Effects of Patient Activation Intervention on Chronic Diseases: A Meta-Analysis

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ABSTRACT

Background: Patient activation has been described as a potential strategy to improve chronic disease self-management. However, the effects of patient activation interventions on psychological and behavioral outcomes have not been systematically evaluated.

Purpose: This study was designed to evaluate the effects of patient activation interventions on physiological, psychological, behavioral, and health-related quality of life outcomes in patients with chronic diseases.

Methods: We systematically searched four databases (PubMed, Cochrane, CINAHL, and Embase) from inception to September 1, 2017. We identified English- and Chinese-language published reports of randomized controlled trials that evaluated the effects of patient activation interventions for adults with chronic diseases. Study selection, data extraction, and quality assessment were performed by two reviewers independently. We summarized the intervention effects with Hedges’s g values and 95% confidence intervals using a random-effects model. We used the Cochrane Handbook to assess the methodological quality of the randomized controlled trials.

Results: Twenty-six randomized controlled trials were included in the qualitative synthesis and meta-analysis. In terms of overall study quality, most of the included studies were affected by performance and detection bias. Patient activation interventions produced significant effects on outcomes related to physiological, psychological, behavioral, and health-related quality of life in the context of chronic diseases. The following effect sizes were obtained: (a) physiological, namely, glycated hemoglobin = −0.31 (p < .01), systolic blood pressure = −0.20 (p < .01), diastolic blood pressure = −0.80 (p = .02), body weight = −0.12 (p = .03), and low-density lipoprotein = −0.21 (p = .01); (b) psychological, namely, depression = −0.21 (p < .01) and anxiety = −0.25 (p = .01); (c) behavioral, namely, patient activation = 0.33 (p < .01) and self-efficacy = 0.57 (p < .01); and (d) health-related quality of life = 0.25 (p = .01).

Conclusions: Patient activation interventions significantly improve patients’ physiological, psychosocial, and behavioral health statuses. Healthcare providers should implement patient activation interventions that tailor support to the individual patients’ level of patient activation and strengthen the patients’ role in managing their healthcare to improve chronic-disease-related health outcomes.

KEY WORDS: chronic disease, meta-analysis, depression, anxiety, self-efficacy.

Introduction

Patient activation, which is defined as having the knowledge, skill, and confidence to manage one’s health, emphasizes patients’ willingness and ability to take independent actions to manage their health and care (Hibbard et al., 2004). Patient activation, or engaging patients in their own care, has been described as a potential strategy to improve chronic disease self-management (Hibbard et al., 2007). Raising levels of patient activation is desirable because patients who are more activated are more likely to engage in self-management behaviors that improve health (Hibbard et al., 2007; Jacobson et al., 2018). Patient activation is a critical component of management strategies for patients with chronic diseases and is the least well-developed intervention within chronic disease care (Hibbard et al., 2007). Patient activation interventions have focused specifically on a tailored approach to improve patients’ motivation, knowledge, skills, and confidence to manage their health (Hibbard et al., 2004; Young et al., 2016). For example, health coaching is a patient-oriented intervention that activates patients to change their behavior (Bennett et al., 2010; Olsen, 2014). Empowerment is an intervention to help people make behavior changes to adhere to a care plan. Patients are empowered when they have the necessary knowledge, skills, attitudes, and self-awareness to change both their behavior and the behavior of others to improve their quality of life (Funnell et al., 1991; Tol et al., 2015). Self-management programs that focus on skill development, problem solving, and/or peer support are believed to increase the activation levels of patients (Greene & Hibbard, 2012). Strategies

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commonly used in patient activation interventions include problem solving, feedback, individualized care plans, peer support, lay health advisors, theory-based counseling, and skill building (Bolen et al., 2014).

Noncommunicable diseases, also known as chronic diseases, are defined by the World Health Organization as diseases that have a long duration, have generally slow progression, and are not passed from person to person. Diseases of this type are a leading global health problem and a significant cause of premature death (World Health Organization, 2018). Patients with chronic diseases must become their own principal caregiver and take responsibility for daily disease management, behavioral changes, management of emotions, and accurate reporting on disease status (Holman & Lorig, 2004). Therefore, important outcomes for the self-management of chronic diseases include physiologic, psychological, and behavioral outcomes.

Patient activation has been associated with outcomes of care for patients with chronic conditions (Hibbard et al., 2007; Mosen et al., 2007). Patient activation is strongly related to a broad range of health-related outcomes, and related interventions have great potential and must be examined to assess their effectiveness (Greene & Hibbard, 2012). In addition, emerging evidence suggests that patient activation is a factor that may predict the health status of patients with chronic diseases (Hibbard & Greene, 2013). A previous meta-analysis revealed that patient activation interventions were associated with improvements in clinical outcomes such as glycated hemoglobin (HbA1C), systolic blood pressure (SBP), body weight, and low-density lipoprotein (LDL) in adults with diabetes mellitus (Bolen et al., 2014). The effects of patient activation interventions on psychological and behavioral outcomes have not been evaluated systematically. Thus, despite widespread research into interventions to improve patient activation, the effect of patient activation interventions on chronic conditions remains unclear. No systematic review or meta-analysis has been conducted since 2014 on the effect of patient activation interventions on patients with chronic diseases. Cardiovascular disease, cancer, chronic respiratory diseases, and diabetes mellitus are the largest causes of death worldwide (World Health Organization, 2018). Therefore, we conducted a meta-analysis of randomized controlled trials to quantify the outcomes of physiological, psychological, behavioral, and health-related quality of life (HRQOL) for patient activation interventions across these four chronic disease categories.

Methods
This study conformed to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement.

Search Strategy
Four electronic databases (PubMed, Cochrane, CINAHL, and Embase) were searched from their inception to September 1, 2017, using the following strings of keywords: (“cardiovascular” OR “coronary heart disease” OR “coronary artery disease” OR “heart failure” OR “hypertension” OR “blood pressure” OR “peripheral vessel disease” OR “cancer” OR “neoplasm” OR “tumor” OR “malignancy” OR “oncology” OR “neoplasms” OR “carcinoma” OR “diabetes” OR “diabetes mellitus” OR “DM” OR “chronic obstructive pulmonary disease” OR “COPD” OR “chronic respiratory disease” OR “lung” OR “pulmonary” OR “asthma” OR “noncommunicable diseases”) AND (“patient activation” OR “activation intervention” OR “PAM” OR “empowerment” OR “patient engagement” OR “patient participation” OR “coaching” OR “motivational interviewing” OR “self-management”) AND (“randomized controlled trial” OR “controlled clinical trial” OR “random allocation” OR “randomization” OR “RCT”). Furthermore, references from the retrieved articles were reviewed to identify additional, potentially relevant studies.

Study Eligibility
Reports of randomized controlled trials published in either English or Chinese that enrolled adults aged 18 years or older with a diagnosis of cardiovascular disease, cancer, chronic respiratory disease, or diabetes mellitus and used an intervention (i.e., health coaching, empowerment, self-management programs, or patient activation programs) to increase patients’ knowledge, skills, and confidence to self-manage their health were eligible for inclusion. Outcomes of interest were physiological (i.e., HbA1C, SBP, diastolic blood pressure [DBP], body weight, and LDL), psychosocial (i.e., depression, anxiety, and HRQOL), and behavioral (i.e., patient activation and self-efficacy).

Study Selection
The initial screening was performed by two reviewers who independently screened the titles and abstracts of potentially relevant studies. Full texts of the studies that met the inclusion criteria were retrieved and evaluated independently for inclusion by the two reviewers. Any disagreements were resolved by discussion, and if necessary, a third reviewer was involved.

Data Extraction
Data regarding the study design, participant characteristics, interventions, and outcome measures were extracted independently by the same two reviewers. A self-developed data extraction form was used to extract data. We contacted the authors of primary reports to request any unpublished data. If no response or additional data were received from an author, the available data only were used in the analysis.

Quality Assessment
The two reviewers independently assessed the methodological quality of the included randomized controlled trials using the Cochrane Handbook for assessing the risk of bias (Higgins et al., 2011). We evaluated random sequence
Statistical Analysis

All statistical analyses were performed using Comprehensive Meta-Analysis software 2.0. Hedges’s g was used to interpret the values of effect sizes established for our pooled estimates. Furthermore, 95% confidence intervals were assessed using a random-effects model. A two-sided p value of < .05 was used to indicate statistical significance.

Egger’s regression was used to assess publication bias, and I² or Q value was used to assess the statistical heterogeneity and inconsistency of study results. Subgroup and moderator analyses according to type of intervention, type of disease, intervention delivery mode, and intervention duration were conducted to explore possible sources of heterogeneity in the effect sizes. We conducted subgroup analyses when at least two studies could be included in each subgroup. Moderator variables were analyzed using an analog to the analysis of variance for categorical moderators that compare within- and between-group heterogeneity using the Q statistic. Age and gender are associated with health-related behaviors (Deeks et al., 2009). Therefore, we examined the impact of age and gender on the estimates of treatment effect. We conducted a meta-regression analysis on mean age and percentage of female participants as independent variables, using heterogeneous outcomes as the dependent variables.

Publication Bias

The results of Egger’s regression analyses were not significant in any of the outcomes assessed.

Quality Assessment

In terms of overall study quality, most of the included studies were subject to performance bias and detection bias. Table 2 illustrates the risk of bias of each study.

Physiological Effects: Glycated Hemoglobin

The effects of patient activation interventions on patients’ HbA1C were evaluated in 16 studies, and the pooled effect was statistically significant. The study population included patients with diabetes mellitus and patients with cardiovascular disease. The effect on HbA1C had an effect size of −0.31 (p < .01), which indicated a small effect (Table 3). The studies were moderately heterogeneous (I² = 74.12, p < .01). The moderator analysis indicated no significant differences in effect sizes for HbA1C among the three types of interventions (p = .20; Table 4), suggesting that the size of the effect for HbA1C was not influenced by intervention type. Interventions varied in length from 6 weeks to 18 months. The moderator analysis indicated no significant differences in effect sizes for HbA1C among the three intervention durations, suggesting that the size of the effect for HbA1C was not influenced by intervention duration (p = .25; Table 4). The intervention delivery mode was face-to-face plus telephone support in 10 studies, face-to-face only in three studies, and telephone support only in three studies. The moderator analysis indicated no significant differences in effect sizes for HbA1C among the three intervention delivery modes, suggesting that the size of the effect for HbA1C was not influenced by intervention delivery mode (p = .26; Table 4). Meta-regression results showed a significant association between mean age and the effect size of HbA1C (p = .01; Table 5). No significant association was found between the effect size of HbA1C and the percentage of female participants (p = .83; Table 5).

Physiological Effects: Systolic Blood Pressure

The effects of patient activation interventions on patients’ SBP were evaluated in nine studies, and the pooled effect was statistically significant. The study population included patients with diabetes mellitus and patients with cardiovascular disease. The effect on SBP had an effect size of −0.20 (p < .01), which indicated a small effect (Table 3). The studies were unlikely to be heterogeneous (I² < 0.01, p = .44). Although significant heterogeneity in the effect sizes of SBP was not found, a moderator analysis was performed, which indicated no significant...
differences in effect sizes for SBP among the three intervention types ($p = .09$; Table 4). Interventions varied in length from 5 weeks to 15 months. The moderator analysis indicated no significant differences in effect sizes for SBP among the three intervention durations ($p = .71$; Table 4). The intervention delivery mode was face-to-face plus telephone support in six studies, face-to-face only in one study, and telephone support only in two studies. The moderator analysis indicated no significant differences in effect sizes for SBP between the two intervention delivery modes, suggesting that SBP effect size was not influenced by intervention delivery mode ($p = .19$; Table 4).

**Physiological Effects: Diastolic Blood Pressure**

The effects of patient activation interventions on patients' DBP were evaluated in seven studies, and the pooled effect was statistically significant. The study population included patients with diabetes mellitus and patients with cardiovascular disease. The effect on DBP had an effect size of $-0.80$ ($p = .02$), indicating a large effect (Table 3). The studies were highly heterogeneous ($I^2 = 97.34$, $p < .01$). The moderator analysis showed no significant differences in effect sizes for DBP between intervention types ($p = .63$; Table 4), suggesting that type of intervention is unable to explain the source of heterogeneity in the effect sizes for DBP. The duration of the interventions ranged from 5 weeks to 15 months. The moderator analysis showed no significant differences in effect sizes for DBP among the three intervention durations ($p = .60$; Table 4), suggesting that intervention duration is unable to explain the source of heterogeneity in the effect sizes for DBP. The intervention delivery mode was face-to-face plus telephone support in five studies, face-to-face only in one study, and telephone support only in one study. Meta-regression results showed no significant association between the effect size of DBP and mean age ($p = .20$; Table 5) or between the effect size of DBP and the percentage of female participants ($p = .45$; Table 5).

**Physiological Effects: Body Weight**

The effects of patient activation interventions on patients' body weight were evaluated in five studies, and the pooled effect was statistically significant. The study population included patients with diabetes mellitus and patients with
| Author (Year)/ Location | Study Population | No. of Patients | Mean Age | Intervention | Type | Duration | Mode of Delivery |
|-------------------------|-----------------|----------------|----------|--------------|------|----------|-----------------|
| Yun et al. (2017)/ South Korea | Cancer | EG: 134 | CG: 72 | EG: 50.52 ± 10.21 | Health coaching | 6 months | Face-to-face |
| | | | | CG: 61.04 ± 7.56 | | | Telephone |
| Moein et al. (2017)/ Iran | DM | EG: 47 | CG: 49 | NA | Empowerment program | 4 weeks | Face-to-face |
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| Cortez et al. (2017)/ United States | DM | EG:127 | CG:111 | EG: 58.00 ± 9.20 | Empowerment program | Over 12 months | Face-to-face |
| | | | | CG: 57.50 ± 9.70 | | | Telephone |
| Young et al. (2016)/ United States | HF | EG: 51 | CG: 49 | EG: 66.70 ± 11.80 | Patient activation | 3 months | Face-to-face |
| | | | | CG: 71.80 ± 12.60 | | | Telephone |
| Pauley et al. (2016)/ United States | DM | EG: 47 | CG: 47 | EG: 65.10 ± 13.20 | Self-management coaching | 6 weeks | Face-to-face |
| | | | | CG: 66.90 ± 11.70 | | | Telephone |
| Odnoletkova et al. (2016)/ Europe | DM | EG:287 | CG:287 | EG: 63.80 ± 8.70 | Health coaching | 6 months | Telephone |
| | | | | CG: 62.40 ± 8.90 | | | |
| Meng et al. (2016)/ Europe | HF | EG: 248 | CG: 227 | EG: 61.20 ± 11.70 | Self-management | Not specified | Face-to-face |
| | | | | CG: 61.90 ± 11.20 | | | |
| Ebrahimi et al. (2016)/ Iran | DM | EG: 53 | CG: 53 | EG: 46.97 ± 5.54 | Empowerment program | 8 weeks | Face-to-face |
| | | | | CG: 48.15 ± 6.52 | | | Telephone |
| Safford et al. (2015)/ United States | DM | EG:168 | CG:192 | EG: 59.20 ± 11.80 | Health coaching | 10 months | Telephone |
| | | | | CG: 61.10 ± 12.40 | | | |
| Chen et al. (2015)/ Taiwan, ROC | DM | EG: 36 | CG: 36 | EG: 62.12 ± 7.51 | Empowerment program | 3 months | Face-to-face |
| | | | | CG: 61.72 ± 8.79 | | | Telephone |
| Jonsdottir et al. (2015)/ Europe | COPD | EG: 48 | CG: 52 | EG: 59.41 ± 4.66 | Self-management | 6 months | Face-to-face |
| | | | | CG: 58.67 ± 4.39 | | | Telephone |
| García et al. (2015)/ United States | DM | EG: 39 | CG: 33 | EG: 50.00 ± 8.70 | Self-management | 6 months | Face-to-face |
| | | | | CG: 49.10 ± 9.70 | | | Telephone |
| Lynch et al. (2014)/ United States | DM and HT | EG: 30 | CG: 31 | EG: 53.40 ± 11.40 | Self-management | 6 months | Face-to-face |
| | | | | CG: 54.80 ± 8.50 | | | Telephone |
| Thom et al. (2013)/ United States | DM | EG: 148 | CG: 151 | EG: 56.30 ± 10.30 | Health coaching | 6 months | Face-to-face |
| | | | | CG: 54.10 ± 10.40 | | | Telephone |
| Shao et al. (2013)/ Taiwan, ROC | HF | EG: 54 | CG: 54 | EG: 72.20 ± 5.66 | Self-management | 3 months | Face-to-face |
| | | | | CG: 71.87 ± 5.34 | | | Telephone |
| Blackberry et al. (2013)/ Australia | DM | EG: 236 | CG: 237 | EG: 63.60 ± 10.40 | Empowerment-based health coaching | 15 months | Face-to-face |
| | | | | CG: 61.90 ± 10.50 | | | Telephone |
| Van der Wulp et al. (2012)/ Europe | DM | EG: 59 | CG: 60 | NA | Self-management coaching | 3 months | Face-to-face |
| | | | | | | | Telephone |
| Li et al. (2012)/ China | DM | EG: 123 | CG: 125 | 65.34 ± 12.25 | Self-management | 18 months | Face-to-face |
| | | | | | | | Telephone |
| Tousman et al. (2011)/ United States | Asthma | EG: 21 | CG: 24 | EG: 51.40 ± 14.70 | Self-management | 7 weeks | Face-to-face |
| | | | | CG: 55.00 ± 10.00 | | | |
| McGowan (2011)/ United States | DM | EG: 82 | CG: 152 | EG: 55.00 ± 12.00 | Self-management | 6 weeks | Face-to-face |
| | | | | CG: 59.00 ± 12.00 | | | |
| Wolever et al. (2010)/ United States | DM | EG: 30 | CG: 26 | EG: 53.10 ± 8.29 | Health coaching | 6 months | Telephone |
| | | | | CG: 52.80 ± 7.64 | | | |

(continues)
herniation disease. The effect on body weight had an effect size of −0.12 (p = .03), indicating a small effect (Table 3). The studies were unlikely to be heterogeneous (I² < 0.01, p = .86).

Although significant heterogeneity in the effect sizes of body weight was not found, a moderator analysis was performed. The duration of interventions ranged from 6 weeks to 15 months. The moderator analysis showed no significant differences in effect sizes for body weight between intervention durations (p = .52; Table 4).

**Physiological Effects: Low-Density Lipoprotein**

The effects of patient activation interventions on patients' LDL were evaluated in the population with diabetes in eight studies, and the pooled effect was statistically significant. The effect on LDL had an effect size of −0.21 (p = .01), indicating a small effect (Table 3). The studies were moderately heterogeneous (I² = 61.60, p = .01). The moderator analysis indicated no significant differences in effect sizes for LDL among the three types of interventions (p = .60; Table 4), suggesting that the size of the effect for LDL was not influenced by intervention type. Interventions varied in length from 6 weeks to over 12 months. The moderator analysis indicated no significant differences in effect sizes for LDL among the three intervention durations, suggesting that the size of the effect for LDL was not influenced by intervention duration (p = .13; Table 4). The intervention delivery mode was face-to-face plus telephone support in four studies, face-to-face only in two studies, and telephone support only in two studies. The moderator analysis indicated no significant differences in effect sizes for LDL among the three intervention delivery modes, suggesting that the size of the effect for LDL was not influenced by intervention delivery mode (p = .80; Table 4). Meta-regression results showed a significant association between mean age and the effect size of LDL (p = .03; Table 5). No significant association was found between the effect size of LDL and the percentage of female participants (p = .68; Table 5).

**Psychological Effects: Depression**

The effects of patient activation interventions on patients' depression were evaluated in eight studies, and the pooled effect was statistically significant. The study population included patients with cancer, chronic respiratory diseases, and diabetes mellitus. The effect on depression had an effect size of −0.16 (p < .01), indicating a small effect (Table 3). The studies were unlikely to be heterogeneous (I² < 0.01, p = .65). Although significant heterogeneity in the effect sizes of depression was not found, a moderator analysis was performed, which found no significant differences in effect sizes for depression between types of disease (p = .80; Table 4). The duration of interventions ranged from 6 weeks to 24 months. The moderator analysis showed no significant differences in effect sizes for depression among the three intervention durations (p = .51; Table 4). The intervention delivery mode was face-to-face plus telephone support in five studies and face-to-face only in three studies. The moderator analysis showed no significant differences in effect sizes for depression between the two intervention delivery modes (p = .11; Table 4).

**Psychological Effects: Anxiety**

The effects of patient activation interventions on patients' anxiety were evaluated in three studies, and the pooled effect was statistically significant. The study population included patients with cancer, chronic respiratory diseases, and diabetes mellitus. The effect on anxiety had an effect size of −0.25 (p = .01), indicating a small effect (Table 3). The studies were unlikely to be heterogeneous (I² < 0.01, p = .49). Interventions varied in length from 6 weeks to 6 months. The intervention delivery mode was face-to-face...
### Table 2

#### Risk of Bias Summary of Methodological Quality for Each Included Study

| Author (Year)               | Selection Bias | Performance Bias | Detection Bias | Attrition Bias | Reporting Bias |
|-----------------------------|----------------|------------------|----------------|----------------|----------------|
|                             | Random Sequence Generation | Allocation Concealment | Blinding of Participants and Personnel | Blinding of Outcome Assessment (Patient-Reported Outcome) | Blinding of Outcome Assessment (Objective Outcome) | Incomplete Outcome Data | Selective Reporting |
| Yun et al. (2017)           | +              | ?                | ?              | −              | −              | +              | +                 |
| Moein et al. (2017)         | +              | ?                | −              | −              | −              | ?              | +                 |
| Cortez et al. (2017)        | +              | ?                | −              | −              | +              | −              | +                 |
| Young et al. (2016)         | +              | +                | −              | −              | +              | +              | +                 |
| Pauley et al. (2016)        | +              | ?                | −              | −              | −              | +              | +                 |
| Odnoletkova et al. (2016)   | +              | ?                | −              | −              | +              | +              | +                 |
| Meng et al. (2016)          | +              | +                | −              | ?              | +              | −              | +                 |
| Ebrahimi et al. (2016)      | +              | ?                | −              | ?              | +              | +              | +                 |
| Safford et al. (2015)       | +              | ?                | −              | +              | +              | +              | +                 |
| Chen et al. (2015)          | +              | +                | −              | +              | +              | +              | +                 |
| Jonsdottir et al. (2015)    | +              | ?                | −              | −              | ?              | −              | +                 |
| Garcia et al. (2015)        | ?              | ?                | −              | +              | +              | +              | +                 |
| Lynch et al. (2014)         | +              | +                | ?              | −              | +              | +              | +                 |
| Thom et al. (2013)          | ?              | +                | −              | ?              | +              | +              | +                 |
| Shao et al. (2013)          | +              | +                | +              | −              | ?              | +              | +                 |
| Blackberry et al. (2013)    | +              | +                | −              | −              | −              | +              | +                 |
| Van der Wulp et al. (2012)  | +              | +                | −              | +              | ?              | +              | +                 |
| Li et al. (2012)            | ?              | ?                | −              | ?              | +              | +              | +                 |
| Touman et al. (2011)        | ?              | ?                | −              | −              | +              | +              | +                 |
| McGowan (2011)              | +              | +                | −              | −              | +              | +              | +                 |
| Wolever et al. (2010)       | ?              | ?                | −              | −              | +              | +              | +                 |
| Lorig et al. (2009)         | +              | ?                | −              | −              | +              | +              | +                 |
| Anderson et al. (2009)      | +              | +                | −              | −              | +              | +              | +                 |
| Xue et al. (2008)           | +              | +                | −              | −              | +              | +              | +                 |
| Keeratiyutawong et al. (2006)| +              | +                | −              | −              | +              | +              | +                 |
| Anderson et al. (2005)      | ?              | ?                | −              | −              | +              | +              | +                 |

Note. + = low risk of bias; − = high risk of bias; ? = uncertain risk of bias.
Table 3
Effect Sizes for Studies Measuring Patient Activation Intervention on Outcomes

| Study (Year)     | Statistic for Each Study | Hedges's g | SE  | Variance | p    |
|------------------|--------------------------|------------|-----|----------|------|
|                  |                          | Hedges's g | SE  | Variance | p    |
|                  |                          |            |     |          |      |
| 1. HbA1C         |                          | −0.31      | 0.13| 0.02     | .02  |
| Cortez et al. (2017) |                      | −0.20      | 0.09| 0.01     | .02  |
| Odnoletkova et al. (2016) |                    | −0.60      | 0.20| 0.04     | .00  |
| Ebrahimi et al. (2016) |                    | −0.05      | 0.12| 0.01     | .68  |
| Safford et al. (2015) |                    | −0.38      | 0.25| 0.06     | .12  |
| Chen et al. (2015) |                    | −1.97      | 0.29| 0.08     | .00  |
| Garcia et al. (2015) |                    | −0.45      | 0.27| 0.07     | .10  |
| Lynch et al. (2014) |                    | −0.26      | 0.13| 0.02     | .04  |
| Thom et al. (2013) |                    | −0.04      | 0.10| 0.01     | .64  |
| Blackberry et al. (2013) |                 | −0.52      | 0.13| 0.02     | .00  |
| Li et al. (2012) |                    | −0.34      | 0.14| 0.02     | .01  |
| McGowan (2011) |                    | −0.38      | 0.27| 0.07     | .16  |
| Wolever et al. (2010) |                 | −0.06      | 0.12| 0.01     | .60  |
| Long et al. (2009) |                    | −0.20      | 0.13| 0.02     | .11  |
| Anderson et al. (2009) |                 | −0.20      | 0.10| 0.01     | .05  |
| Keeratyutawong et al. (2006) |             | −0.57      | 0.17| 0.03     | .00  |
| Anderson et al. (2005) |                 | −0.16      | 0.13| 0.02     | .24  |
| Total (95% CI)   |                          | −0.31      | 0.07| 0.01     | .00  |

2. SBP
| Study (Year)     | Statistic for Each Study | Hedges's g | SE  | Variance | p    |
|------------------|--------------------------|------------|-----|----------|------|
| Cortez et al. (2017) |                      | −0.32      | 0.13| 0.02     | .01  |
| Odnoletkova et al. (2016) |                    | −0.12      | 0.09| 0.01     | .16  |
| Safford et al. (2015) |                    | −0.07      | 0.12| 0.01     | .59  |
| Garcia et al. (2015) |                    | −0.37      | 0.24| 0.06     | .12  |
| Lynch et al. (2014) |                    | −0.16      | 0.27| 0.07     | .54  |
| Thom et al. (2013) |                    | −0.20      | 0.13| 0.02     | .11  |
| Blackberry et al. (2013) |                 | −0.20      | 0.10| 0.01     | .05  |
| Xue et al. (2008) |                    | −0.57      | 0.17| 0.03     | .00  |
| Anderson et al. (2005) |                 | −0.16      | 0.13| 0.02     | .24  |
| Total (95% CI)   |                          | −0.20      | 0.04| 0.00     | .00  |

3. DBP
| Study (Year)     | Statistic for Each Study | Hedges's g | SE  | Variance | p    |
|------------------|--------------------------|------------|-----|----------|------|
| Cortez et al. (2017) |                      | −2.89      | 0.19| 0.03     | .00  |
| Odnoletkova et al. (2016) |                    | −0.11      | 0.09| 0.01     | .21  |
| Garcia et al. (2015) |                    | −1.60      | 0.27| 0.07     | .00  |
| Lynch et al. (2014) |                    | −0.30      | 0.27| 0.07     | .26  |
| Blackberry et al. (2013) |                 | −0.10      | 0.10| 0.01     | .34  |
| Xue et al. (2008) |                    | −0.57      | 0.17| 0.03     | .00  |
| Anderson et al. (2005) |                 | −0.11      | 0.13| 0.02     | .42  |
| Total (95% CI)   |                          | −0.80      | 0.34| 0.11     | .02  |

4. Body weight
| Study (Year)     | Statistic for Each Study | Hedges's g | SE  | Variance | p    |
|------------------|--------------------------|------------|-----|----------|------|
| Odnoletkova et al. (2016) |                    | −0.14      | 0.09| 0.01     | .12  |
| Lynch et al. (2014) |                    | −0.37      | 0.27| 0.07     | .17  |
| Blackberry et al. (2013) |                 | −0.10      | 0.10| 0.01     | .35  |
| McGowan (2011) |                    | −0.11      | 0.14| 0.02     | .40  |
| Anderson et al. (2005) |                 | −0.04      | 0.14| 0.02     | .78  |
| Total (95% CI)   |                          | −0.12      | 0.05| 0.00     | .03  |
Table 3
Effect Sizes for Studies Measuring Patient Activation Intervention on Outcomes, Continued

| Study (Year)          | Statistic for Each Study | Hedges's $g$ and 95% CI |
|-----------------------|--------------------------|-------------------------|
|                       | Hedges's $g$ | SE | Variance | p          |
| 5. LDL                |              |    |          |            |
| Cortez et al. (2017)  | -0.03        | 0.13 | 0.02     | .84        |
| Odnoletkova et al. (2016) | -0.24     | 0.09 | 0.01     | .01        |
| Ebrahimi et al. (2016) | -0.48        | 0.20 | 0.04     | .02        |
| Safford et al. (2015) | -0.11        | 0.12 | 0.01     | .35        |
| Garcia et al. (2015)  | -1.03        | 0.25 | 0.06     | .00        |
| Thorn et al. (2013)   | -0.09        | 0.13 | 0.02     | .51        |
| Blackberry et al. (2013) | -0.05       | 0.10 | 0.01     | .65        |
| McGowen (2011)        | -0.19        | 0.14 | 0.02     | .16        |
| Total (95% CI)        | -0.21        | 0.08 | 0.01     | .01        |
| 6. Depression         |              |    |          |            |
| Yun et al. (2017)     | -0.03        | 0.15 | 0.02     | .83        |
| Pauley et al. (2016)  | -0.13        | 0.20 | 0.04     | .52        |
| Jonsdottir et al. (2015) | -0.19      | 0.20 | 0.04     | .34        |
| Blackberry et al. (2013) | -0.13       | 0.10 | 0.01     | .19        |
| Van der Wulp et al. (2012) | -0.07      | 0.18 | 0.03     | .69        |
| Tousman et al. (2011) | -0.05        | 0.29 | 0.09     | .87        |
| Lorig et al. (2010)   | -0.39        | 0.12 | 0.01     | .00        |
| Anderson et al. (2009)| -0.12        | 0.13 | 0.02     | .34        |
| Total (95% CI)        | -0.16        | 0.05 | 0.00     | .00        |
| 7. Anxiety            |              |    |          |            |
| Yun et al. (2017)     | -0.36        | 0.15 | 0.02     | .01        |
| Pauley et al. (2016)  | -0.06        | 0.21 | 0.04     | .77        |
| Jonsdottir et al. (2015) | -0.23      | 0.20 | 0.04     | .24        |
| Total (95% CI)        | -0.25        | 0.10 | 0.01     | .01        |
| 8. Patient activation |              |    |          |            |
| Young et al. (2016)   | 0.44         | 0.20 | 0.04     | .03        |
| Safford et al. (2015) | 0.25         | 0.12 | 0.01     | .04        |
| Tousman et al. (2011) | 0.41         | 0.30 | 0.09     | .17        |
| Wolever et al. (2010) | 0.70         | 0.27 | 0.07     | .01        |
| Lorig et al. (2009)   | 0.28         | 0.12 | 0.01     | .02        |
| Total (95% CI)        | 0.33         | 0.07 | 0.01     | .00        |
| 9. Self-efficacy      |              |    |          |            |
| Moein et al. (2017)   | 0.98         | 0.21 | 0.05     | .00        |
| Young et al. (2016)   | 0.28         | 0.20 | 0.04     | .16        |
| Pauley et al. (2016)  | 0.20         | 0.22 | 0.05     | .37        |
| Meng et al. (2016)    | 0.00         | 0.10 | 0.01     | 1.00       |
| Chen et al. (2015)    | 0.97         | 0.26 | 0.07     | .00        |
| Garcia et al. (2015)  | 2.26         | 0.31 | 0.10     | .00        |
| Shao et al. (2013)    | 1.39         | 0.23 | 0.05     | .00        |
| Blackberry et al. (2013) | 0.11       | 0.10 | 0.01     | .27        |
| Van der Wulp et al. (2012) | 0.12      | 0.18 | 0.03     | .51        |
| McGowen (2011)        | 0.12         | 0.14 | 0.02     | .39        |
| Lorig et al. (2009)   | 0.39         | 0.12 | 0.01     | .00        |
| Total (95% CI)        | 0.57         | 0.15 | 0.02     | .00        |

(continues)
plus telephone support in two studies and face-to-face only in one study.

**Behavioral Effects: Patient Activation**

The effects of patient activation interventions on patients’ activation were evaluated in five studies, and the pooled effect size was statistically significant. The study population included patients with cardiovascular disease, chronic respiratory diseases, and diabetes mellitus. The effect on patient activation had an effect size of 0.33 (p < .01), indicating a small effect (Table 3). The studies were unlikely to be heterogeneous ($I^2 < 0.01$, p = .60). The moderator analysis showed no significant differences in effect sizes for patients’ activation between intervention types (p = .65; Table 4). The interventions varied in length from 6 weeks to 10 months. The intervention delivery mode was face-to-face plus telephone support in one study, face-to-face only in two studies, and telephone support only in two studies. The moderator analysis showed no significant differences in effect sizes for patient activation between the face-to-face and telephone modes (p = .65; Table 4).

**Behavioral Effects: Self-Efficacy**

The effects of patient activation interventions on patients' self-efficacy were evaluated in 11 studies, with the pooled effect size found to be statistically significant. The study population included patients with diabetes mellitus and patients with cardiovascular disease. The effect on self-efficacy had an effect size of 0.57 (p < .01), indicating a medium effect (Table 3). The studies were highly heterogeneous ($I^2 = 89.53$, p < .01). The moderator analysis indicated no significant differences in the effect sizes for self-efficacy between intervention types (p = .53; Table 4) or between types of disease (p = .91; Table 4), suggesting that intervention and disease types did not affect the size of the effect for self-efficacy. The interventions varied in length from 4 weeks to 15 months. The intervention delivery mode was face-to-face plus telephone support in six studies and face-to-face only in five studies. The moderator analysis indicated no significant differences in the effect sizes for self-efficacy between the two intervention delivery modes (p = .12; Table 4), suggesting that mode of intervention delivery did not affect the size of the effect for self-efficacy. Meta-regression results showed no significant association between the effect size of self-efficacy and mean age (p = .24; Table 5) or between the effect size of self-efficacy and the percentage of female participants (p = .15; Table 5).

**Effects on Health-Related Quality of Life**

The effects of patient activation interventions on patients’ HRQOL were evaluated in nine studies, and the pooled effect size was statistically significant. The study population included patients with cancer, diabetes mellitus, chronic respiratory diseases, and cardiovascular disease. The effect on HRQOL had an effect size of 0.25 (p = .01), indicating a small effect (Table 3). The studies were moderately heterogeneous ($I^2 = 66.58$, p < .01). The moderator analysis showed no significant differences in effect sizes for HRQOL between intervention types (p = .41) or between types of disease (p = .14; Table 4), suggesting that the size of the effect for HRQOL was not influenced by either different types of interventions or different types of disease. The interventions varied in length from 7 weeks to 15 months. The moderator analysis showed no significant differences in effect sizes for HRQOL among the three intervention durations (p = .38; Table 4), suggesting that the size of the effect for HRQOL was not influenced by differences in intervention durations. The intervention delivery mode was face-to-face plus telephone support in six studies, telephone support only in one study, and face-to-face only in two studies. The moderator analysis showed no significant differences in effect sizes for HRQOL between the face-to-face plus

| Study (Year)      | Statistic for Each Study | Hedges’s g and 95% CI |
|-------------------|--------------------------|-----------------------|
|                   | Hedges’s g | SE  | Variance | p       |               |
| 10. HRQOL         | Yun et al. (2017)        | 0.11 | 0.15 | 0.02   | .45          |
|                   | Meng et al. (2016)       | 0.09 | 0.10 | 0.01   | .38          |
|                   | Safford et al. (2015)    | 0.06 | 0.12 | 0.01   | .63          |
|                   | Chen et al. (2015)       | 1.04 | 0.26 | 0.07   | .00          |
|                   | Jonsdottir et al. (2015) | 0.05 | 0.21 | 0.04   | .79          |
|                   | Blackberry et al. (2013) | 0.11 | 0.10 | 0.01   | .27          |
|                   | Tousman et al. (2011)    | 0.07 | 0.29 | 0.09   | .82          |
|                   | Wolever et al. (2010)    | 0.23 | 0.28 | 0.08   | .42          |
|                   | Keeratikutawong et al. (2006) | 0.92 | 0.23 | 0.05   | .00          |
| Total (95% CI)    | 0.25 | 0.10 | 0.01   | .01          |

Note. HbA1C = glycated hemoglobin; SBP = systolic blood pressure; DBP = diastolic blood pressure; LDL = low-density lipoprotein; HRQOL = health-related quality of life.
Table 4
Summary of Results for Moderator Analyses

| Group                        | No. of RCT | Hedges's g  | 95% CI          | p   | Between-Group p |
|------------------------------|------------|-------------|-----------------|-----|-----------------|
| **Types of intervention**    |            |             |                 |     |                 |
| 1. HbA1C                     |            |             |                 |     |                 |
| Health coaching              | 4          | -0.19       | [-0.31, -0.07]  | < .01 |                 |
| Empowerment                  | 4          | -0.31       | [-0.51, -0.11]  | < .01 |                 |
| Self-management              | 6          | -0.52       | [-0.92, -0.13]  | .01  |                 |
| 2. SBP                       |            |             |                 | .09  |                 |
| Health coaching              | 3          | -0.13       | [-0.25, -0.01]  | .04  |                 |
| Empowerment                  | 2          | -0.24       | [-0.43, -0.06]  | .01  |                 |
| Self-management              | 3          | -0.43       | [-0.67, -0.19]  | < .01 |                 |
| 3. DBP                       |            |             |                 | .63  |                 |
| Empowerment                  | 2          | -1.50       | [-4.23, 1.23]   | .28  |                 |
| Self-management              | 3          | -0.81       | [-1.51, -0.12]  | .02  |                 |
| 4. LDL                       |            |             |                 | .60  |                 |
| Health coaching              | 3          | -0.17       | [-0.29, -0.04]  | .01  |                 |
| Empowerment                  | 2          | -0.23       | [-0.67, 0.21]   | .31  |                 |
| Self-management              | 2          | -0.59       | [-1.41, 0.24]   | .16  |                 |
| 5. Patient activation        |            |             |                 | .65  |                 |
| Health coaching              | 2          | 0.41        | [-0.01, 0.83]   | .06  |                 |
| Self-management              | 2          | 0.30        | [0.08, 0.51]    | .01  |                 |
| 6. Self-efficacy             |            |             |                 | .53  |                 |
| Empowerment                  | 2          | 0.98        | [0.66, 1.30]    | < .01 |                 |
| Self-management              | 5          | 0.77        | [0.20, 1.34]    | .01  |                 |
| 7. HRQOL                     |            |             |                 | .41  |                 |
| Health coaching              | 3          | 0.09        | [-0.08, 0.27]   | .29  |                 |
| Self-management              | 4          | 0.27        | [-0.11, 0.64]   | .16  |                 |
| **Types of disease**         |            |             |                 |     |                 |
| 1. Depression                |            |             |                 | .80  |                 |
| Respiratory diseases         | 2          | -0.15       | [-0.47, 0.18]   | .39  |                 |
| Diabetes mellitus            | 5          | -0.19       | [-0.31, -0.07]  | < .01 |                 |
| 2. Self-efficacy             |            |             |                 | .91  |                 |
| Cardiovascular               | 3          | 0.54        | [-0.23, 1.31]   | .17  |                 |
| Diabetes mellitus            | 8          | 0.59        | [0.23, 0.94]    | < .01 |                 |
| 3. HRQOL                     |            |             |                 | .14  |                 |
| Respiratory diseases         | 2          | 0.06        | [-0.27, 0.39]   | .73  |                 |
| Diabetes mellitus            | 5          | 0.43        | [0.07, 0.79]    | .02  |                 |
| **Intervention duration**    |            |             |                 |     |                 |
| 1. HbA1C                     |            |             |                 | .25  |                 |
| ≤ 3 months                   | 5          | -0.25       | [-0.44, -0.07]  | .01  |                 |
| > 3 months but ≤ 6 months    | 5          | -0.61       | [-1.07, -0.14]  | .01  |                 |
| > 6 months                   | 6          | -0.19       | [-0.35, -0.03]  | .02  |                 |
| 2. SBP                       |            |             |                 | .71  |                 |
| ≤ 3 months                   | 2          | -0.35       | [-0.75, 0.05]   | .09  |                 |
| > 3 months but ≤ 6 months    | 4          | -0.17       | [-0.30, -0.04]  | .01  |                 |
| > 6 months                   | 3          | -0.19       | [-0.33, 0.06]   | .01  |                 |
| 3. DBP                       |            |             |                 | .60  |                 |
| ≤ 3 months                   | 2          | -0.32       | [-0.77, 0.12]   | .16  |                 |
| > 3 months but ≤ 6 months    | 2          | -0.65       | [-1.51, 0.21]   | .14  |                 |
| > 6 months                   | 2          | -1.49       | [-4.23, 1.25]   | .29  |                 |
| 4. Body weight               |            |             |                 | .52  |                 |
| ≤ 3 months                   | 2          | -0.08       | [-0.27, 0.11]   | .43  |                 |
| > 3 months but ≤ 6 months    | 2          | -0.16       | [-0.32, 0.01]   | .06  |                 |

(continues)
telephone support and face-to-face only by delivery modes \((p = .16; \text{Table 4})\), suggesting that the size of the effect for HRQOL was not influenced by different intervention delivery modes. Meta-regression results found no significant association between the effect size of HRQOL and mean age \((p = .79; \text{Table 5})\) or between the effect size of HRQOL and the percentage of female participants \((p = .64; \text{Table 5})\).

### Discussion

Improving the level of activation in patients is desirable because patients who are more activated are more likely to engage in self-management behaviors perceived as effective in improving health (Hibbard et al., 2007; Jacobson et al., 2018). This meta-analysis of 26 studies determined the effects of patient activation interventions for patients with chronic diseases. The patient activation interventions were found to improve patients’ physiological, psychosocial, and behavioral health statuses as well as HRQOL.

Bolen et al. (2014) found that patient activation interventions reduced slightly the intermediate outcomes for HbA1C, SBP, body weight, and LDL in patients with diabetes mellitus. However, the effects of patient activation interventions on psychological and behavioral contexts remain unclear. Depression,
anxiety, and physical illness commonly co-occur, and depression and anxiety are prevalent in patients with chronic diseases (Clarke & Currie, 2009; Yohannes et al., 2010). Individuals with multiple comorbidities experience difficulties participating in care planning and self-management (Jowsey et al., 2009). Anxiety and depression are associated with poor disease self-management (Fredericks et al., 2012) and nonadherence to medications (Grenard et al., 2011). The data presented in this study show the effect of patient activation interventions on the psychological and behavioral aspects of chronic-disease-related outcomes as well as on physiological outcomes. Significant improvements in HbA1C, SBP, DBP, body weight, LDL, depression, anxiety, patient activation, and self-efficacy were observed, supporting implementing patient activation programs for patients with chronic diseases. Patient-reported outcomes such as HRQOL are important disease-specific clinical outcomes (Grimm & Grünwald, 2017). The salient finding from this study is that patient activation interventions were effective in improving self-reported HRQOL in patients with chronic diseases.

In this study, the evaluation of physiological, psychological, and quality of life outcomes in relation to patient activation interventions found only small effects because of several reasons. First, patient characteristics may affect, at least in part, the effect of patient activation on physiological outcomes, as the effect sizes for HbA1C and LDL were found to be larger in older adults. Second, more intensive management of chronic diseases, including various types of patient activation interventions, possibly led to increased feelings of burden and subsequent negative effects on psychological outcomes and quality of life. Third, given the complex nature of chronic diseases, a multimodal approach to disease management may be necessary to affect care outcomes in patients with chronic diseases substantively (Kim et al., 2014).

The evidence indicates that interventions that are tailored to an individual’s level of activation effectively increase patient activation as an intermediate outcome of care that is linked to improved outcomes (Hibbard & Greene, 2013). In addition, the results of previous research suggest that interventions enhance self-management support by addressing the suggested areas of knowledge, improving information sharing, and providing tangible support (Donald et al., 2019). Therefore, healthcare providers should regularly assess patients’ activation levels related to their self-management of chronic diseases. Appropriate patient activation interventions may be used to increase patient activation in clinical settings, which in turn may improve health outcomes.

This study was affected by several limitations. First, some relevant studies were possibly not included in the meta-analysis because relevant databases were not used because of their lack of medical subject headings. Second, the limited effect that the patient activation interventions had on self-management behavior may be because of an insufficient number of relevant studies overall. Third, because of varying intervention designs and types of disease, significant heterogeneity existed among the included studies. Thus, moderator analyses were performed to explore whether the differences in types of disease, types of interventions, intervention duration, and intervention delivery mode accounted for the observed heterogeneity. The effect sizes for HbA1C, DBP, body weight, LDL, self-efficacy, and HRQOL were found to be unaffected by intervention type, intervention duration, disease type, or mode of intervention delivery. Meta-regression revealed that age influenced the effects of patient activation interventions on HbA1C and LDL. Unfortunately, we were unable to identify other moderator variables that explained the heterogeneity.

Conclusions

The results of the meta-analysis show patient activation interventions to be effective in improving the health status and quality of life in patients with chronic diseases. Therefore, healthcare providers should assess patients’ activation levels in the self-management of chronic diseases regularly. Furthermore, healthcare providers should implement patient activation interventions that tailor support to the individual’s level of patient activation and strengthen the role of patients in managing their healthcare to improve chronic-disease-related health outcomes.

Author Contributions

Study conception and design: PST, MYL
Data collection: MYL, WSW, RWA, PVT
Data analysis and interpretation: PST, MYL
Drafting of the article: All authors
Critical revision of the article: PST

Table 5
Summary of Results for Meta-Regression Analyses

| Parameter | No. of RCT | Coefficient | Standard Error | p  |
|-----------|------------|-------------|----------------|----|
| 1. HbA1C  |            |             |                |    |
| Age       | 15         | 0.04        | 0.01           | .01|
| %Female   | 16         | −0.00       | 0.01           | .83|
| 2. DBP    |            |             |                |    |
| Age       | 7          | 0.10        | 0.08           | .20|
| %Female   | 7          | −0.02       | 0.03           | .45|
| 3. LDL    |            |             |                |    |
| Age       | 8          | 0.03        | 0.01           | .03|
| %Female   | 8          | −0.00       | 0.01           | .68|
| 4. Self-efficacy |    |             |                |    |
| Age       | 9          | −0.04       | 0.04           | .24|
| %Female   | 11         | 0.02        | 0.01           | .15|
| 5. HRQOL  |            |             |                |    |
| Age       | 8          | 0.00        | 0.01           | .79|
| %Female   | 9          | 0.00        | 0.01           | .64|

Note: RCT = randomized controlled trial; HbA1C = glycated hemoglobin; DBP = diastolic blood pressure; LDL = low-density lipoprotein; HRQOL = health-related quality of life.
The authors declare no conflicts of interest.

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*References marked with an asterisk indicate studies included in the meta-analysis.

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