



# Effects of dependent care theory-based post-surgical home care intervention on self-care, symptoms, and caregiver burden in patients with primary brain tumor and their caregivers: a randomized controlled trial

Derya Dağdelen<sup>1</sup> · Handan Zincir<sup>1</sup>

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## Abstract

**Purpose** This study aimed to examine the effect of dependent care theory-based post-surgical home care intervention on self-care, symptoms, and caregiver burden in primary brain tumor patients and their caregivers.

**Methods** A parallel-group randomized controlled trial was conducted with patients who underwent surgery for a primary brain tumor between March 2019 and January 2020 in a tertiary hospital and with caregivers who cared for them at home. Eligible patients and caregivers were determined by block randomization. Outcome measures included validated measures of self-care agency (Self-Care Agency Scale), symptoms and interference by symptoms (MD Anderson Symptom Inventory Brain Tumor-Turkish Form), and caregiver burden (Caregiver Burden Scale). Two-way analysis of variance was used in repeated measurements from general linear models compared to scale scores.

**Results** Self-care agency was significantly higher in the intervention group than in the control group in the first and sixth months after surgery ( $p < 0.05$ ). The severity of the patients' emotional, focal neurologic, and cognitive symptoms and interference by symptoms were significantly lower in the intervention group than in the control group ( $p < 0.05$ ). Caregiver burden was significantly lower in the intervention group in the first, third, and sixth months after surgery ( $p < 0.05$ ).

**Conclusion** Dependent care theory-based post-surgical home care intervention increased patients' self-care and reduced symptoms and their effects. It also reduced the caregiver burden. Dependent care theory can guide the nursing practices of nurses who provide institutional and/or home care services to patients with chronic diseases and their caregivers.

**Trial Registration** NCT05328739 on April 14, 2022 (retrospectively registered).

**Keywords** Caregiving burden · Home care · Nursing · Primary brain tumors · Self-care/dependent care · Self-care agency

## Introduction

Brain and central nervous system (CNS) cancers are rare [1] but are responsible for significant morbidity and mortality worldwide and have increased in incidence [2]. The age-standardized incidence rate is 3.9 in males and 3.0 in females [3]. In Türkiye, the age-standardized incidence rate is 5.2

(per 100,000) for males and 4.2 (per 100,000) for females [4], which is above the world average.

Whether primary brain tumors (PBTs) are malignant or benign, patients experience many symptoms. Their effects continue after surgical treatment. Symptoms trigger each other, and more than one symptom disrupts individuals' physical, cognitive, and psychosocial functions in a way that affects daily life [5–7]. Many challenges remain in the effective management of symptoms in adults with brain tumors [8]. Patients may become dependent on others before and after surgery [5]. When the caregiver burden studies in caregivers of patients with PBT were reviewed, it was found that the neuropsychological status of the patients [9], activities of daily living [10], and economic inadequacies [11] increase the caregiver burden and cause many problems in

✉ Derya Dağdelen  
ddagdelen@erciyes.edu.tr

Handan Zincir  
hzincir@erciyes.edu.tr

<sup>1</sup> Department of Public Health Nursing, Faculty of Health Sciences, Erciyes University, 38280 Kayseri, Turkey

caregivers [12]. Studies conducted with PBT patients and their caregivers have suggested that effective interventions should be developed to meet their needs [13–15].

Orem's Self-Care Deficit Nursing Theory (SCDNT) is one of the most frequently used theories in nursing practice [16]. Dependent Care Theory (DCT), one of the four central theories of SCDNT, provides the opportunity to evaluate patients and caregivers. The role of nurses in self-care/dependent care practices becomes crucial in the shortening of hospitalization times and the transfer of care of individuals from institutions to society [17]. Nurse-led intervention programs that evaluate PBT patients and their caregivers in their own homes after surgical treatment are limited [18–22]. It is emphasized that it is essential to provide appropriate interventions to patients and caregivers in meeting the needs of care-related individuals. Providing information appropriate to individuals' experiences and needs in providing care and support can increase success [23, 24]. No studies based on DCT were found that evaluated patients with PBT and their caregivers. PBTs are a disease that can cause the emergence of many intense and unmet therapeutic self-care demands in the patient and caregivers. Patients and their caregivers must be taught how to provide and maintain appropriate care in their homes and the pathological problems and harmful effects that may arise during treatment and care [25]. This study aimed to examine the effect of dependent care theory-based post-surgical home care intervention on self-care, symptoms, and caregiver burden in primary brain tumor patients and their caregivers.

We hypothesized that the dependent care theory-based post-surgical home care intervention could improve self-care, decrease patients' severity of symptoms and interference by symptoms, and caregiver burden for patients with PBT and their caregivers.

## Methods

### Study design

This study was a parallel-group randomized controlled trial (ClinicalTrials.gov; registration number: NCT05328739).

### Participants

Criteria for patients inclusion in the study were living within the region's borders, being aged  $\geq 18$  years old, being diagnosed with PBT (glioma or meningioma and grade I–III), having KPS  $\geq 50$  points, and being able to read and communicate. Patients' exclusion criteria were diagnosed as having metastatic brain tumor, a pituitary adenoma, having undergone emergency surgery, having a biopsy, and being in grade IV. Caregiver inclusion criteria were age  $\geq 18$  years, providing

primary care for patients, and being able to read and communicate. Criteria for terminating the research process for participants were wanting to leave the research process, meeting one of the criteria for exclusion from the sample after the surgery, spending the home care and follow-up process in another province, and/or being unable to reach the individual.

### Sample size

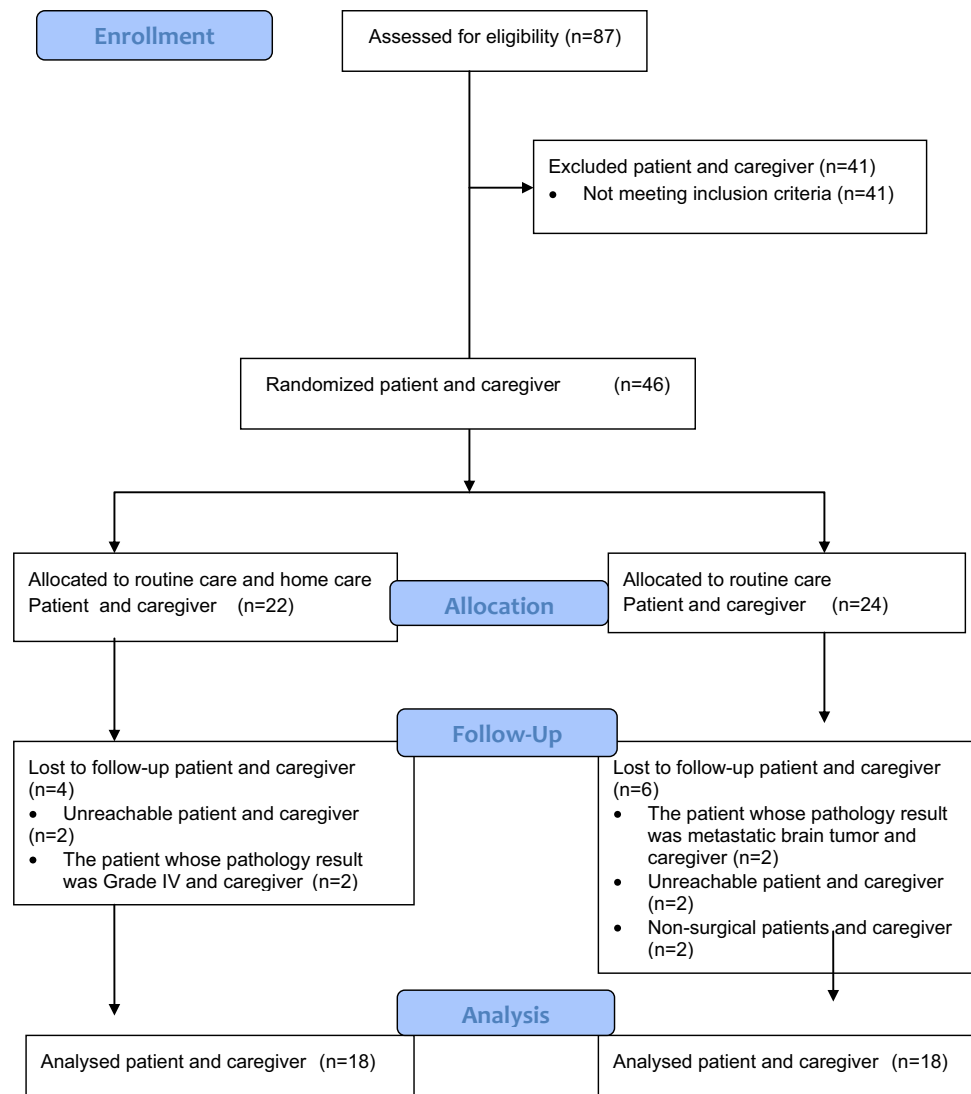
G\*Power 3.1.9.2 was used to calculate the sample size for this study. A similar study was used to determine the study's sample [26]. The power of the study was 0.903 at the  $\alpha=0.05$  level and 0.816 effect size. The study was conducted with 18 patients and 18 caregivers (Fig. 1).

### Randomization

Block randomization was used to balance the sample size between groups over time. A quadruple block structure consisting of six combinations was created. According to this structure created by an independent person from the research, intervention and control groups were generated by specifying which group the registered participant belonged to the researcher conducting the research process. Blinding was provided because patients and caregivers who met the inclusion criteria and agreed to participate in the study did not know which group they would join [27].

### Post-surgical home care intervention program

This program comprised the transition home after discharge and the 6-month post-surgical period for patients who underwent surgery for PBT and their caregivers. The program was constructed based on dependent care theory and had three purposes (Table 1). The first was to regulate, protect, and raise self-care agency; the second was to reduce the severity of symptoms and interference by symptoms; and the third was to reduce caregiver burden. In order to ensure the continuity of post-surgical care at home in 6 months, a supportive-developmental nursing system based on the DCT was used. This system, which includes education, counseling, and nursing care, focuses on goals. The content of the training booklet was created by determining the topics related to the postoperative self-care/dependent care demands and the practices that could meet them. The booklet for patients with PBT and their caregivers was prepared based on the literature on home care [17, 25, 26, 28–31]. The booklet, submitted for expert opinion, was found suitable by experts in the field ( $W=0.267$ ;  $p=0.230$ ). Nursing care was given to the patient and caregiver in line with the nursing diagnoses determined according to the self-care/dependent care

**Fig. 1** The study flowchart according to CONSORT 2010

demands of the patients and caregivers who had undergone craniotomy due to PBT [17, 25, 26, 28–30].

## Procedures

Patients and caregivers were recruited at the same time between March 2019 and January 2020 in a tertiary hospital in Türkiye. After the decision for surgery, the patient and caregiver were interviewed and informed about the study, the Informed Voluntary Consent Form-IVCF was filled out, and initial data were collected (preoperative period-T0). Block randomization assigned patients and caregivers to intervention and control groups. Patients and caregivers in the control group received routine care in the hospital until discharge. Three home visits were made to collect the data of patients and caregivers in the first (postoperative period-T1), third (postoperative period-T2), and sixth (postoperative

period-T3) months of surgery after discharge, but no intervention was made.

Patients and caregivers in intervention groups received training and a training booklet until patients were discharged. This total time lasted 90–120 min. In order to prepare the patient and caregiver for the transition home, training was provided on the self-care/dependent care demands that may be encountered in the first week at home and how they can be met, where care can be given and necessary environmental arrangements, what to do in emergencies and drug treatment. Two home visits were made within the first month, planned for education, counseling, and nursing care. The first home visit was made the week after discharge (10–18 days after surgery). At this stage, the patient and caregiver were evaluated in their environment, and nursing care was given for the needs and problems determined for the first visit. At the second home visit (30–40 days after surgery), planned and made at the

**Table 1** Dependent care theory based on post-surgical home care program for patients with PBT and their caregivers

Nursing agency	Supportive-development nursing (counseling, education, nursing care)	Sources for patients and caregivers
Aims:		
1. Regulating, protecting, and raising self-care agency		
2. Reducing the severity of symptoms and interference by symptoms		
3. Reducing caregiver burden		
Determine if patients and caregivers' self-care/dependent care demands	<ul style="list-style-type: none"> <li>✓ After surgery, maintaining adequate air, water, and food intake at home</li> <li>Nursing diagnoses: strengthening fluid balance, lack of self-care in oral hygiene, inadequate and/or unbalanced nutrition</li> <li>✓ After surgery, ensuring adequate elimination and excretion at home</li> <li>Nursing diagnoses: functional urinary incontinence, risk of constipation, constipation</li> <li>✓ After surgery, maintaining the balance between activity and rest at home</li> <li>Nursing diagnoses: risk of activity intolerance, activity intolerance, insufficient physical activity, pain, disruption in sleep pattern, fatigue, lack of self-care in bathing, lack of self-care in dressing, lack of self-care in meeting toilet needs, risk of ineffective cerebral tissue perfusion, risk of deterioration in home care</li> <li>✓ After surgery, prevention of hazards at home</li> <li>Nursing diagnoses: risk of infection, delay in surgical recovery, fall/injury risk, risk of seizure, bleeding risk</li> <li>✓ After surgery, maintaining the balance between loneliness and social interaction at home</li> <li>Nursing diagnoses: fear, anxiety, deterioration in mood, social isolation, disruption in social interaction, distortion in body image, decreased self-esteem, ineffective role performance, change in family process, spiritual distress, disruption in family coping, risk of strain in the caregiver role, strain in the caregiver role</li> </ul>	<ul style="list-style-type: none"> <li>Training booklet</li> <li>Home visits</li> <li>Face-to-face interaction</li> <li>Telephone contacts</li> </ul>
Support to caregiver	<ul style="list-style-type: none"> <li>✓ Ability to decide where care will be provided for the patient</li> <li>✓ Ability to make safe and healthy environmental arrangements for the patient</li> <li>✓ Ability to determine and meet care needs</li> <li>✓ Ability to develop, change, and balance self-care agency</li> <li>✓ Ability to balance self-care/ dependent care roles</li> <li>✓ Ability to collaborate and communicate</li> </ul>	<ul style="list-style-type: none"> <li>Training booklet</li> <li>Home visits</li> <li>Face-to-face interaction</li> <li>Telephone contacts</li> </ul>
Develop and protect power components for self-care/dependent care	<ul style="list-style-type: none"> <li>✓ Self-confidence and respect</li> <li>✓ Controlling physical energy</li> <li>✓ Motivation</li> <li>✓ Ability to make decisions about self-care</li> <li>✓ Ability to acquire and apply knowledge</li> <li>✓ Cognitive status and communication skills</li> <li>✓ Ability to integrate self-care behaviors into individual and social life</li> </ul>	<ul style="list-style-type: none"> <li>Training booklet</li> <li>Home visits</li> <li>Face-to-face interaction</li> <li>Telephone contacts</li> </ul>

end of the first month, the patient and caregiver were evaluated in their environment, and nursing care was given for the needs and problems determined for the second visit. Then, in the home visits made once in the second, third, and fourth months, the patient and caregiver were evaluated in their environment similarly, and nursing care was given for the needs and problems determined for that visit. No home visits were made between the fourth and sixth months, but telephone counseling was provided when necessary. The last home visit was made for the sixth-month measurements and goodbye to the patient and caregivers. In this process, nursing care was given to the patient and caregiver per the nursing diagnoses determined according to patients' and caregivers' self-care/dependent care demands.

## Measurements

Self-care was measured using the Self-Care Agency Scale (SCAS) [32], and the severity of symptoms in patients with PBT and the life-threatening condition of patients were measured using the MD Anderson Symptom Inventory Brain Tumor-Turkish Form (MDA-BTSETr) [33]. Caregiver burden was measured using the Caregiver Burden Scale (CBS) [34]. These measurement tools are valid and reliable tools suitable for Turkish society. Cronbach's alpha value of the measurement tools in this study was acceptable, at 0.94 in patients and 0.91 in caregivers for SCAS; 0.85 and 0.88 for MDA-BTSETr and CBS, respectively. The Karnofsky Performance Scale (KPS) [35] allows the evaluation of the patients' individual and medical care needs to obtain

**Table 2** Comparison of the patients' and caregivers 'descriptive and clinical characteristics

Variable	Intervention group (n=9), n (%)	Control group (n=9), n (%)	<i>p</i> <sup>†</sup>	Variable	Intervention group (n=9), n (%)	Control group (n=9), n (%)	<i>p</i> <sup>†</sup>
Patients				Caregivers			
Gender			1.000	Gender			1.000
Female	6 (66.7)	5 (55.6)		Female	7 (77.8)	6 (66.7)	
Male	3 (33.3)	4 (44.4)		Male	2 (22.2)	3 (33.3)	
Marital status			1.000	Marital status			0.471
Married	8 (88.9)	9 (100.0)		Married	7 (77.8)	9 (100.0)	
Single	1 (11.1)	0 (0.0)		Single	2 (22.2)	0 (0.0)	
Education status				Education status			0.418
Literate	1 (11.1)	1 (11.1)		Literate	0 (0.0)	1 (11.2)	
Primary school graduate	2 (22.2)	6 (66.7)	0.333	Primary school graduate	4 (44.4)	4 (44.4)	
Secondary school graduate	2 (22.2)	1 (11.1)		Secondary school graduate	1 (11.2)	0 (0.0)	
High school graduate	3 (33.3)	0 (0.0)		High school graduate	0 (0.0)	2 (22.2)	
Undergraduate	1 (11.1)	1 (11.1)		Undergraduate	4 (44.4)	2 (22.2)	
Working status			1.000	Working status			1.000
Working	3 (33.3)	3 (33.3)		Working	3 (33.3)	2 (22.2)	
Not working	6 (66.7)	6 (66.7)		Not working	6 (66.7)	7 (77.8)	
Type of tumor			1.000	Chronic disease status			0.576
Glioma	3 (33.3)	2 (22.2)		Yes	1 (11.1)	3 (33.3)	
Meningioma	6 (66.7)	7 (77.8)		No	8 (88.9)	6 (66.7)	
Tumor grade				Place of residence			1.000
Grade-1	6 (66.7)	7 (77.8)	0.576	City center	7 (77.8)	6 (66.7)	
Grade-2	1 (11.1)	2 (22.2)		District	2 (22.2)	3 (33.3)	
Grade-3	2 (22.2)	0 (0.0)		Role in family			1.000
Tumor resection			1.000	Child	3 (33.3)	4 (44.4)	
Total	7(77.8)	8 (88.9)		Sibling	1 (11.1)	0 (0.0)	
Subtotal	2 (22.2)	1 (11.1)		Spouse	5 (55.6)	5 (55.6)	
Treatment			0.471	Support from relatives, friends, and neighbors			1.000
S	7 (77.8)	9 (100.0)		Yes	8 (88.9)	9 (100.0)	
S + RT	1 (11.1)	0 (0.0)		No	1 (11.1)	0 (0.0)	
S + RT + CT	1 (11.1)	0 (0.0)					
T0-KPS							
50–70	4 (44.4)	3 (33.3)	0.367				
80–100	5(55.6)	6 (66.7)					
T1–KPS							
50–70	0 (0.0)	3 (33.3)	0.367				
80–100	9 (100.0)	6 (66.7)					
T2-KPS							
50–70	0 (0.0)	1 (11.1)	0.367				
80–100	9 (100.0)	8 (88.9)					
T3-KPS			-				
50–70	0 (0.0)	0 (0.0)					
80–100	9 (100.0)	9 (100.0)					

<sup>†</sup>Fisher's exact test, *S* surgical, *RT* radiotherapy, *CT* chemotherapy, *KPS* Karnofsky Performance Scale, *T0* preoperative period, *T1* postoperative period-1st month, *T2* postoperative period-3rd month, *T3* postoperative period-6th month

**Table 3** Comparison of self-care agency mean scores of patients in the intervention and control groups by measurement times

Measurement times	Intervention groups, mean (SD)	Control groups, mean (SD)	Between groups, TS		Model statistics <sup>§</sup>		
			F	p	Effect	F	p
Self-care agency							
T0 <sup>§§</sup>	90.11 (21.97) <sup>a,b</sup>	84.22 (13.49)	0.469	0.503	Group	4.905	0.045
T1 <sup>§§</sup>	101.11 (11.45) <sup>a,b</sup>	86.44 (15.21)	5.342	0.034	Time	4.738	0.006
T2 <sup>§§</sup>	98.55 (8.02) <sup>a</sup>	88.22 (14.32)	3.566	0.077	Group x time	1.572	0.208
T3 <sup>§§</sup>	104.44 (11.12) <sup>b</sup>	88.55 (13.96)	7.127	0.017			
Within groups TS	F = 4.173; p = 0.026	F = 0.391; p = 0.762					

<sup>§</sup>General linear models, two-way analysis of variance

<sup>§§</sup>a, b: within groups Bonferroni's correction multiple comparison test

TS test statistics, T0 preoperative period, T1 postoperative period-1st month, T2 postoperative period-3rd month, T3 postoperative period-6th month

information about symptom severity and level of function at work and home.

## Statistical analysis

IBM SPSS 26 was used for statistical analyses. Descriptive statistics are given as number of units (*n*), percentage (%), and mean  $\pm$  standard deviation. The normal distribution of the data of numerical variables was evaluated with the Shapiro–Wilk test of normality and Q-Q graphs. Homogeneity of variances was evaluated with the Levene test, and two-way analysis of variance was used in repeated measurements from general linear models in comparison of scale scores between T0, T1, T2, and T3 between groups and within groups. Bonferroni correction was applied when comparing the main effects. Comparisons between categorical variables and groups were evaluated with Fisher's exact test in  $2 \times 2$  and  $r \times c$  tables [36],  $p < 0.05$  value was considered statistically significant.

## Results

### Participant characteristics

Comparisons of patients' and caregivers' descriptive and clinical characteristics are shown in Table 2; there were no differences between the two groups ( $p > 0.05$ ), indicating that they were comparable.

### Intervention effects for primary brain tumor patients

Comparison of the mean scores of SCAS of the patients in the control and intervention groups according to the measurement times are shown in Table 3. At baseline, SCAS scores for patients in the intervention and control groups were similar ( $p > 0.05$ ). General linear model analysis showed a significant effect of group on SCAS score ( $p = 0.45$ ) and the effect of time ( $p = 0.006$ ). SCAS scores for patients in the intervention group were higher than in the control group in the first and sixth months after the surgery ( $p < 0.05$ ). These results suggest that patients in the intervention group had increased SCAS scores after the intervention.

Comparisons of the mean scores of the severity of symptoms and interference by symptoms of the patients in the control and intervention groups according to the measurement times are shown in Table 4. General linear model analysis showed a significant effect of time ( $p < 0.001$ ) on emotional and focal neurologic symptom scores. Significant effects of group ( $p = 0.047$ ), the effect of time ( $p < 0.001$ ), and group x time ( $p = 0.008$ ) on cognitive symptoms were also significant. Significant effects of time ( $p < 0.001$ ) and

**Table 4** Comparison of MDA-BTSE<sup>Tr</sup> symptom mean scores of patients in the intervention and control groups by measurement times

Measurement times	Intervention groups, mean (SD)	Control groups, mean (SD)	Between groups, TS		Model statistics <sup>†</sup>		
			<i>F</i>	<i>p</i>	Effect	<i>F</i>	<i>p</i>
<b>Emotional</b>							
T0 <sup>††</sup>	4.49 (1.11) <sup>a</sup>	2.95(2.20) <sup>a</sup>	3.475	0.081	Group	0.406	0.533
T1 <sup>††</sup>	3.40 (2.13) <sup>a</sup>	3.40(2.00) <sup>a, c</sup>	0.000	1.000	Time	16.397	<0.001
T2 <sup>††</sup>	1.64 (1.90) <sup>b</sup>	1.89(1.55) <sup>a</sup>	0.090	0.768	Group x time	1.329	0.277
T3 <sup>††</sup>	0.67 (1.04) <sup>b</sup>	0.67 ± 0.98 <sup>b</sup>	0.000	1.000			
<i>Within groups TS</i>	<i>F</i> = 23,384; <i>p</i> < 0.001	<i>F</i> = 15,623; <i>p</i> < 0.001					
<b>Cognitive</b>							
T0 <sup>††</sup>	2.90 (1.54) <sup>a</sup>	1.11 (1.32)	7.030	0.017	Group	4.633	0.047
T1 <sup>††</sup>	0.47 (1.09) <sup>b</sup>	0.33 (0.83)	0.092	0.765	Time	20.692	<0.001
T2 <sup>††</sup>	0.19 (0.58) <sup>b</sup>	0.11 (0.33)	0.138	0.715	Group x time	4.478	0.008
T3 <sup>††</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00)	-	-			
<i>Within groups TS</i>	<i>F</i> = 12.298; <i>p</i> < 0.001	<i>F</i> = 2.446; <i>p</i> = 0.107					
<b>Focal neurologic</b>							
T0 <sup>††</sup>	2.53 (2.42) <sup>a</sup>	2.14 (2.36) <sup>a, b</sup>	0.119	0.735	Group	0.329	0.574
T1 <sup>††</sup>	1.05 (0.97) <sup>a, b</sup>	1.80 (1.21) <sup>a</sup>	2.096	0.167	Time	11.196	<0.001
T2 <sup>††</sup>	0.30 (0.37) <sup>a, b</sup>	0.69 (0.55) <sup>b</sup>	3.051	0.100	Group x time	0.632	0.598
T3 <sup>††</sup>	0.00 (0.00) <sup>b</sup>	0.03 (0.08) <sup>c</sup>	1.000	0.332			
<i>Within groups TS</i>	<i>F</i> = 5.044; <i>p</i> = 0.014	<i>F</i> = 9.798; <i>p</i> < 0.001					
<b>Treatment evaluation</b>							
T0 <sup>††</sup>	2.26 (2.14) <sup>a</sup>	0.63 (0.85)	4.514	0.049	Group	1.490	0.240
T1 <sup>††</sup>	1.18 (1.97) <sup>a, b</sup>	0.89 (1.59)	0.122	0.731	Time	2.301	0.089
T2 <sup>††</sup>	1.04 (1.41) <sup>a, b</sup>	0.74 (0.72)	0.318	0.581	Group x time	1.864	0.148
T3 <sup>††</sup>	0.33 (0.58) <sup>b</sup>	0.48 (0.73)	0.224	0.643			
<i>Within groups TS</i>	<i>F</i> = 4.352; <i>p</i> = 0.023	<i>F</i> = 0.469; <i>p</i> = 0.709					
<b>General</b>							
T0	1.05 (0.90)	1.00 (1.16)	0.013	0.911	Group	0.013	0.911
T1	0.55 (0.57)	0.55 (0.69)	0.000	1.000	Time	2.721	0.118
T2	0.30 (0.39)	0.39 (0.50)	0.155	0.699	Group x time	0.046	0.987
T3	0.05 (0.17)	0.11 (0.22)	0.364	0.555			
<i>Within groups TS</i>	<i>F</i> = 2.928; <i>p</i> = 0.115	<i>F</i> = 2.470; <i>p</i> = 0.121					
<b>Gastrointestinal</b>							
T0	2.50 (3.95)	0.55 (1.10)	2.021	0.174	Group	1.820	0.196
T1	0.22 (0.67)	0.22 (0.67)	0.000	1.000	Time	4.462	0.051
T2	0.00 (0.00)	0.00 (0.00)	-	-	Group x time	1.955	0.133
T3	0.00 (0.00)	0.00 (0.00)	-	-			
<i>Within groups TS</i>	<i>F</i> = 3.349; <i>p</i> = 0.063	<i>F</i> = 0.565; <i>p</i> = 0.580					
<b>Interference by symptoms</b>							
T0 <sup>††</sup>	4.78 (1.64) <sup>a</sup>	3.74 (2.05) <sup>a, b</sup>	1.401	0.254	Group	0.273	0.609
T1 <sup>††</sup>	4.28 (1.05) <sup>a</sup>	4.59 (1.07) <sup>a</sup>	0.398	0.537	Time	27.274	<0.001
T2 <sup>††</sup>	2.24 (1.63) <sup>b</sup>	3.13 (0.87) <sup>b</sup>	2.090	0.168	Group x time	2.924	0.043
T3 <sup>††</sup>	1.18 (1.00) <sup>c</sup>	1.98 (1.17) <sup>c</sup>	2.404	0.141			
<i>Within groups TS</i>	<i>F</i> = 58.472; <i>p</i> < 0.001	<i>F</i> = 31.620; <i>p</i> < 0.001					

<sup>†</sup>General linear models, two-way analysis of variance test

<sup>††</sup>*a, b, c*: within groups Bonferroni's correction multiple comparison test

*TS* test statistics, *T0* preoperative period, *T1* postoperative period-1st month, *T2* postoperative period-3rd month, *T3* postoperative period-6th month

**Table 5** Comparison of self-care agency and caregiver burden mean scores of caregivers in the intervention and control groups by measurement times

Measurement times	Intervention groups, mean (SD)	Control groups, mean (SD)	Between groups, TS		Model statistics <sup>†</sup>		
			F	p	Effect	F	p
Self-care agency							
T0	103.44 (11.48)	92.33 (18.08)	2.423	0.139	Group	1.254	0.279
T1	102.22 (10.07)	95.33 (24.12)	0.625	0.441	Time	0.449	0.719
T2	102.11 (10.47)	97.89 (17.44)	0.388	0.542	Group x time	0.360	0.782
T3	105.00 (10.04)	98.11 (21.72)	0.746	0.400			
Within groups TS	$F = 0.603; p = 0.624$	$F = 0.465; p = 0.711$					
Caregiver burden							
T0 <sup>††</sup>	23.44 (10.14) <sup>a</sup>	26.55 (11.38) <sup>a, c</sup>	0.375	0.549	Group	10.849	0.005
T1 <sup>††</sup>	24.55 (9.96) <sup>a</sup>	46.78 (5.45) <sup>b</sup>	34.460	<0.001	Time	22.186	<0.001
T2 <sup>††</sup>	18.33 (11.57) <sup>a</sup>	35.44 (11.08) <sup>a</sup>	10.262	0.006	Group x time	6.798	0.001
T3 <sup>††</sup>	12.11 (11.55) <sup>b</sup>	23.00 (10.40) <sup>c</sup>	4.417	0.048			
Within groups TS	$F = 12.042; p < 0.001$	$F = 58.510; p < 0.001$					

<sup>†</sup>General linear models, two-way analysis of variance test

<sup>††</sup>a, b: within groups Bonferroni's correction multiple comparison test

TS test statistics, T0 preoperative period, T1 postoperative period-1st month, T2 postoperative period-3rd month, T3 postoperative period-6th month

group x time ( $p = 0.043$ ) on interference by symptoms scores were also significant. These results suggest that patients in the intervention group had decreased severity symptoms and interference by symptoms scores after the intervention.

### Intervention effects for caregivers

Comparisons of the mean scores of SCAS and CBS according to the measurement times of the caregivers in the control and intervention groups are shown in Table 5. General linear model analysis showed no significant effects of the group, the effect of time, and group x time ( $p > 0.05$ ) on the SCAS score. These results suggest that the intervention does not affect caregivers' SCAS scores. Significant effects of group ( $p = 0.005$ ), the effect of time ( $p < 0.001$ ), and group x time ( $p < 0.001$ ) on CBS scores were also significant. According to model statistics, in the change of the mean scores of CBS over time, the decrease in the intervention group's scores was higher than that of the control group ( $p < 0.001$ ).

### Discussion

In this study, we examined the effect of a post-surgical home care intervention based on dependent care theory on patients with primary brain tumors and their caregivers and found

that self-care increased and the severity of symptoms and interference by symptoms and caregiver burden decreased.

Our results showing increased patients' self-care ability are similar to previous studies [20, 37–39]. The difference between this study and others is that the home care intervention, based on the dependent care theory, simultaneously supports the patient and the caregiver. In addition, it is thought that evaluating individuals in their environment through home visits, determining their care needs, and systematically planning and implementing education, counseling, and nursing care positively affect self-care skills.

Many patients with primary brain tumors experience symptoms before and after treatment that interfere with daily activities, mood, and tasks, including household chores, relationships with other people, walking, and enjoyment of life [6, 9, 33, 40–43]. It is essential because the symptoms are important severity and interference in individuals' lives target therapeutic self-care needs and affect self-care/dependent care ability and nursing practices. After the intervention, the severity of emotional, focal neurological, and cognitive symptoms and interference by symptoms decreased in patients, similar to the previous report [26]. These results suggest that the resources created for patients and caregivers within the scope of the home care program, which is the road map in the study, are adequate.

After our intervention, there was no significant difference in caregivers' self-care agency. This result is consistent with



the results of Deek et al. [44]. This may be due to sample differences and intervention differences. Our results showing a decrease in the CBS of caregivers were similar to previous studies [45, 46], but there were also study results that were not similar [19, 22]. The difference between this study and others is that the home care intervention supports the patient and caregiver simultaneously. In the home care intervention, it was prioritized to develop the skills and abilities of caregivers, such as determining and meeting the needs of the patient, determining care priorities, applications for emergencies, evaluating the home environment and making the necessary arrangements, using support resources, and protecting and developing their own self-care agency. The significant decrease in the postoperative CBS scores of the caregivers in the intervention group compared to the control group showed that home care programs targeting both the patient and the caregivers contributed positively.

## Limitations

This study has some limitations. In the region where the research was conducted, brain surgeries were performed in a single center. Since both the patient and their caregivers were evaluated in the study, individuals who met the conditions of the research criteria at the same time were included in the study. Therefore, the research was conducted with a small group.

## Conclusion

Dependent care theory-based post-surgical home care intervention increased patients' self-care and reduced symptoms and their effects. It also reduced the caregiver burden. Dependent care theory can guide the nursing practices of nurses who provide institutional and/or home care services to patients with chronic diseases and their caregivers.

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**Author contribution** D. D. and H. Z. made substantial contributions to the conception and design, or acquisition of data, or analysis and interpretation of data; D. D. carried out the implementation phase of the study; D. D. and H. Z. involved in drafting the manuscript or revising it critically for important intellectual content; and D. D. and H. Z. gave the final approval of the version to be published. Each author has participated sufficiently to take public responsibility for appropriate portions of the content.

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**Data availability** No datasets were generated or analysed during the current study.

## Declarations

**Ethics approval** This study was performed in line with the principles of the Declaration of Helsinki and approved by the Academic Committee Decision (2019/1) and Erciyes University Clinical Research Ethics Committee (2019/179). All participants provided written informed consent, and the trial was registered in the Clinical Trial Registry at NCT05328739 on April 14, 2022.

**Consent to participate** Informed consent was obtained from all participants included in the study.

**Consent for publication** Informed consent for publication was obtained from all participants.

**Competing interests** The authors declare no competing interests.

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