activation levels in self-management behaviors for adults with hypertension. Therefore, we conducted a systematic review to evaluate the impact of self-management interventions on changes in activation in adults with hypertension.

Methods

Search Strategy Terms

We developed a protocol to conduct a systematic search around the impact of behavioral interventions on patient

Table 1. The PICOT Format of the Study.

Population	Adults with Hypertension
Intervention	Strategies used in hypertension self-management interventions ((ie, motivational interviewing, community-based education, other behavioral interventions focused on motivation and engagement in hypertension care plans)
Comparison	Behavioral/self-management intervention and usual care
Outcome	Changes in patient activation measure scores
Time	N/A
Setting	Hospitals, inpatient/outpatient clinics, and home care

Table 2. Study Characteristics.

Author/ Year/	Study D/Study Purpose/ Population	Follow-Up (Length)	Intervention	Instruments and Outcomes	Findings	Level of Evidence
Hibbard, 2007	RCT (parallel arms) **Objective**: Determine whether patient activation is a changing or changeable characteristic and to assess whether changes in activation also are accompanied by changes in health behavior. **Target**: Patients with chronic diseases, including hypertension	6 weeks	The intervention group received "the chronic disease self-management program (CDSMP), which is a workshop given once a week, for 2 and a half hours, over 6 weeks, in community settings." The control group received usual care and were offered the CDSMP course at the end of the study period	The patient activation measure (PAM)-13. Change in PAM score	For changes in activation levels for the intervention and control groups, the intervention group increased activation scores significantly above those in the control group by 6 weeks ($F= 13.44$, $P < .0001$)	Level I and good quality
Ryvicker, 2013	RCT (three arms) **Objective**: Examine the impact of the interventions change in PAM score and whether change in PAM score was associated with BP outcomes. **Target**: Patients with hypertension	12 M	In addition to usual care and basic interventions (eg, receiving emails regarding hypertension specific recommendations), the augmented intervention is grounded on patient activation and motivational interviewing techniques	The 13-item PAM-13. The change in PAM score	The augmented group did not yield a significant positive change in PAM score relative to usual care at 12 months	Level I and good quality
Wagner, 2012	RCT. Examine the impact of a personal health record (PHR) in patient with hypertension. **Target:** Patients with hypertension	12 M	The intervention group received PHR intervention regarding hypertension self-management. Others received usual care	The 13-item PAM. The change in PAM score	No impact of the PHR was observed on the change in activation levels between 2 groups	Level I and low quality
Young, Hertzog, and Barnason (2016)	RCT. **Objective** To evaluate the mechanism of the patient activation intervention, comparing the intervention and usual care (UC) groups on patient activation at the end of intervention. **Target:** Patients with chronic diseases including hypertension	3 M	The intervention received a home-based activation intervention. The control group received only usual care related to chronic disease self-management	The 13-item PAM. The change in PAM score	A home-based activation intervention was observed on the change in activation levels between 2 groups	Level I and good quality

RCTs= Randomized controlled trials. PHRs= personal health records.

activation in adults with hypertension. We searched for original articles published between January 1, 2004, and May 1, 2021, in 3 electronic databases: PubMed; Cumulative Index of Nursing and Allied Health Literature (CINAHL); and the Cochrane Central Register of Controlled Trials. We also used gray literature searching and additional records were identified as indicated in Figure 1. The search strategy used for the bibliographic databases included terms related to hypertension and behavioral interventions (see Appendix A for the detailed search strategy).

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were developed using the PICOT format (see Table 1). We included studies that 1) conducted a behavioral intervention with hypertensive adults; 2) were written in English; 3) were published between 2004 and 2021; and 4) measured patient activation using the patient activation measure (PAM). We included only randomized controlled trials (RCTs) that compared interventions focused on hypertension self-management to routine care. Studies that did not meet the inclusion criteria were excluded. For instance, some studies were excluded because of not measuring patient activation using the PAM-13.

Search Process

We searched the health-related bibliographic databases PubMed, CINAHL, and the Cochrane Central Register of Controlled Trials. A librarian was consulted for assistance with searching each database appropriately (see Appendix A). We implemented 2 levels of screening. At the first level, 2 reviewers independently screened the titles of each study. At the second level, 2 independent reviewers read the abstracts of each study. On the basis of the inclusion and exclusion criteria, decisions were made to include or exclude studies from this review. Two independent reviewers then read and

Table 3. Population Characteristics.

Author/Year	Sample Size	Number of the Intervention/ Control Group	Age and Gender	Participant Characteristics
Hibbard, 2007	479 participants	Intervention group:	Intervention group: Male: 31%	Intervention:
		N= 244	Female: 69% *M age= 59.6	Race= 97.5% white and 2.5% other
		Control group:	Control group: 30.4% male	Control:
		N= 235	69.6% female M age= 60	Race: 95.6% white and 4.4% other
Ryvicker, 2013	396 participants	The augmented group: N = 188	Augmented group: Male= 29.8% (56) Female= 70% (132)	Augmented group:
			M age= 64.4	M Income <1000= 56.2%
		The control group: N= 208	Control group:	Educational level (>high school graduate= 35.6%
			Male= 33.7%	Control group:
			Female= 66.4%	M Income <1000= 55.6%
			M age= 63.2	M educational level (>high school graduate= 42.8
Wagner, 2012	443 participants	Intervention: 190. Control: 250	**Intervention**/Mean age: 54.75	**Intervention**/White: 98 (50.5%)
			Male: 45 (24.9%)	African American: 86 (45.3%)
			Female: 145 (75.1%)	Other: 8 (4.2%)
			Control/Mean age: 54.83	Control/White: 124 (50%)
			Male: 85 (34%)	African American: 116 (46.8)
			Female: 165 (66%)	Other: 8 (3.2%)
Young, Hertzog, and Barnason (2016)	97 participants	Intervention: 50	**Intervention**/mean age: 68.7.	**Intervention**/M annual family income <$30,000= 47.1%
			Male: 24 (47.1%)	
			Female: 27 (52.9%)	Control group:
		Control: 47	Control/mean age: 71.8	
			Male: 12 (25.5%)	M annual family income <$30,000= 55.1%
			Female: 35 (74.5%)	

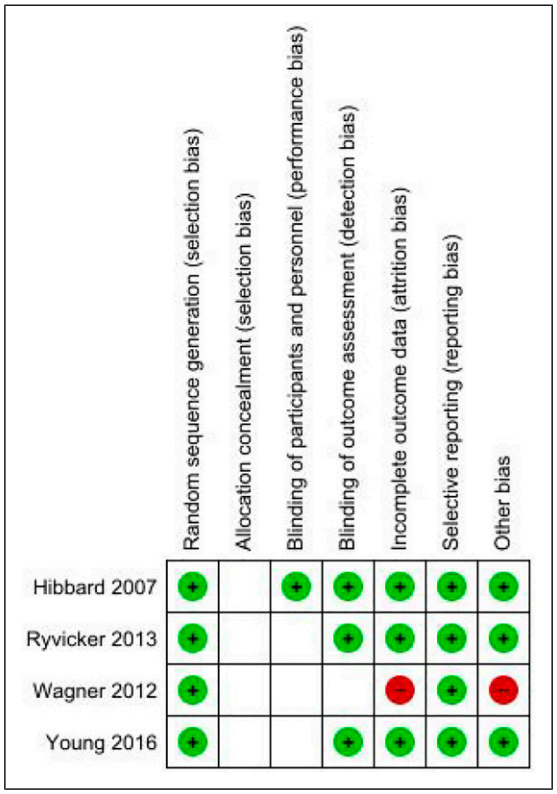

Figure 2. The Cochrane Collaboration's Tool to assess Risk of Bias for RCTs.

critically appraised the full text of each study. They identified at the first level which study was included in the discussion and analysis.

Data Extraction and Quality Assessment

Both reviewers extracted the pertinent data using standardized forms on study design, study population, study interventions, and outcome measures and results. Two independent reviewers assessed the data entry and quality of included studies.

Data Synthesis and Analysis

Data were displayed in tables to facilitate comparisons in study design, population, intervention, and quality (Tables 2 and 3). When studies were sufficiently homogenous across these characteristics, we conducted meta-analyses evaluating the differences in patient activation scores between the behavioral intervention and usual care. We combined studies and calculated the weighted mean difference and 95% confidence interval using the random effects model to account for between-study heterogeneity.

Where included studies contained multiple arms, only 2 arms were assessed to maintain study independence. We selected the most rigorous intervention arm to include in the meta-analysis if more than 1 intervention arm was conducted.[1,2,7] Statistical heterogeneity was examined based on the value of an I-squared test (heterogeneity is considered substantial if $I^2 > 50\%$).[8] Egger's test was used to quantify publication bias captured by the funnel plot. All statistical tests were set at a two-sided significant alpha of .05. All statistical analyses were carried out using Review Manager (RevMan) version 5.3.

Grading of the Evidence

Using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) working group criteria, 2 reviewers assessed the consistency of the results, the directness of the instruments used for outcome measurements, the precision of the results, and the magnitude of the effects. Risk of bias across studies was evaluated using the Cochrane Collaboration's tool (eg, assessing for selection, performance, detection, attention, reporting, and other biases). As most included studies compared hypertension self-management interventions to usual care, it was often impossible to conduct double blinding. Knowledge of interventions allocation, in either the researcher or the participant may influence the results of any trials. The nature of hypertension self-management interventions (ie, physical exercise or other HTN self-management activities) made it impossible to blind the participants and personnel due to the subjectivity of study outcomes. Thus, the component blinding of participants and personnel in the Cochrane Collaboration's tool was not addressed in this meta-analysis. To grade the strength of the evidence of an outcome, certain conditions were taken into account. The criteria for grading the quality of evidence included risk of bias, inconsistency of the evidence across research studies, indirectness of the evidence, imprecision and magnitude of the intervention outcome, potential publication bias.[9]

Results

Study and Population Characteristics

Of 9094 citations, 4 studies involving 1415 participants met the inclusion criteria (Figure 1). All studies were RCTs, and all were conducted in the United States. The majority of participants in the selected studies were female (around 70% of the total participants in the 4 studies). The target population of the selected studies[10,11] was patient with hypertension, except the study conducted by.[12] All the participants included in the study by Hibbard lived with chronic diseases including hypertension disease. Thus, we included all the participants in the meta-analysis. Subjects were middle-aged (weighted mean age 59 years) and with fair baseline blood pressure control

(weighted mean SBP 143 mmHg in 2 studies). To measure patient activation, all studies used the same instrument (the 13-item PAM). Studies incorporated different hypertension self-management interventions. Only 2 studies conducted self-management interventions grounded in patient activation and motivational interviewing techniques.[10,12]

The strategies used in the other studies focused on personal health record intervention to improve hypertension self-management and chronic disease self-management. Most interventions were delivered by healthcare professionals such as physicians and nurses. The intervention was conducted in a patient–physician clinic, via a home care nurse's usual care, or in a community setting.[10-12] In terms of duration, 2 of the studies spanned 12 months, while other 2 lasted 3 months and 6 weeks, respectively. Study and population characteristics can be found in Tables 2 and 3.

Quality: Risk of Bias

All selected studies reported the method of random sequence generation in sufficient detail. However, none of the 4 studies provided information regarding the allocation concealment method. One of the selected studies provided no details on handling missing data and reported threats to external and internal validity (eg, cross-arm contamination) and was thus low quality.[11] The remaining studies (75%) had a low risk of bias based on the Cochrane Collaboration's tool (Figure 2).

Meta-Analysis of Effects of Changes in Activation

Four RCTs contributed to the data on the effects of hypertension self-management interventions on changes in patient activation. Hypertension self-management interventions modestly increased patient activation scores compared to usual care or control groups (mean difference = 2.30 and 95% CI = .52 to 4.09; see Figure 3). The strength of the evidence was moderate for changes in patient activation scores given that results were considered direct and precise with a low risk of bias. Details about the GRADE working group criteria for the meta-analysis of hypertension self-management interventions on changes in activation can be found in Table 4.

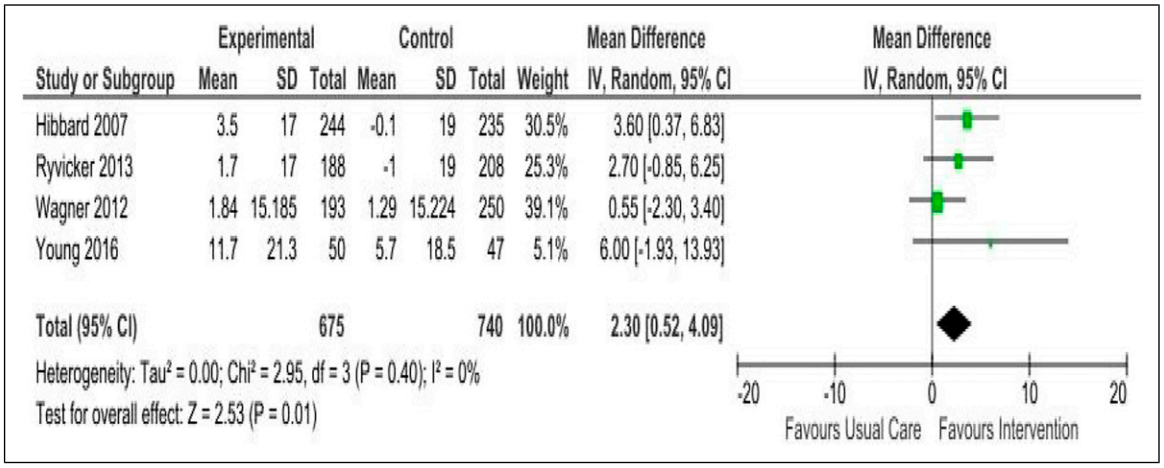

Figure 3. Meta-analysis of effect on patient activation.

Table 4. The GRADE Guidelines.

Comparison	Behavioral/Self-Management Intervention Among Patients with Hypertension and Usual Care
Number of articles (N participants)	4 articles (1415 participants)
Risk of bias	Low risk of bias
Consistency	No important inconsistency
Directness	Direct
Publication on bias/reporting bias	Undetected
Precision	Imprecise (Wide confidence intervals)
Magnitude of effect	Small (mean effect Size= 2.30)
Conclusion	Intervention favored over usual care for the change in PAM scores
Strength of the evidence	Moderate

Publication Bias

All 4 studies were plotted near the average. The funnel plot for the change in patient activation outcome did not demonstrate evidence of publication bias ($P = .40$ and $I^2 = 0\%$; Figure 4).

Discussion

Key Findings

We examined 4 different types of hypertension patient activation interventions in 4 separate studies. In this meta-analysis, the change in patient activation scores was used as the primary outcome, as it was reported in all of the included trials. Our meta-analysis showed that these interventions increased activation scores in adults with hypertension (ranging from .52 to 4.09). The strength of evidence was rated moderate for the outcome due to consistency among the studies with low risk of bias. Various strategies were implemented to advance patient activation to higher levels to improve their hypertension self-management behaviors and health outcomes. A home-based activation intervention, a community-based disease self-management program, and patient activation and motivational interviewing strategies elicited the largest improvements in patient activation compared to the personal health record intervention; these increased activation scores by 11.7, 3.60, and 2.70, respectively, compared with .55. By contrast, the personal health record intervention showed the lowest improvement in activation scores among adults with hypertension. However, these also had higher baseline patient activation scores and large numbers of patients with controlled blood pressure, which could have made improvements more difficult to detect. Our meta-analysis indicated no significant heterogeneity between the studies, but power was low to detect these differences.

Prior Literature

A growing body of evidence links patient activation to the adoption of healthy lifestyles, improved clinical indicators, and lower rates of healthcare utilization.[13] In a cross-sectional study of 1470 patients with diabetes and cardiovascular diseases, researchers explored the relationship between patient activation levels and the frequency of visits to primary healthcare facilities.[14] In aspects of all activation stages, participants with cardiovascular conditions had a greater tendency to frequently visit healthcare facilities.[14] Other researchers have shown that individuals with high levels of activation are more likely to engage in positive lifestyle modifications such as regular exercise, higher consumption of fruits and vegetables, stress management, and not smoking.[12]

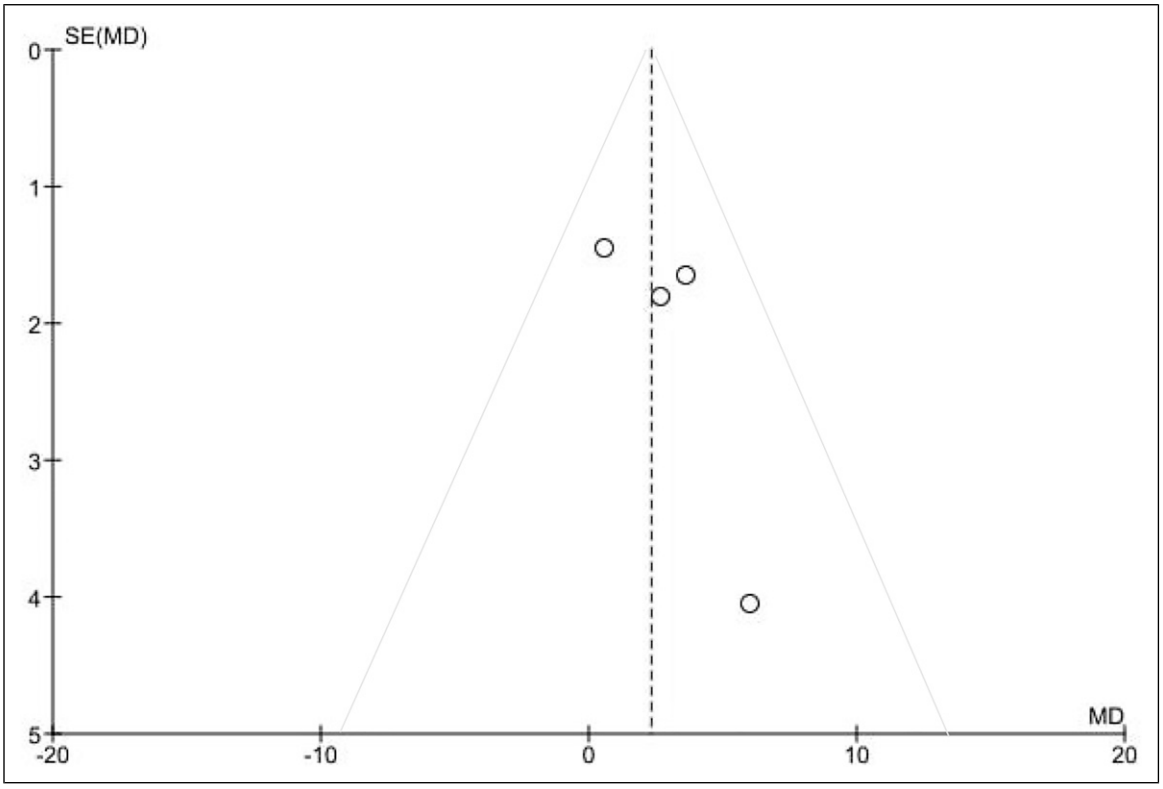

Figure 4. The funnel plot for the assessment of publication bias.

Novel Findings

No prior systematic reviews have examined the effects of behavioral interventions on the change in patient activation scores for adults with hypertension. This systematic review and meta-analysis contributes to the current knowledge base on the importance of patient activation, particularly in the context of hypertension self-management. This study evaluated 3 different strategies for activating adults in the practice of required hypertension self-management activities. It demonstrated that a community-based disease self-management program and motivational interviewing techniques were the most efficient interventions and had a significant impact on patient activation.[10,12] Other researchers found that a 3-month, home-based activation program was associated with larger improvements in patient activation scores.[15]

Limitations

The trials included in this review have some limitations. First, only 4 trials met the eligibility criteria and were included in this study; the lower power made it challenging to draw firm conclusions regarding publication bias.[10-12,15] Second, 2 articles did not report measures of variability (eg, standard deviation), making it difficult to perform the forest plot to evaluate our outcome. One of the pervasive problems in meta-analyses of continuous outcome data is missing standard deviations.[7] As alternative solutions, we used other studies' baseline standard deviations in the same meta-analysis.[7]

Implications

Given the high incidence of hypertension worldwide, it is clear that healthcare providers must address inadequate hypertension self-management. The annual cost of providing optimum treatment for uncontrolled hypertension in the United States was around 42.9 billion.[16] Improving patient activation may result in reduced rates of health service utilization and, as a result, lower healthcare expenditures. Our findings suggest that community-based chronic disease self-management programs should be incorporated into primary care, particularly for people with uncontrolled hypertension. Strategies that combine chronic disease self-management and motivational interviewing techniques by healthcare providers are more likely to activate patients in the practice of recommended self-management tasks than standard care.

Conclusion

Community-based disease self-management programs and motivational interviewing methods are effective in increasing patient activation and, in turn, support self-management behaviors around chronic conditions such as hypertension. Healthcare providers should consider actively involving adults with poor blood pressure control in self-management activities to prevent hypertension complications and reduce healthcare service utilization. The future research must focus on tailoring support to the individual's level of activation in hypertension self-management.

Appendix A

Databases and Keywords

PubMed (2004-2021)

"Hypertension" (tiab) OR "hypertension" [Mesh] AND ("self-management" (tiab) OR "self care" [Mesh] OR "patient activation" (tiab) OR "PAM-22" [tiab] OR "PAM-13" (tiab) OR "patient participation" [Mesh] OR "patient engagement" [tiab] OR "patient empowerment" (tiab) OR "Individualized care plans" (tiab) OR "behavioral intervention" (tiab) OR "behavior change" (tiab) OR "self-regulation" (tiab)).

CINAHL (2004-2021)

MH "Hypertension/ED/TH/PC" AND ("patient activation" OR "PAM-22" OR "PAM-13" OR MH "Patient Education/ED") OR (MH "Patient Centered Care/ED") OR "patient engagement" OR (MH "Self Care/ED") OR "self-management" OR "behavioral intervention").

Cochrane (2004-2021)

Hypertension" AND ("self-management" or "self care" OR "patient activation" OR "patient participation" OR "patient engagement" OR "patient empowerment" OR "Individualized care plans" OR "behavioral intervention" OR "behavior change" OR "self regulation").

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Authors' Contributions

We ensure that the authors listed above have contributed to this study based on the criteria of the International Committee of Medical Journal Editors. The authors approved the manuscript and agreed to be submitted to *Inquiry* journal

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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