Received: 11 February 2023 | Revised: 29 July 2023 | Accepted: 19 August 2023

DOI: 10.1111/nhs.13048

RESEARCH ARTICLE

Nursing & Health Sciences WILEY

Effectiveness of a nurse-led personalized patient engagement program to promote type 2 diabetes self-management: A randomized controlled trial

Dilara Cengiz RN, PhD | Fatoş Korkmaz RN, PhD

Department of Fundamentals of Nursing, Hacettepe University Faculty of Nursing, Ankara, Turkey

Correspondence
Dilara Cengiz, Hacettepe University Faculty of Nursing, Adnan Saygun Ave., D-Block, 1st Floor, 06100 Altindag, Ankara, Turkey.
Email: dilarausta6@gmail.com

Funding information
Türkiye Bilimsel ve Teknolojik Araştırma Kurumu, Grant/Award Number: 220S317

Abstract

PHEinAction® is a theory-based nurse-led patient engagement intervention developed among an Italian older adult population with various chronic diseases to facilitate cognitive, emotional, and behavioral processes in promoting individuals' active roles. This study aims to adapt and evaluate the effectiveness of PHEinAction® on diabetes self-management (DSM) among Turkish type 2 diabetes mellitus patients. First, the generic content of the intervention was customized for diabetes management and adapted for the Turkish population, including back-forward translation and expert panel evaluation; then, a randomized controlled trial was conducted with 51 adult diabetes patients randomly assigned to intervention or the control group receiving the usual care. The intervention consisted of two in-person sessions of 4-week intervals, a telephone consultation, and home-based written exercises, which involved personalized care activities addressing individuals' engagement levels and covering the cognitive, emotional, and behavioral aspects. The scores for treatment adherence, self-efficacy, and patient engagement had significantly improved with a large size effect in the intervention group at the fourth-week follow-up compared with the control group. Findings suggest that the nurse-led personalized patient engagement program could effectively promote DSM.

KEYWORDS
nursing, patient engagement, self-efficacy, self-management, treatment adherence, type 2 diabetes mellitus

Key points

- This individually delivered nurse-led personalized patient engagement intervention improved the treatment adherence, self-efficacy, and patient engagement levels among patients with type 2 diabetes mellitus in Turkey.
- PHEinAction® may offer a structured and theory-based approach for clinicians to engage diabetes patients, enabling them to plan care targeting individual and unique needs.

The research protocol of this study was presented orally at the 8th International Nursing Management Conference, which was held between 27 and 29 October 2022 in Istanbul, Turkey, and awarded the second prize.

- PHEinAction® can be combined with diabetes education in outpatient clinics to promote diabetes self-management by strengthening patients in cognitive, emotional, and behavioral domains.

1 | INTRODUCTION

Diabetes mellitus has become the most critical health concern, with a global burden reaching over 537 million people in 2021, and is projected to exceed one billion people by 2050 (International Diabetes Federation, 2021; Ong et al., 2023). Turkey ranks first among European countries, with a prevalence rate of 15.9% in the adult population (International Diabetes Federation, 2021). Type 2 diabetes mellitus (T2DM) accounts for approximately 90% of all diabetes cases (Kazerouni et al., 2020) leads to many complications with severe physical and psychological consequences for patients and their families (Chatterjee et al., 2017), and causes an economic burden on healthcare systems (World Health Organization, 2018). These problems underline the effective management of diabetes, which refers to how individuals perform self-care encompassing the understanding, mindset, and actions for sustaining well-being and reducing health-related risks (Serrano-Gil & Jacob, 2010).

Self-management is related to better health outcomes and quality of life (Ji et al., 2020; Liang et al., 2021). However, diabetes self-management (DSM) is achieved by adapting medication therapy and life practices, including physical exercise, dietary changes, self-monitoring, regular medical follow-up, and coping with psychosocial challenges (Shin & Lee, 2018). Performing these activities and integrating them into daily routines can often become highly problematic (Fidan et al., 2020; Lambrinou et al., 2019), which impact individuals' capacity to manage diabetes and adherence to recommended self-care practices (Adu et al., 2019; Im et al., 2022). Therefore, identifying the possible risks related to diabetes and addressing the underlying mechanisms to develop interventions are essential to promote self-management.

Patients' degree of belief and confidence pertains to their ability to use their skills to achieve a particular goal, which refers to self-efficacy (Bandura, 2018). Self-efficacy is a psychological construct in managing chronic conditions (Xie et al., 2020), which directly influences dedication to sustaining health behaviors and improving health outcomes (Bandura, 2018). Higher self-efficacy leads to better adherence to self-care (Fereydouni et al., 2022), improved DSM (Hurst et al., 2020), and reduced diabetes complications (C. Tan, Cheng, et al., 2020). However, DSM requires lifelong commitment and motivation (Speight et al., 2020), coping with new and undesirable situations, and adapting to these situations physiologically and psychologically (Fidan et al., 2020). These factors are related to maintaining motivation, which involves supporting patients' increased responsibility in healthcare and focusing on the psychosocial factors that patients undergo in the chronic process (Graffigna & Barello, 2018).

Moreover, adjusting the disease process may vary due to some nonmodifiable (i.e., age, gender, socioeconomic status) and modifiable (i.e., illness perceptions, health literacy, cognition) factors, which may create a unique experience for each individual (Seixas et al., 2020). Patients with similar demographics or medical disorders need a personalized approach involving the development of tailored nutrition plans, physical activity recommendations, medication management strategies, setting care goals with ranking the priorities, and developing individual coping mechanisms (Pranata et al., 2021). These factors require clinicians to adopt a well-designed and personalized approach addressing the unique needs to promote self-management. In this perspective, patient engagement aims to encourage behavior change and meet psychosocial needs that appear critical for DSM (Varming et al., 2019). Patient engagement is defined as "the desire and capability to participate in care in a way uniquely appropriate to the individual, in cooperation with healthcare providers or institutions, to maximize outcomes or care experiences" (Higgins et al., 2017). Studies reported that actively engaged individuals are more adherent to medication therapy (Alfian et al., 2021; Graffigna et al., 2017), more likely to perform self-care behaviors properly (Cengiz et al., 2022), and demonstrate higher self-efficacy (Zhang et al., 2023). Active engagement in DSM involves dynamic interaction among various experiential aspects, not only including developing knowledge, supporting behavior change, and improving decision-making capacity but also accepting the diagnosis, complying with physiological and psychosocial changes, and elaborating individuals' role in their healthcare (Graffigna et al., 2016). Based on these assumptions, embracing patient engagement may be valuable in supporting diabetes patients (W. H. Tan, Loh, et al., 2020).

From this perspective, the Personalized Patient Engagement Plan (PHEinAction®) was introduced, which was rooted in patients' psychological experiences (Menichetti & Graffigna, 2016). PHEinAction® comprises two-monthly in-person interview sessions, a telephone consultation, and a set of home-based written exercises addressing cognitive, emotional, and behavioral domains to be conducted by patients at home in between the face-to-face encounters (Menichetti & Graffigna, 2016). The intervention was previously optimized in different clinical settings among the Italian adult populations (Menichetti et al., 2021; Menichetti, Pitacco, et al., 2018), and its feasibility is planned to be evaluated with patients receiving cancer care (Bonetti, Barello, et al., 2022).

Diabetes self-management education (DSME) is a globally recognized method for improving DSM worldwide (Celik et al., 2022; Zheng et al., 2019). In Turkey, nurses play an essential role in meeting the educational requirements of people with diabetes (Sivrikaya & Ergün, 2018). However, DSME practices in Turkey lack standardization in terms of content, duration, and methods (Celik et al., 2022), often fail to address motivational factors and patients' unique care needs, and are not based on a theory/model (Surucu et al., 2017).

Furthermore, the standard interventions usually involve passive learning techniques such as clinician recommendations, instructions, and didactic lectures and mostly lack follow-up care plans (van Vugt et al., 2018). Although DSME improves metabolic control, factors such as social support, motivation, negative attitudes toward disease, stress, anxiety, and denial of diagnosis may affect the success of DSM (Açıl & Bahar, 2019; Inga-Britt & Kerstin, 2019). While educational interventions are recognized to encourage self-management, few prioritize promoting active engagement and addressing psychosocial changes (Menichetti, Graffigna, et al., 2018).

Based on these premises, the study aimed to culturally adapt the components of PHEinAction® for implementation in adult Turkish T2DM patients through language and content validation and to examine its impact on DSM. We hypothesized that T2DM patients conducting PHEinAction® would experience improvements in treatment adherence, self-efficacy, and patient engagement.

1.1 | The nurse-led personalized patient engagement program: PHEinAction®

PHEinAction® is a 4-week personalized care plan developed as a generic tool (not explicitly designed for DSM but embracing various chronic conditions) to promote individuals' engagement in healthcare management. The intervention originated from the Patient Health Engagement Model (PHE model), which highlights the role of emotional maturation as a critical factor in engaging self-management practices. The PHE model delineates patient engagement as a developmental and dynamic process that encapsulates individuals' ability to live with a disease through four experiential phases: blackout, arousal, adhesion, and eudaimonic project (Graffigna & Barello, 2018). These phases describe individuals' psychological adjustment and maturation related to their ability to manage the disease, from blackout, a state of fear and anxiety leading to a loss of control over their health (disengagement), to eudaimonic project, where patients successfully incorporate self-management skills into their daily lives and adopt a positive approach to managing their disease (full-engagement). The content of PHEinAction®, including home-based written exercise booklets, is designed to reflect the specific features of each PHE model phase so that the intervention aims to respond to the individual care needs embracing cognitive, emotional, and behavioral domains of health engagement (Menichetti & Graffigna, 2016).

2 | METHODS

2.1 | Design

This single-center, two-parallel-group, randomized controlled trial was conducted between January 2020 and November 2021. The study was reported based on the Consolidated Standards of Reporting Trials (CONSORT) statement and was prospectively registered at ClinicalTrials.gov (registration number: NCT04256304).

2.2 | Participants and setting

Participants were recruited from an outpatient endocrine clinic of a university hospital in Ankara, Turkey, between January and April 2021. The inclusion criteria included individuals who (i) were aged between 18 and 65, (ii) had T2DM for ≥6 months, (iii) had been using medication for T2DM treatment, (iv) were able to communicate in Turkish, and (v) had scored an average of 2.5 points of the Health Literacy Scale (HLS). Participants who were unable to perform self-care, had a pregnancy, and had a cognitive impairment were excluded.

2.3 | Sample size estimation

We used G*Power® 3.1.9.4 software to estimate the sample size (Faul et al., 2009). Based on the findings from a nonrandomized pilot study with 12 patients (6: intervention and 6: control), the sample size was estimated to be a minimum of 48 participants with an effect size of $d = 0.87$, power of 0.90, and a 95% confidence interval for the independent sample t-test. The pilot study data were not included in the main research. Finally, data from 51 participants (24: intervention and 27: control) were collected and analyzed.

2.4 | Recruitment, randomization, and allocation concealment

Four hundred ninety-four patients were screened regarding eligibility. Among these patients, 435 did not meet the inclusion criteria (Figure 1). Fifty-nine patients who provided written informed consent were assigned a number to be allocated to the intervention or control group through simple randomization. Random assignment was performed using Microsoft Excel® with a coin flip method, creating a 30- and 29-numbered ranking list with the "random" command by an associate professor (AP) who was not involved in the research team and had no contact with the participants or data analysis. The list involving random allocation was concealed from the researchers and the participants until the intervention procedure began. After randomization, the researcher called the participants to schedule an appointment for the first in-person interview session, and eight patients (*n*: 6 from the intervention and *n*: 2 from the control) dropped out of the study before the first assessment. At the beginning of each first in-person session, the researcher contacted the AP to reveal which group the participant was allocated. Blinding the participants and the study staff was not possible due to the design of the intervention.

2.5 | Instruments

All participants were evaluated regarding their health literacy levels during the recruitment. Sociodemographic and health-related characteristics were obtained at the first assessment. Treatment adherence, self-efficacy, and patient engagement were collected in both groups

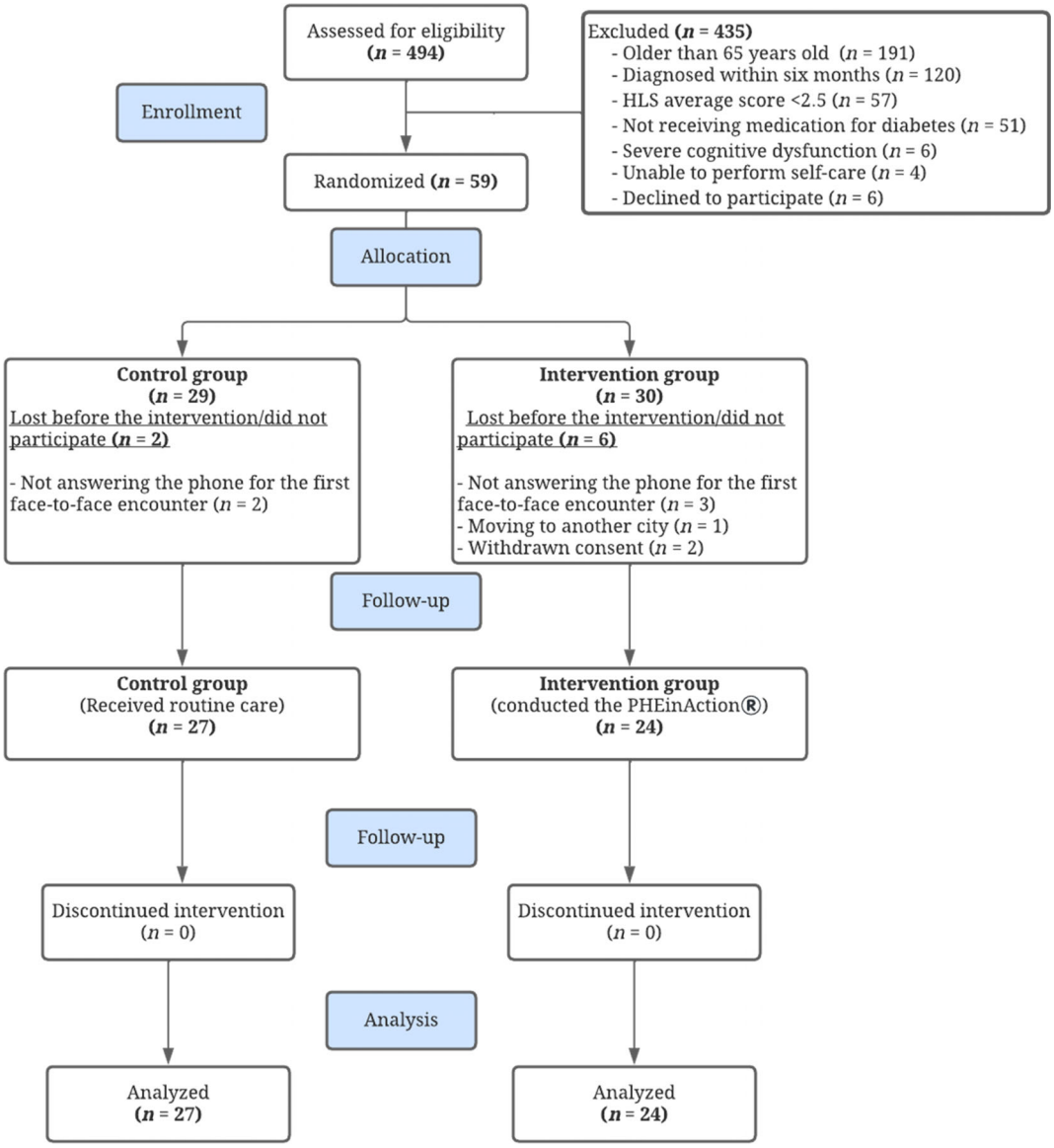

FIGURE 1 CONSORT diagram.

at first and at second face-to-face encounters between 4-week intervals. Data were collected between June and November 2021.

Sociodemographic and health-related information included individuals' age, gender, marital status, education level, employment, self-reported income, place of residence, household people, duration of diabetes, diabetes treatment plan, acute/chronic complications, comorbidities, family history of diabetes, self-reported treatment engagement (regular blood glucose monitoring, physical exercise, and following a diabetic diet), and whether received diabetes education. The body mass index was immediately calculated, and the most recent hemoglobin A1c values (recorded in the last 3 months) were obtained from previous health records.

Health literacy was assessed using the validated HLS. The authors requested permission to use the HLS from Ishikawa et al. (2008), who developed the scale, and from Ağralı and Akyar (2018), who adopted it in Turkish. The scale has 14 items comprising three subscales: functional, communicative, and critical health literacy, with a four-point Likert structure (from never to often). For communicative and critical subscales, higher scores indicate higher health literacy; conversely, the functional health literacy subscale is reverse-scored. The Turkish validation study reported the internal consistency coefficient as Cronbach's $\alpha = 0.96$ (Ağralı & Akyar, 2018). The current study showed acceptable internal consistency (Cronbach's $\alpha = 0.68$).

Treatment adherence was assessed with the Type 2 Diabetes Mellitus Treatment Patient Compliance Scale. The authors requested permission to use the scale from Demirtaş and Akbayrak (2017), who developed it with the Turkish diabetes population. The scale has 30 items with 7 domains, with a five-point Likert structure (ranging from 30 to 150 points). Lower scores indicate better adherence to treatment. In the explanatory factor analysis, each factor explained 47.36% of the variance. The internal consistency coefficient Cronbach

$\alpha = 0.77$ for the original scale and the current study reported high internal consistency (Cronbach's $\alpha = 0.90$).

Self-efficacy was measured via the Diabetes Management Self-Efficacy Scale (DMSES). The authors requested permission to use the DMSES from Bijl et al. (1999), who developed the scale, and from Kara et al. (2006), who adopted it in Turkish. The Turkish validated scale consists of 20 items with five factors. Total scores ranged from 20 to 100 with a five-point Likert format, with higher scores demonstrating better self-efficacy. In the Turkish validation study, each factor explained 73.6% of the variance. Regarding internal consistency, Cronbach's α was 0.89 (Kara et al., 2006). In this study, we found Cronbach's α as 0.85 on the scale.

Patient engagement was evaluated with the Patient Health Engagement Scale (PHE-s®). The authors requested permission to use the PHE-s® from Graffigna et al. (2015), who developed the scale, and from Usta et al. (2019), who adopted it in Turkish. The PHE-s® was generated based on the PHE model to evaluate patients in terms of engagement level from low to high (Graffigna et al., 2015). The scale comprised five items with seven responses with a single factor and ordinal structure, enabling patients to locate themselves in intermediate positions to avoid social desirability bias. The ordinal alpha was 0.80 in the Turkish validation study (Usta et al., 2019). The present study showed good internal reliability (Cronbach's $\alpha = 0.89$).

2.6 | Content of the written materials

The authors obtained written permission to adopt the intervention from the original authors (Menichetti & Graffigna, 2016). Figure 2 presents the components of the intervention. The home-based written exercises become gradually challenging in consecutive engagement phases. To illustrate, exercises for the arousal phase also require individuals to complete the previous phase—blackout; in further stages, activities become more demanding to strengthen flexibility and personalization of the intervention (Menichetti & Graffigna, 2016). The following section outlines the content of the written materials within cognitive, emotional, and behavioral domains and the specific tasks related to each engagement phase.

2.6.1 | Cognitive domain

This section aims to support the ability to gather, organize, and understand the information and knowledge related to DSM. The cognitive domain includes: (i) for blackout, an information-gathering activity about what the patient knows about DSM and resuming the diabetes knowledge; (ii) for arousal, a question-asking exercise to define practical questions and to collect and organize the diabetes-related information; (iii) for adhesion, creating a personal agenda consisting of recommendations to manage information, such as adopting a self-monitoring logbook and organizing tasks to prepare before the consultation appointment; and (iv) for eudaimonic project, a mapping exercise to identify the informal sources of information.

2.6.2 | Emotional domain

This section aims to promote the expression of the psychological impact of diabetes and elaboration on the illness experience to strengthen patients in developing positive life trajectories. The emotional domain includes: (i) for blackout, an expressive writing task to reveal the diabetes experience, including feelings about the diagnosis and lifestyle changes that need to be implemented; (ii) for arousal, keeping a seven-day-diary focusing on positive thoughts about the DSM; (iii) for adhesion, a task describing the well-being/discomfort areas in daily life to unravel the sources of positive thinking; and (iv) for eudaimonic project, a positive psychology exercise as identifying three personal strengths to discover how to use them in DSM.

2.6.3 | Behavioral domain

This section aims to identify practical and achievable steps patients can take to improve their self-care skills and self-efficacy. The behavioral domain includes: (i) for blackout, an exercise to list the domains of action in DSM (i.e., dieting, physical exercise, blood-sugar monitoring, taking medication) and to discover the informal sources of managing these routines; (ii) for arousal, a self-assessment exercise of self-efficacy and

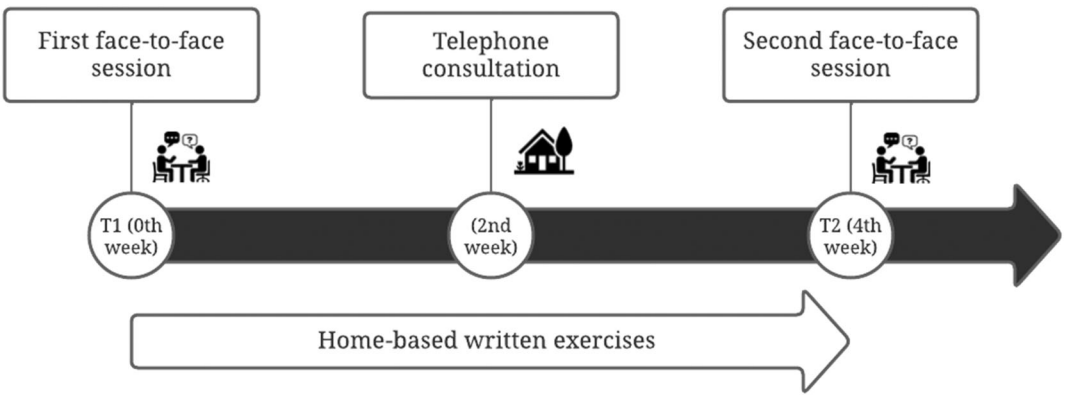

FIGURE 2 Components of PHEinAction® (Menichetti Delor, 2017).

motivation for DSM dimensions that patients need to manage; (iii) for adhesion, a task involving planning behaviors to activate the defined health actions and personalized care goals; and (iv) for eudaimonic project, an exercise to predict the possible barriers to implementing the DSM plan and finding solutions to the potential problems in the long term.

2.7 | Procedure

2.7.1 | Translation and adaptation of PHEinAction®

Before the randomized controlled phase, the materials in home-based written exercises were translated into Turkish and the content of PHEinAction® was adapted to align with diabetes management practices. The adaption process involved several steps: forward translation, customization, expert panel evaluation, back-translation, and pilot study.

The forward translation included translating the original Italian version of the home-based written exercises into Turkish by a professional translator. This translated version was then compared with the original text by an Italian language specialist to ensure conformity. Since the intervention was initially designed as a generic tool for chronic conditions, the materials were customized for DSM (i.e., integrating blood glucose monitoring and foot care) by adding simple explanations and examples to improve comprehensibility.

The translated and adapted materials were evaluated for semantics and content by an expert panel of 10 specialists with extensive experience in chronic care, health psychology, and diabetes nursing. The specialists individually rated each exercise content on a four-point ordinal scale for clarity, understandability, and cultural relevance (1: not relevant, 2: somewhat relevant, 3: quite relevant, 4: highly relevant) (Davis, 1992). The item-level index scores ranged from 0.90 to 1.00, with an average scale-level index of 0.98 in the final version. The expert panel also made recommendations to improve the comprehensibility and scope of the content.

After incorporating the changes according to the expert panel recommendations, a Turkish language specialist checked the materials for comprehensibility. Another blinded professional translator then carried out the back-translation. The back-translated version was compared with the original PHEinAction® by the author who developed the intervention to ensure congruence. Finally, during the pilot study with 12 diabetes patients, they were asked to comment on the materials' readability, understandability, and cultural appropriateness, and no changes were required within the content.

2.7.2 | Randomized controlled phase: Effectiveness of the PHEinAction®

Intervention group

Participants in the intervention group conducted PHEinAction®, which commenced with the first in-person interview. Interviews were conducted based on the participant's preference, either in a room in the outpatient clinic or in an open-air sitting area on the university's campus due to the COVID-19 pandemic. Initially, sociodemographic and health-related information was collected, followed by the baseline assessment of treatment adherence and self-efficacy.

The session, which lasted about 75 min, began by collecting information about the participant's diabetes journey using an experience map to reveal their awareness of the condition since the diagnosis. The discussion explored the events that had occurred during their diabetes journey (i.e., recognizing symptoms, seeking healthcare services, type of treatment) and the emotions they had experienced. The rationale for engaging in DSM was explained, and the participants' patient engagement phase was identified using the PHE-s®. In line with the diabetes experience and the specific characteristics of identified patient engagement phase, achievable and personalized diabetes care goals were set within subsequent cognitive, emotional, and behavioral domains based on diabetes care requirements. Then, the home-based exercise booklet was introduced, and participants were encouraged to actively use these tools to work toward their engagement goals over the next 4 weeks.

Two weeks after the first session, the researcher provided a 10-min telephone consultation to follow up on the participants' progress, including supporting their motivation, addressing any difficulties encountered with the written materials or to achieve personalized care goals, and answered any questions regarding the process. Afterward, the second face-to-face interview session was arranged.

Four weeks after the first session, the second in-person interview, which lasted about 90 min, took place. The session began by collecting participants' experiences and reviewing their progress with the written exercises. After re-assessing the engagement phase, the personalized care goals were discussed by providing feedback to support improvement using motivational interviewing techniques. Participants were encouraged to set a new engagement goal and to maintain the health engagement plan. At the end of the second session, participants' treatment adherence and self-efficacy levels were reassessed. The second session lasted approximately 90 min (Figure 3).

Control group

Participants in the control group received usual care from their endocrinologist or general practitioner. Usual care involved standard procedures, including quarterly physician consultations, six-monthly or three-monthly HbA1c tests, physical examinations, and self-managing recommended diabetes therapy.

2.8 | Data analysis

Statistical analyses were performed using IBM® SPSS 24 (IBM Corp., Armonk, USA). The clinical significance regarding the effect sizes was calculated with Cohen's *d* values (0.2 for small, 0.5 for medium, and 0.8 for large) (Cohen, 2013; Rosenthal, 1996). Descriptive data were presented as frequencies, proportions, mean, and standard deviation. Sociodemographic and health-related characteristics were compared between two groups at baseline assessment with chi-square tests for categorical variables and the independent samples *t*-test for continuous data. The normality assumption was provided with the Kolmogorov–

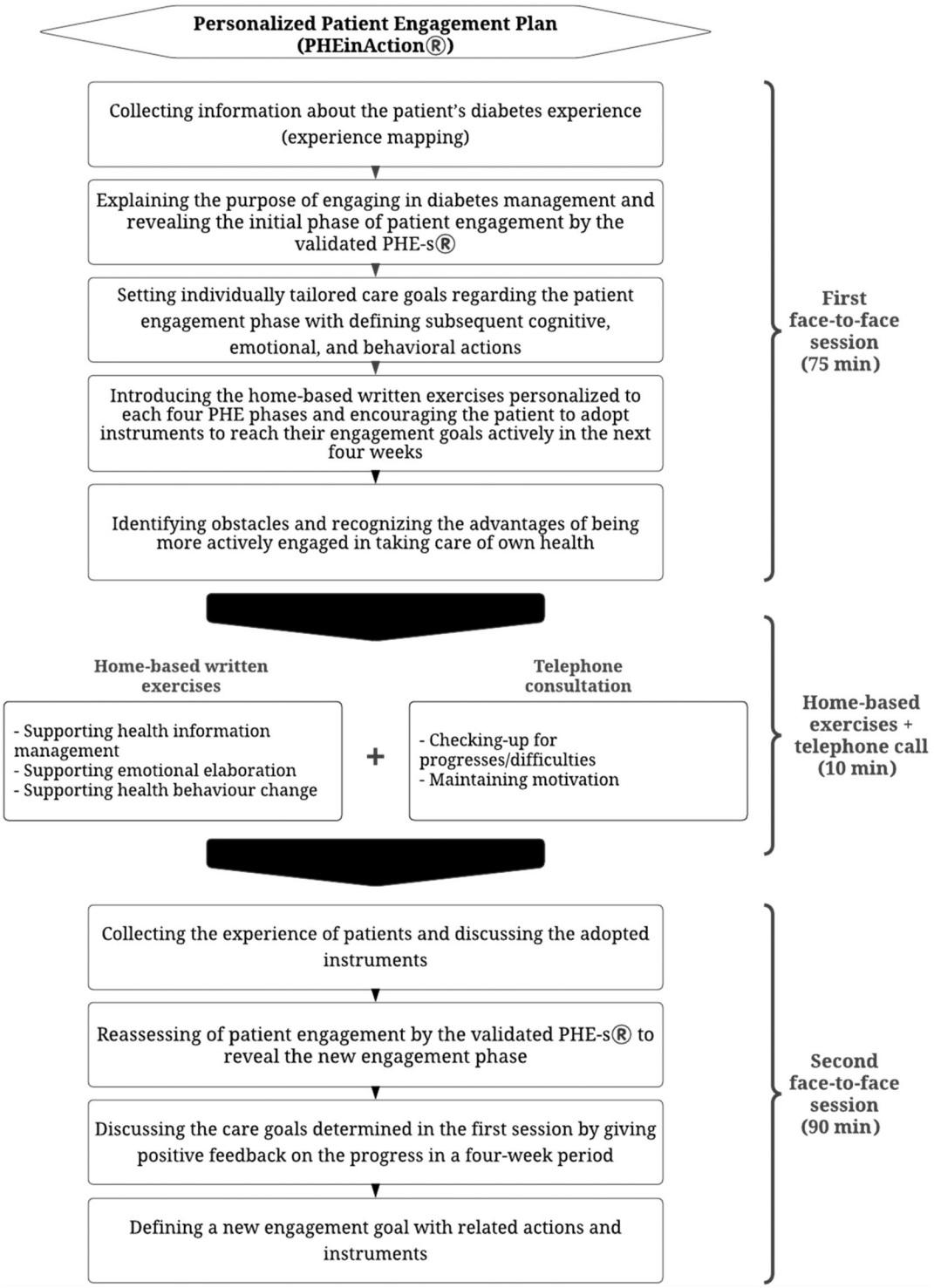

FIGURE 3 Intervention procedure (Menichetti & Graffigna, 2016).

Smirnov normality test. Independent variables were calculated as mean scores for treatment adherence, self-efficacy, and patient engagement. After the post-assessments, the paired *t*-test measured significant differences in treatment adherence, self-efficacy, and patient engagement scores on a pre–post analysis of each group, followed by the groups' comparison using an independent sample *t*-test after the intervention. A *p*-value of <0.05 was considered statistically significant.

2.9 | Ethical considerations

The current study was approved by Hacettepe University Clinical Research Ethics Committee (no: KA-19031) and adhered to the tenets of the Declaration of Helsinki. Institutional approval was obtained from the hospital where the study was conducted. After the study protocol was explained, written informed consent was obtained from

participants. All participants were informed that they could withdraw from the study at any time and that their decision would not affect the care/treatment process. Moreover, the entire research process was conducted anonymously.

3 | RESULTS

The study was conducted with 51 diabetes patients. All participants completed the baseline and follow-up assessments, none withdrew from the study, and no data were missing in the trial. Participants' mean age was 52.7 years, and almost 61% of the patients were female. At baseline, no significant differences between the intervention and control groups were identified in sociodemographic and health-related characteristics and health literacy scores ($p > 0.05$) (Table 1).

Table 2 demonstrates the distributions of the scores for treatment adherence, self-efficacy, and patient engagement. Regarding the baseline scores, no significant difference was found in treatment adherence scores between the two groups ($t = 1.372$, $p = 0.176$). The level of treatment adherence was moderate in the intervention group (88.8 ± 16.11) and the control group (81.5 ± 21.24) before the intervention. The mean scores for self-efficacy in baseline assessment indicated no significant difference between the two groups ($t = -1.331$, $p = 0.189$). The level of self-efficacy was moderate in the intervention group (58.2 ± 11.39) and the control group (62.8

TABLE 1 Participants' demographic and health-related characteristics in intervention and control groups.

Characteristics	All ($n = 51$) Mean (SD)	Intervention ($n = 24$) Mean (SD)	Control ($n = 27$) Mean (SD)	Statistical analysis t	p
Health Literacy Scale (HLS)	3.3 (0.40)	3.3 (0.36)	3.2 (0.43)	0.790	0.433
Age (years)	52.7 (7.05)	52.9 (7.55)	52.4 (6.72)	0.218	0.829
Duration of diabetes (years)	9.2 (6.38)	8.2 (5.77)	10.1 (6.86)	−1.082	0.285
Body mass index (kg/m^2)	29.8 (3.83)	30.4 (4.08)	29.3 (3.60)	1.013	0.316
HbA1c% (mmol/mol)	7.8 (1.76)	8.0 (1.93)	7.5 (1.61)	0.869	0.389
Characteristics	**All ($n = 51$) n (%)**	**Intervention ($n = 24$) n (%)**	**Control ($n = 27$) n (%)**	**Statistical analysis χ^2**	**p**
Gender					
Female	31 (60.8)	15 (62.5)	16 (59.3)	0.056	0.813
Male	20 (39.2)	9 (37.5)	11 (40.7)		
Marital status					
Married	47 (92.2)	21 (87.5)	26 (96.3)	1.360[b]	0.244
Single	4 (7.8)	3 (12.5)	1 (3.7)		
Education level					
Elementary	8 (15.7)	6 (25.0)	2 (7.4)	4.618[c]	0.244
Secondary	5 (9.8)	3 (12.5)	2 (7.4)		
High school	18 (35.3)	8 (33.3)	10 (37.1)		
University and further	20 (39.2)	7 (29.2)	13 (48.1)		
Employment					
Unemployed or retired	37 (72.5)	19 (79.1)	18 (66.6)	0.997	0.318
Employed	14 (27.5)	5 (20.9)	9 (33.4)		
Self-reported income					
Low	4 (7.8)	2 (8.4)	2 (7.4)	0.904[c]	0.636
Moderate	37 (72.5)	16 (66.6)	21 (77.8)		
High	10 (19.6)	6 (25.0)	4 (14.8)		
Place of residence					
Urban	28 (54.9)	15 (62.5)	13 (48.1)	1.057	0.304
Rural	23 (45.1)	9 (37.5)	14 (51.9)		
Household people					
Alone	5 (9.8)	4 (16.7)	1 (3.7)	2.559[c]	0.278
With spouse	11 (21.6)	5 (20.8)	6 (22.2)		
With spouse and children	35 (68.6)	15 (62.5)	20 (74.1)		

TABLE 1 (Continued)

Characteristics	All ($n = 51$) *n* (%)	Intervention ($n = 24$) *n* (%)	Control ($n = 27$) *n* (%)	Statistical analysis	
				χ^2	*p*
Diabetes treatment plan					
Insulin	6 (11.8)	4 (16.6)	2 (7.4)	1.953[c]	0.377
Oral antidiabetic drug	26 (51.0)	10 (41.7)	16 (59.3)		
Insulin and oral antidiabetic drug	19 (37.2)	10 (41.7)	9 (33.3)		
Chronic complication					
Yes	39 (76.5)	18 (75.0)	21 (77.8)	0.054	0.815
No	12 (23.5)	6 (25.0)	6 (22.2)		
Acute complication					
Yes	42 (82.4)	18 (75.0)	24 (88.9)	1.792[b]	0.127
No	9 (17.6)	6 (25.0)	3 (11.1)		
Comorbidities					
Yes	42 (82.4)	21 (87.5)	21 (77.8)	0.898[b]	0.373
No	9 (17.6)	3 (12.5)	6 (22.2)		
Family history of diabetes					
Yes	41 (80.4)	21 (87.5)	20 (74.1)	0.726[b]	0.300
No	10 (19.6)	3 (12.5)	7 (25.9)		
Regular monitoring of blood glucose[a]					
Yes	26 (51.0)	12 (50.0)	14 (51.9)	0.017	0.895
No	25 (49.0)	12 (50.0)	13 (48.1)		
Regular physical exercise[a]					
Yes	27 (52.9)	11 (45.8)	16 (59.9)	0.919	0.338
No	24 (47.1)	13 (54.2)	11 (40.7)		
Adherence to a diabetic diet[a]					
High	17 (33.3)	7 (29.2)	11 (37.1)	0.354	0.838
Moderate	12 (23.5)	6 (25.0)	6 (22.2)		
Low	22 (43.2)	11 (45.8)	10 (40.7)		
Education about diabetes					
Yes	46 (90.2)	22 (91.7)	24 (88.9)	0.000[b]	1.000
No	5 (9.8)	2 (8.3)	3 (11.1)		

Note: *t*, independent samples *t*-test; *p*, significance level.
Abbreviation: SD, standard deviation.
[a]Self-reported data.
[b]Fisher's exact chi-square test.
[c]Freeman–Halton Fisher exact chi-square test.

± 13.46) at baseline assessment. Further, no significant difference was found between the two groups' baseline patient engagement scores ($t = -0.070$, $p = 0.945$). The level of patient engagement was moderate in the intervention group (4.1 ± 1.23) and the control group (4.1 ± 1.48) before the intervention.

Regarding the post-intervention assessments, we found significant improvements in treatment adherence, self-efficacy, and patient engagement scores in the intervention group. The mean treatment adherence score in the intervention group was significantly lower after the intervention compared with the baseline assessment ($t = 10.725$, $p < 0.001$) and the control group ($t = -6.439$, $p < 0.001$). The intervention produced a greater improvement in treatment adherence with a very large effect size from baseline to the fourth week ($d = 2.52$). The mean scores of self-efficacy in the intervention group were significantly higher compared with the baseline assessment ($t = -11.908$, $p < 0.001$) and the control group ($t = 6.242$, $p < 0.001$). The effect size for PHEinAction® on self-efficacy from baseline to the fourth week was $d = 2.40$, which is in the very large range. Moreover, participants' patient engagement scores in the intervention group were significantly higher than the baseline assessment ($t = -6.530$, $p < 0.001$) and the control group ($t = 3.967$, $p < 0.001$). Similarly, a substantial improvement in patient engagement scores was observed among the PHEinAction® group from baseline to the fourth week with a large effect size ($d = 1.07$).

TABLE 2 Effect of PHEinAction® intervention on the study variables.

Variables	Measurement	Intervention ($n = 24$)	Control ($n = 27$)	Statistical analysis	
		Mean (SD)	Mean (SD)	t^b	p
Treatment adherence	Baseline	88.8 (16.11)	81.5 (21.24)	1.372	0.176
	Fourth week	52.7 (12.26)	81.0 (18.67)	−6.439	<0.001*
	t^a, p	10.725; <0.001*	0.575; 0.570		
Self-efficacy	Baseline	58.2 (11.39)	62.8 (13.46)	−1.331	0.189
	Fourth week	84.5 (10.49)	63.9 (13.01)	6.242	<0.001*
	t^a, p	−11.908; <0.001*	−1.765; 0.089		
Patient engagement	Baseline	4.1 (1.23)	4.1 (1.48)	−0.070	0.945
	Fourth week	5.3 (1.00)	4.0 (1.25)	3.967	<0.001*
	t^a, p	−6.530; <0.001*	0.864; 0.395		

Note: p, significance level.
Abbreviation: SD, standard deviation.
[a]t-test (dependent group).
[b]t-test (independent group).
*$p < 0.001$.

4 | DISCUSSION

The current study demonstrated the positive effect of PHEinAction® on improving treatment adherence, self-efficacy, and patient engagement levels of individuals with type 2 diabetes in Turkey. These findings revealed that this nurse-led patient engagement intervention had a large effect size on DSM, indicating a significant clinical improvement. The large effect size might be attributed to the personalized approach of the intervention, the increased interaction between the nurse and the patient, and the combination of strategies addressing cognitive, emotional, and behavioral domains.

Interventions engaging individuals in diabetes provided promising results and improved treatment adherence, particularly those that are structured considering the reasons for difficulties experienced in diabetes control (Alfian et al., 2021), supporting patients to ask health-related questions (Elsabrout, 2018) and focusing on problem-solving skills (Schultz et al., 2021). Tailoring behavioral strategies to the specific needs of individuals and incorporating psychosocial aspects to maintain adherence to healthy behaviors is strongly recommended (Magon et al., 2021; Seixas et al., 2020). Consistent with our findings, Gimbel et al. (2020) reported greater improvements in self-care practices and treatment adherence to a self-management program tailored to patients' activation levels and emotional states. Although the existing interventions intended to enhance patient engagement, they remained limited in being tailored to the individual's level of engagement, potentially limiting the provision of personalized care. Additionally, interventions primarily focused on supporting individuals' knowledge and skills, and the emotional and psychosocial aspects of the self-management process may be neglected (Menichetti, Graffigna, et al., 2018). We suggest that the improvement in diabetes treatment adherence could be attributed to PHEinAction®, which considers the individual's specific needs, preferences, and treatment goals, including written exercises tailored to the patient's level of engagement. This intervention addresses the cognitive aspect of treatment adherence through home-based written exercises that enable individuals to record their medication times, dosages, and questions to ask healthcare professionals. Supporting individuals in seeking and using health information has been shown to be effective in promoting treatment adherence (J. P. Tan et al., 2019). Besides, the seven-day-diary exercise included the emotional aspect and allowed individuals to identify emotional barriers to treatment adherence. This is consistent with a previous study that implemented diaries to improve treatment adherence (J. P. Tan et al., 2019). We believe that this activity encouraged individuals to actively engage in self-care practices and improve medication adherence by allowing them to express their feelings about the challenges encountered in daily life and define barriers to treatment adherence, and helped them to recognize their needs for diabetes as a written data source. Furthermore, activities allowing patients to self-assessment of motivation may have encouraged them to adhere to self-care activities within the intervention's behavioral domain. In conclusion, PHEinAction® showed a positive impact on supporting treatment adherence.

Notably, interventions aimed at supporting motivation in self-management are acknowledged as an effective method for improving engagement in care (Bonetti, Tolotti, et al., 2022). Evidence revealed that behavioral strategies to strengthen patient engagement improve individuals' self-efficacy by supporting their confidence in managing health (Selçuk-Tosun & Zincir, 2019). A study that combined face-to-face interviews and weekly phone calls reported that setting personalized goals for DSM based on individual needs increased diabetes self-efficacy (Swoboda et al., 2017). Besides, motivational interviewing that integrates face-to-face and phone methods has been reported to improve self-efficacy (Chapman et al., 2018). We propose that PHEinAction®, which follows similar methods as reported in previous studies (Almutairi et al., 2020), enables the nurse to maintain contact with patients through in-person and telephone interviews, also

employing motivational interviewing techniques. The self-assessment exercises on self-efficacy in each action area allowed patients to identify their needs and encouraged them to reinforce their motivation. These methods are used to discover the factors that increase motivation to engage in health behavior change, to determine individual-specific achievable care goals, to identify personal resistances and find ways to overcome them, and to focus on the points that the individual has achieved (Menichetti & Graffigna, 2016). Thus, all these components of PHEinAction® may have improved the self-efficacy of participants.

PHEinAction® has the potential to improve patient engagement in diabetes patients. The increase in engagement scores may be attributed to patients becoming more aware of their condition and exploring their coping skills to better engage in their care (Menichetti, Pitacco, et al., 2018). Existing interventions related to patient engagement/activation/empowerment often include informational/educational content and lack a theoretical model or direct measurement of patient engagement (Savarese et al., 2021). Instead, patient engagement is commonly defined by health outcomes such as medication adherence (Lauffenburger et al., 2019), patient activation levels (Glenn et al., 2020), blood glucose monitoring practices (Cai et al., 2023), self-efficacy, and quality of life (Bonetti, Tolotti, et al., 2022). Although few studies have focused on patient engagement within the PHE model, one study showed that personalized training videos provided to patients with diabetes during a routine outpatient clinic visit increased their PHE-s® scores and engagement levels (Elsabrout, 2018). PHEinAction® also increased patient engagement levels in individuals with morbid obesity (Menichetti et al., 2021). Personalized home-based written exercises, tailored to each engagement phase, likely played a role in personalizing care and supporting motivation, and setting easy-to-achieve care goals may be effective for behavior change. Implementing PHEinAction® improved communication with the nurse, encouraged patients to ask questions, and supported them in making decisions about their health. The program's inclusion of the emotional domain may have effectively supported participants in a short period. By setting personalized care goals and addressing the emotional impact, PHEinAction® helped individuals to manage their chronic condition, ultimately improving patient engagement among the diabetes population.

4.1 | Limitations

The present study has limitations. Firstly, the participants were recruited from a single healthcare setting, which limits the generalizability of the findings to the general population. A multicenter study involving internal medicine outpatient clinics and primary healthcare settings with a larger and more diverse sample would be necessary to ensure the intervention's effectiveness. Secondly, the effectiveness of PHEinAction® was assessed immediately after the intervention. A longer follow-up period and additional sessions would provide valuable insights into the long-term effects of the program and whether individuals maintain their health engagement plan over an extended period. This is particularly important given the short time frame and COVID-19 restrictions that impacted the study. Thirdly, excluding patients with lower health literacy may limit the generalizability of the findings to populations with varied health literacy levels. For this reason, we also recommend redesigning written materials for the population with lower health literacy. Besides, we involved patients diagnosed with T2DM longer than 6 months to describe their accumulated disease experience; however, this program may be useful for elaborating newly diagnosed individuals' experience as well. Excluding patients unable to perform self-care might limit the study's scope, and future research should explore interventions involving family caregivers to enhance support for those individuals. Also, the study relied on self-reported data, which may be subject to recall bias.

4.2 | Conclusions

This nurse-led personalized patient engagement intervention effectively encouraged participants with T2DM to adhere to their treatment, improved their diabetes management self-efficacy, and increased their engagement in their care. PHEinAction® is a potentially effective strategy that focuses on the individual's needs and preferences and incorporates personalized treatment goals and care strategies encompassing cognitive, emotional, and behavioral domains.

4.3 | Relevance for clinical practice

Compared with similar approaches targeting behavior change or patient engagement, PHEinAction® offers personalized care by encompassing cognitive, emotional, and behavioral components of the healthcare management process and considers individuals' psychosocial experiences, which makes it an innovative intervention (Menichetti et al., 2021). PHEinAction® bridges the gap between theory and practice from a patient engagement perspective. While diabetes education for self-management is well-supported by evidence, diabetes nurses may find it challenging to focus on initiatives that actively engage patients throughout the entire process, especially during the COVID-19 pandemic when additional infection control procedures are required. PHEinAction® offers a solution to these barriers with concise strategies combining face-to-face sessions, telephone consultations, and home-based exercises designed to overcome healthcare accessibility and scheduling barriers. Therefore, this research may provide insights to nurses to combine the intervention with diabetes education to overcome contextual barriers and strengthen their relationship with patients, even providing remote healthcare.

AUTHOR CONTRIBUTIONS

Dilara Cengiz: Conceptualization; writing – original draft; data curation; project administration; funding acquisition; methodology; software; formal analysis; resources; visualization; writing – review and editing;

investigation; validation. **Fatoş Korkmaz:** Writing – review and editing; supervision; data curation; methodology; conceptualization; software; formal analysis; resources; visualization; validation; investigation.

ACKNOWLEDGMENTS

We would like to thank all the patients who participated in the study and shared their special experiences, thoughts, and emotions. We would like to express our sincere gratitude to Dr. Julia Menichetti, Dr. Leyla Dinç, Dr. Özlem Bozo, Dr. İmatullah Akyar, and Dr. Ugur Unluturk for their guidance and advice on the study, which is a PhD thesis of the corresponding author.

FUNDING INFORMATION

This research was supported by the Scientific and Technological Research Council of Turkey (TUBITAK) (project number: 220S317). The content is only the responsibility of the authors and does not represent the official views of the funding institution.

CONFLICT OF INTEREST STATEMENT

None declared.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Dilara Cengiz https://orcid.org/0000-0003-1300-0678
Fatoş Korkmaz https://orcid.org/0000-0003-4457-8691

REFERENCES

Açıl, D., & Bahar, Z. (2019). Perceived barriers to diabetes management at home: A qualitative study. *Turkish Journal of Biochemistry*, *44*(5), 621–629. https://doi.org/10.1515/tjb-2018-0343

Adu, M. D., Malabu, U. H., Malau-Aduli, A. E. O., & Malau-Aduli, B. S. (2019). Enablers and barriers to effective diabetes self-management: A multi-national investigation. *PLoS One*, *14*(6), e0217771. https://doi.org/10.1371/journal.pone.0217771

Ağralı, H., & Akyar, I. (2018). Turkish validation and reliability of health literacy scale for diabetic patients. *Acıbadem Üniversitesi Sağlık Bilimleri Dergisi*, *9*(3), 314–321. https://doi.org/10.31067/0.2018.31

Alfian, S. D., van Boven, J. F. M., Abdulah, R., Sukandar, H., Denig, P., & Hak, E. (2021). Effectiveness of a targeted and tailored pharmacist-led intervention to improve adherence to antihypertensive drugs among patients with type 2 diabetes in Indonesia: A cluster randomised controlled trial. *British Journal of Clinical Pharmacology*, *87*(4), 2032–2042. https://doi.org/10.1111/bcp.14610

Almutairi, N., Hosseinzadeh, H., & Gopaldasani, V. (2020). The effectiveness of patient activation intervention on type 2 diabetes mellitus glycemic control and self-management behaviors: A systematic review of RCTs. *Primary Care Diabetes*, *14*(1), 12–20. https://doi.org/10.1016/j.pcd.2019.08.009

Bandura, A. (2018). Toward a psychology of human agency: Pathways and reflections. *Perspectives on Psychological Science*, *13*(2), 130–136. https://doi.org/10.1177/1745691617699280

Bijl, J. V. D., Poelgeest-Eeltink, A. V., & Shortridge-Baggett, L. (1999). The psychometric properties of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus. *Journal of Advanced Nursing*, *30*(2), 352–359. https://doi.org/10.1046/j.1365-2648.1999.01077.x

Bonetti, L., Barello, S., Franzoso-Sartorio, C., Rinaldi, M. C., Cattaneo, A., Tolotti, A., Liptrott, S., & Sari, D. (2022). Protocol for a pilot and feasibility study evaluating a complex nurse-led patient education intervention to promote cancer patient engagement in healthy lifestyle (O-PHE programme). *BMJ Open*, *12*(12), e066163. https://doi.org/10.1136/bmjopen-2022-066163

Bonetti, L., Tolotti, A., Anderson, G., Nania, T., Vignaduzzo, C., Sari, D., & Barello, S. (2022). Nursing interventions to promote patient engagement in cancer care: A systematic review. *International Journal of Nursing Studies*, *133*, 104289. https://doi.org/10.1016/j.ijnurstu.2022.104289

Cai, J., Xu, H., Jiang, S., Sung, J., Sawhney, R., Broadley, S., & Sun, J. (2023). Effectiveness of telemonitoring intervention on glycaemic control in patients with type 2 diabetes mellitus: A systematic review and meta-analysis. *Diabetes Research and Clinical Practice*, 201, 110727. https://doi.org/10.1016/j.diabres.2023.110727

Celik, S., Olgun, N., Yilmaz, F. T., Anataca, G., Ozsoy, I., Ciftci, N., Aykiz, E. F., Yasa, S., Karakiraz, E., Ulker, Y., Demirhan, Y. E., Celik, S. Y., Arpaci, I., Gunduz, F., Temel, D., Dincturk, C., Sefer, B. E., Bagdemir, E., Erdem, E., … Sert, A. (2022). Assessment the effect of diabetes education on self-care behaviors and glycemic control in the Turkey Nursing Diabetes Education Evaluating Project (TURNUDEP): A multi-center study. *BMC Nursing*, *21*(1), 215. https://doi.org/10.1186/s12912-022-01001-1

Cengiz, D., Agrali, H., Korkmaz, F., & Akyar, İ. (2022). Mediation role of patient engagement on the association between health literacy and self-care behaviours in individuals with type 2 diabetes. *International Journal of Nursing Practice*, *28*(3), e13051. https://doi.org/10.1111/ijn.13051

Chapman, A., Browning, C. J., Enticott, J. C., Yang, H., Liu, S., Zhang, T., & Thomas, S. A. (2018). Effect of a health coach intervention for the management of individuals with type 2 diabetes mellitus in China: A pragmatic cluster randomized controlled trial. *Public Health Frontiers*, *6*, 252. https://doi.org/10.3389/fpubh.2018.00252

Chatterjee, S., Khunti, K., & Davies, M. J. (2017). Type 2 diabetes. *The Lancet*, *389*(10085), 2239–2251. https://doi.org/10.1016/S0140-6736(17)30058-2

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic Press.

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied Nursing Research*, *5*(4), 194–197. https://doi.org/10.1016/S0897-1897(05)80008-4

Demirtaş, A., & Akbayrak, N. (2017). Development of an assessment scale for treatment compliance in type 2 diabetes mellitus in Turkish population: Psychometric evaluation. *International Journal of Nursing Sciences*, *4*(3), 244–251. https://doi.org/10.1016/j.ijnss.2017.06.002

Elsabrout, K. (2018). Increasing diabetic patient engagement and self-reported medication adherence using a web-based multimedia program. *Journal of the American Association of Nurse Practitioners*, *30*(5), 293–298. https://doi.org/10.1097/JXX.0000000000000045

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Fereydouni, F., Hajian-Tilaki, K., Meftah, N., & Chehrazi, M. (2022). A path causal model in the association between self-efficacy and self-care with quality of life in patients with type 2 diabetes: An application of the structural equation model. *Health Science Reports*, *5*(2), e534. https://doi.org/10.1002/hsr2.534

Fidan, Ö., Takmak, S., Zeyrek, A. S., & Kartal, A. (2020). Patients with type 2 diabetes mellitus: Obstacles in coping. *Journal of Nursing Research*, *28*(4), e105. https://doi.org/10.1097/jnr.0000000000000379

Gimbel, R. W., Rennert, L. M., Crawford, P., Little, J. R., Truong, K., Williams, J. E., Griffin, S. F., Shi, L., Chen, L., Zhang, L., & Moss, J. B. (2020). Enhancing patient activation and self-management activities in patients with type 2 diabetes using the US Department of Defense Mobile Health Care Environment: Feasibility Study. *Journal of Medical Internet Research*, *22*(5), e17968. https://doi.org/10.2196/17968

Glenn, L. E., Nichols, M., Enriquez, M., & Jenkins, C. (2020). Impact of a community-based approach to patient engagement in rural, low-income adults with type 2 diabetes. *Public Health Nursing*, *37*(2), 178–187. https://doi.org/10.1111/phn.12693

Graffigna, G., & Barello, S. (2018). Spotlight on the Patient Health Engagement model (PHE model): A psychosocial theory to understand people's meaningful engagement in their own health care. *Patient Preference and Adherence*, *12*, 1261–1271. https://doi.org/10.2147/PPA.S145646

Graffigna, G., Barello, S., & Bonanomi, A. (2017). The role of Patient Health Engagement Model (PHE-model) in affecting patient activation and medication adherence: A structural equation model. *PLoS One*, *12*(6), e0179865. https://doi.org/10.1371/journal.pone.017986

Graffigna, G., Barello, S., Bonanomi, A., & Lozza, E. (2015). Measuring patient engagement: Development and psychometric properties of the Patient Health Engagement (PHE) Scale. *Frontiers in Psychology*, *6*, 274. https://doi.org/10.3389/fpsyg.2015.00274

Graffigna, G., Barello, S., Bonanomi, A., & Menichetti, J. (2016). The motivating function of healthcare professional in eHealth and mHealth interventions for type 2 diabetes patients and the mediating role of patient engagement. *Journal of Diabetes Research*, *2016*, 1–10. https://doi.org/10.1155/2016/2974521

Higgins, T., Larson, E., & Schnall, R. (2017). Unraveling the meaning of patient engagement: A concept analysis. *Patient Education and Counseling*, *100*(1), 30–36. https://doi.org/10.1016/j.pec.2016.09.002

Hurst, C. P., Rakkapao, N., & Hay, K. (2020). Impact of diabetes self-management, diabetes management self-efficacy and diabetes knowledge on glycemic control in people with Type 2 Diabetes (T2D): A multi-center study in Thailand. *PLoS One*, *15*(12), e0244692. https://doi.org/10.1371/journal.pone.0244692

Im, J. H. B., Escudero, C., Zhang, K., Choi, D., Sivakumar, A., Booth, G. L., Sale, J., Pritlove, C., Advani, A., & Yu, C. H. (2022). Perceptions and correlates of distress due to the COVID-19 pandemic and stress management strategies among adults with diabetes: A mixed-methods study. *Canadian Journal of Diabetes*, *46*(3), 253–261. https://doi.org/10.1016/j.jcjd.2021.10.006

Inga-Britt, L., & Kerstin, B. (2019). Challenges faced in daily life by persons with type 2 diabetes: A meta-synthesis. *Chronic Illness*, *15*(3), 167–186. https://doi.org/10.1177/1742395318757852

International Diabetes Federation. (2021). *IDF diabetes atlas* (Tenth ed. (Type 2 Diabetes, Issue).). IDF.

Ishikawa, H., Takeuchi, T., & Yano, E. (2008). Measuring functional, communicative, and critical health literacy among diabetic patients. *Diabetes Care*, *31*(5), 874–879. https://doi.org/10.2337/dc07-1932

Ji, M., Ren, D., Dunbar-Jacob, J., Gary-Webb, T. L., & Erlen, J. A. (2020). Self-management behaviors, glycemic control, and metabolic syndrome in type 2 diabetes. *Nursing Research*, *69*(2), E9–E17. https://doi.org/10.1097/NNR.0000000000000401

Kara, M., Van Der Bijl, J. J., Shortridge-Baggett, L. M., Astı, T., & Erguney, S. (2006). Cross-cultural adaptation of the diabetes management self-efficacy scale for patients with type 2 diabetes mellitus: Scale development. *International Journal of Nursing Studies*, *43*(5), 611–621. https://doi.org/10.1016/j.ijnurstu.2005.07.008

Kazerouni, F., Bayani, A., Asadi, F., Saeidi, L., Parvizi, N., & Mansoori, Z. (2020). Type2 diabetes mellitus prediction using data mining algorithms based on the long-noncoding RNAs expression: A comparison of four data mining approaches. *BMC Bioinformatics*, *21*, 1–13. https://doi.org/10.1186/s12859-020-03719-8

Lambrinou, E., Hansen, T. B., & Beulens, J. W. (2019). Lifestyle factors, self-management and patient empowerment in diabetes care. *European Journal of Preventive Cardiology*, *26*(2_suppl), 55–63. https://doi.org/10.1177/2047487319885455

Lauffenburger, J. C., Ghazinouri, R., Jan, S., Makanji, S., Ferro, C. A., Lewey, J., Wittbrodt, E., Lee, J., Haff, N., Fontanet, C. P., & Choudhry, N. K. (2019). Impact of a novel pharmacist-delivered behavioral intervention for patients with poorly-controlled diabetes: The ENhancing outcomes through Goal Assessment and Generating Engagement in Diabetes Mellitus (ENGAGE-DM) pragmatic randomized trial. *PLoS One*, *14*(4), e0214754. https://doi.org/10.1371/journal.pone.0214754

Liang, W., Lo, S. H. S., Tola, Y. O., & Chow, K. M. (2021). The effectiveness of self-management programmes for people with type 2 diabetes receiving insulin injection: A systematic review and meta-analysis. *International Journal of Clinical Practice*, *75*(11), e14636. https://doi.org/10.1111/ijcp.14636

Magon, A., Arrigoni, C., Barello, S., Graffigna, G., & Caruso, R. (2021). Managing anticoagulation in the COVID-19 era between lockdown and reopening phases: Comment. *Internal and Emergency Medicine*, *1-2*, 2017–2018. https://doi.org/10.1007/s11739-021-02647-6

Menichetti Delor, J. P. (2017). *Patient engagement support for older adults: Development and implementation of an intervention in an integrated-care context*. Universita' Cattolica del Sacro Cuore.

Menichetti, J., & Graffigna, G. (2016). "PHE in action": Development and modeling of an intervention to improve patient engagement among older adults. *Frontiers in Psychology*, *7*, 1405. https://doi.org/10.3389/fpsyg.2016.01405

Menichetti, J., Graffigna, G., & Steinsbekk, A. (2018). What are the contents of patient engagement interventions for older adults? A systematic review of randomized controlled trials. *Patient Education and Counseling*, *101*(6), 995–1005. https://doi.org/10.1016/j.pec.2017.12.009

Menichetti, J., Kulla, A., Bosio, C., Steinsbekk, A., & Graffigna, G. (2021). Impact of a patient engagement support intervention (PHEinAction) on pre-bariatric surgery patients: A qualitative evaluation study. *Psicologia Della Salute*, *2*, 117–138. https://doi.org/10.3280/PDS2021-002008

Menichetti, J., Pitacco, G., & Graffigna, G. (2018). Exploring the early-stage implementation of a patient engagement support intervention in an integrated-care context—A qualitative study of a participatory process. *Journal of Clinical Nursing*, *28*(5–6), 997–1009. https://doi.org/10.1111/jocn.14706

Ong, K. L., Stafford, L. K., McLaughlin, S. A., Boyko, E. J., Vollset, S. E., Smith, A. E., Dalton, B. E., Duprey, J., Cruz, J. A., Hagins, H., & Lindstedt, P. A. (2023). Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: A systematic analysis for the global burden of disease study 2021. *The Lancet*, *402*, 203–234. https://doi.org/10.1016/S0140-6736(23)01301-6

Pranata, S., Wu, S.-F. V., Chu, C.-H., & Nugroho, K. H. (2021). Precision health care strategies for older adults with diabetes in Indonesia: A Delphi consensus study. *Medical Journal of Indonesia*, *30*(3), 221–227. https://doi.org/10.13181/mji.oa.215525

Rosenthal, J. A. (1996). Qualitative descriptors of strength of association and effect size. *Journal of Social Service Research*, *21*(4), 37–59. https://doi.org/10.1300/J079v21n04_02

Savarese, M., Sapienza, M., Acquati, G., Nurchis, M. C., Riccardi, M. T., Mastrilli, V., D'elia, R., Graps, E. A., Graffigna, G., & Damiani, G. (2021). Educational interventions for promoting food literacy and patient engagement in preventing complications of type 2 diabetes: A systematic review. *Journal of Personalized Medicine*, *11*(8), 795. https://doi.org/10.3390/jpm11080795

Schultz, A., Wad, J., Willaing, I., Nørgaard, K., Persson, F., & Joensen, L. (2021). Achieving a useful and person-centred diabetes consultation is

a shared responsibility between diabetologists and people with diabetes: A qualitative study of perspectives from people with type 1 diabetes. *Diabetic Medicine*, *38*(6), e14382. https://doi.org/10.1111/dme.14382

Seixas, A., Conners, C., Chung, A., Donley, T., & Jean-Louis, G. (2020). A pantheoretical framework to optimize adherence to healthy lifestyle behaviors and medication adherence: The use of personalized approaches to overcome barriers and optimize facilitators to achieve adherence. *JMIR mHealth and uHealth*, *8*(6), e16429. https://doi.org/10.2196/16429

Selçuk-Tosun, A., & Zincir, H. (2019). The effect of a transtheoretical model–based motivational interview on self-efficacy, metabolic control, and health behaviour in adults with type 2 diabetes mellitus: A randomized controlled trial. *International Journal of Nursing Practice*, *25*(4), e12742. https://doi.org/10.1111/ijn.12742

Serrano-Gil, M., & Jacob, S. (2010). Engaging and empowering patients to manage their type 2 diabetes, part I: A knowledge, attitude, and practice gap? *Advances in Therapy*, *27*(6), 321–333. https://doi.org/10.1007/s12325-010-0034-5

Shin, K. S., & Lee, E. H. (2018). Relationships of health literacy to self-care behaviors in people with diabetes aged 60 and above: Empowerment as a mediator. *Journal of Advanced Nursing*, *74*(10), 2363–2372. https://doi.org/10.1111/jan.13738

Sivrikaya, S. K., & Ergün, S. (2018). Diabetes education and the role of nurses. *Kırşehir Ahi Evran Üniversitesi Sağlık Bilimleri Dergisi*, *2*(2), 25–36.

Speight, J., Holmes-Truscott, E., Hendrieckx, C., Skovlund, S., & Cooke, D. (2020). Assessing the impact of diabetes on quality of life: What have the past 25 years taught us? *Diabetic Medicine*, *37*(3), 483–492. https://doi.org/10.1111/dme.14196

Surucu, H. A., Kizilci, S., & Ergor, G. (2017). The impacts of diabetes education on self care agency, self-care activities and hbA1c levels of patients with type 2 diabetes: A randomized controlled study. *International Journal of Caring Sciences*, *10*(1), 479.

Swoboda, C. M., Miller, C. K., & Wills, C. E. (2017). Impact of a goal setting and decision support telephone coaching intervention on diet, psychosocial, and decision outcomes among people with type 2 diabetes. *Patient Education and Counseling*, *100*(7), 1367–1373. https://doi.org/10.1016/j.pec.2017.02.007

Tan, C., Cheng, K. K. F., Hwang, S. W., Zhang, N., Holroyd, E., & Wang, W. (2020). Effect of a diabetes self-efficacy enhancing program on older adults with type 2 diabetes: A randomized controlled trial. *Clinical Nursing Research*, *29*(5), 293–303. https://doi.org/10.1177/1054773818792480

Tan, J. P., Cheng, K. K. F., & Siah, R. C. J. (2019). A systematic review and meta-analysis on the effectiveness of education on medication adherence for patients with hypertension, hyperlipidaemia and diabetes. *Journal of Advanced Nursing*, *75*(11), 2478–2494. https://doi.org/10.1111/jan.14025

Tan, W. H., Loh, V. W. K., Venkataraman, K., Choong, S. T., Lew, Y. J., Sundram, M., Sou, K., Tan, S. G., Gibbons, B., Entwistle, V., & Young, D. (2020). The Patient Activation through Community Empowerment/Engagement for Diabetes Management (PACE-D) protocol: A non-randomised controlled trial of personalised care and support planning for persons living with diabetes. *BMC Family Practice*, *21*, 1–10. https://doi.org/10.1186/s12875-020-01173-2

Usta, D., Korkmaz, F., Akyar, İ., & Bonanomi, A. (2019). Patient Health Engagement Scale: Validity and reliability for Turkish patients with chronic diseases. *Cukurova Medical Journal*, *44*(3), 1055–1063. https://doi.org/10.17826/cumj.482420

van Vugt, H. A., Boels, A. M., de Weerdt, I., de Koning, E. J., & Rutten, G. E. (2018). Patient activation in individuals with type 2 diabetes mellitus: Associated factors and the role of insulin. *Patient Preference and Adherence*, 2019(13), 73–81. https://doi.org/10.2147/PPA.S188391

Varming, A. R., Rasmussen, L. B., Husted, G. R., Olesen, K., Grønnegaard, C., & Willaing, I. (2019). Improving empowerment, motivation, and medical adherence in patients with poorly controlled type 2 diabetes: A randomized controlled trial of a patient-centered intervention. *Patient Education and Counseling*, *102*(12), 2238–2245. https://doi.org/10.1016/j.pec.2019.06.014

World Health Organization. (2018). *Diabetes*. World Health Organization. http://www.who.int/diabetes/en/

Xie, Z., Liu, K., Or, C., Chen, J., Yan, M., & Wang, H. (2020). An examination of the socio-demographic correlates of patient adherence to self-management behaviors and the mediating roles of health attitudes and self-efficacy among patients with coexisting type 2 diabetes and hypertension. *BMC Public Health*, *20*(1), 1227. https://doi.org/10.1186/s12889-020-09274-4

Zhang, A., Wang, J., Wan, X., Guo, Z., Zhang, Z., Zhao, S., Bai, S., Miao, Y., & Zhang, J. (2023). The mediating effect of self-efficacy on the relationship between diabetes self-management ability and patient activation in older adults with type 2 diabetes. *Geriatric Nursing*, *51*, 136–142. https://doi.org/10.1016/j.gerinurse.2023.02.017

Zheng, F., Liu, S., Liu, Y., & Deng, L. (2019). Effects of an outpatient diabetes self-management education on patients with type 2 diabetes in China: A randomized controlled trial. *Journal of Diabetes Research*, *2019*, 1–7. https://doi.org/10.1155/2019/1073131

How to cite this article: Cengiz, D., & Korkmaz, F. (2023). Effectiveness of a nurse-led personalized patient engagement program to promote type 2 diabetes self-management: A randomized controlled trial. *Nursing & Health Sciences*, *25*(4), 571–584. https://doi.org/10.1111/nhs.13048