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Examining illness narratives in the context of the postoperative psychological state: A mixed-methods study of emotion-focused illness narrative

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Background

Chronic illness as a traumatic experience

The examination and therapeutic approaches of illness narratives have become increasingly prominent in recent decades [11, 19, 25, 41]. Trauma caused by somatic, chronic illness can damage the integrity of the body and the self simultaneously, requiring the sufferer to adapt and develop a new relationship with their body, self and social environment [2, 19, 26, 33]. Through chronic illness, the continuity of life is disrupted, the narrative coherence of the life story is broken, and this traumatic structured crisis can result in a loss of emotional balance and a negative shift in emotion regulation. This makes it difficult to adaptively cope with the psychological distress and physical symptoms of illness in both the short and long term [9, 23, 33, 41].

Chronic disease patients and cancer patients share traumatic experiences, but the specific experiences of each disease have their own characteristics [41, 43]. The important psychological consequences of cancer are that patients may develop a strong fear of death and a strong fear of recurrence, fears that are often based on physical suffering, depending on the type of cancer [56]. Vehling and colleagues [56] found that, in a sample of patients with advanced cancer, death-related anxiety was very common, with 22–55% of their patients having at least moderate levels of anxiety. Medical interventions such as surgery and oncological treatments, which are part of the recovery from cancer, may also lead to further traumatization due to their side effects and negative impact on body image [15, 43].

Illness narratives theory

Narrative theory provides an innovative and beneficial way to study the subjective experience of illness [1, 29, 19]. According to the guiding theory of Arthur W. Frank, illness narratives allow us to learn about the subjective meanings constructed around illness [18–20]. Based on Frank's definition, three illness narratives can be distinguished [18–20].

These narratives are fragmented stories that do not fit into the structural framework of a story; emotions break the narrative, and the stories are about the disintegration of the previous self-image and structures of meaning [19, 20]. The chaos narrative portrays the person as a passive victim, revealing vulnerability and futility [19]. The illness experience is characterised as empty, meaningless and devoid of purpose.

The restitution story is about illness, suffering, and treatment: health is restored through therapy, and

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healing is achieved [19, 20]. This narrative reflects a modernist expectation that there is a remedy for every suffering and that the illness is an unfortunate breakdown in the body [57]. The restitution narrative's basic plot is that "I was healthy yesterday, and now I am sick, but tomorrow I will be better" [19, 20].

The quest story, in which illness is experienced as a kind of mission or research, is a condition in which something can be learned, something can be discovered, and this knowledge can be passed on to others [19, 20]. Quest narratives are heroic; they involve perseverance and are oriented to the future. In quest narratives, events are intertwined, and illness can become a motivator for social action or can be expanded to reveal fate [19, 20].

Whitehead [57] examined the narratives of patients with chronic fatigue syndrome and myalgic encephalomyelitis (CFS/ME) and found that patients portrayed the chaos narrative as expressions of depression, anger, and isolation. The prolonged dominance of this narrative was presumably explained by the uncertainty of the patients' prognosis and the uncertainty of effectiveness of their treatments, with patients not believing they would be cured, in contrast to other patient groups such as HIV or breast cancer. People with CFS/ME do not as actively embrace the restitution narrative, and it can be speculated that this is related to the constant reminder of the illness that they live with; the body is never asymptomatic [57]. Nettleton and colleagues [36], examining the narratives of patients with medically unexplained symptoms, also found a dominance of the chaos narrative, which was based on the assumption of a lack of accurate medical diagnosis, whereby patients could not adequately interpret and thus reconstruct their condition, their physical symptoms having no origin in the absence of diagnosis.

Schoenau [45] investigated the narratives of operable lung cancer patients through interviews, and she showed that 'being lucky' was the dominant narrative about operable lung cancer, based on the patients' perceived lack of control over the disease, passive patient role, and active medical role, an overarching narrative theme that could be considered a restitution illness narrative in Frank's interpretation, due to its focus on recovery. Thomas MacLean [51] examined the illness narratives of breast cancer patients, according to Frank's categorisation and found the restitutiton narrative to be the most desirable narrative, followed by the chaos narrative, with the quest narrative being the least frequent for patients. Ratcliff and colleagues [41] investigated the recovery pathways of patients healing from different cancer types using qualitative and quantitative methods simultaneously, with patients in the 'Never the same path' narrative group having the highest levels of anxiety and depression and the lowest levels of post-traumatic growth compared to the other groups.

In an editorial, Soundy [48] draws attention to the need to understand emotions, hope, and psychological adaptation within narratives about illness: mapping the master plots of the individual and understanding their psycho-emotional content can provide an essential tool for understanding the mental well-being of patients. Further research is needed to explore and consider these points further [36, 41, 48]. However, as we have seen from the research results presented above, the current literature mainly examines and categorizes illness narratives through thematic narrative theories, focusing on the structure of the narrative and meaning of the disease, and there is a lack of literature that uses complex, e.g. mixed methodologies, to investigate the psychological characteristics underlying patients' illness narratives [21, 51, 45, 57]. Frank's conceptualisation provides an understanding of illness narratives that can be used to make sense of the development of the psychological factors that accompany the illness process, This was an essential theoretical framework for our present research in which we used quantitative measures to explore the psychological factors that characterise the postoperative state in an attempt to address a gap in the literature [45, 48, 57].

The use of qualitative methods to study illness narratives: The advantage of timeline-based techniques

Through qualitative research, we can effectively capture the complex, personal phenomenology of the experience of illness described above because these investigations facilitate memory processes and the communication of difficult bodily experiences and emotions to articulate by allowing us to go beyond the limits of verbality. Buckley et al., [10, 37, 47]. Qualitative methods can open the way to elusive experiences such as becoming ill, existential and psychological loss, and damage to the integrity of the body and the self [13, 30, 31]. A multifaceted understanding of the subjective experience of somatic illness and its physical and psychological characteristics can be facilitated by a narrative psychology approach, where narrative can become a tool for the study of complex psychological processes [8, 11, 12, 52, 51, 39].

Graphic, visual elicitation techniques can capture and sometimes evoke untold content, thus creating narratives. When using these techniques, the subject is asked to create a visual artwork, usually a picture or drawing [31, 38, 52]. Drawing autobiographical timelines chronologically plotting significant events helps restructure an individual's life story, which is particularly important when coping with a chronic disease [31, 47, 52]. Visual elicitation techniques can transcend the boundaries of verbality to access the experiences of a person suffering

from an illness and effectively facilitate the verbalisation of specific sensitive topics, such as painful physical experiences and distressing emotions [31, 47, 48, 52]. There are several examples of the use of graphic visual elicitation techniques to explore disease narratives, such as [31] who investigated the meaning-making characteristics of cancer patients using an autobigoraphic timeline and Thygesen and colleagues [52] who investigated changes in the emotional state of patients with gynaecological tumour during their disease process by constructing a graph. Except for the illness narratives defined by Frank, to the best of our knowledge there are currently no studies in the literature that use a graphic visual elicitation technique to map the content of the three narrative types [31, 52].

Objective

The present study investigates illness narratives and their emotional aspects regarding their association with postoperative psychological status. Research in recent years has produced a growing body of knowledge on the content and structures of the three types of illness narratives identified by Frank and which features of illness within particular patient groups; availability of effective therapy, certainty of prognosis, experience of being out of control; determine the dominant illness narrative [36, 45, 51, 57]. However, what is currently unknown in the literature is the psychological state of chaos, restitution, and the quest narrative in terms of depression, anxiety, perceived stress, illness perception, and quality of life among patients who have undergone surgery.

Our objective was to examine the associations of emotion-focused illness narratives with postoperative emotional and mood state, perceived stress, quality of life and illness perception. Our primary research question was: What are the differences between chaos story, restitution story, and quest story groups regarding postoperative psychological status? Based on the available and previously presented literature, we hypothesized that (1) patients who use chaos narrative would be characterized by the most negative psychological status and that they would be the most likely to show a great psychological burden as a result of their illness. We further hypothesized that (2) patients using the restitution narrative would be characterized by a moderate psychological state compared to the other two narrative types, with these patients showing less psychological distress than those using the chaos narrative. Finally, we hypothesize that (3) patients using the quest narrative would be characterised by the most positive psychological state, with the least psychological burden caused by their disease compared to the other two narrative types.

Methods

Study design

Our research was based on an observational, cross-sectional study design, following a qualitatively-driven mixed-methods design that simultaneously used qualitative and quantitative measurement tools. The complete study sample was made up of patients who had undergone surgery, with each subject tested once, within 5 days of surgery. The test session included completing a questionnaire package that assessed the postoperative psychological status, followed by a semi-structured interview that used the Emotional Graph of Illness Trajectory. This graphical elicitation technique is used to explore the emotion-focused illness narrative.

Data collection procedure

The test enrollment period of our study ran for 20 months, from September 2020 to May 2022. The single, face-to-face test session took place in our surgical clinic within five days after surgery, adapting to the constraints of the length of hospital stay and considering the patient's physical condition.

Participation in the study was voluntary, and the study was conducted with the patient's written informed consent. The criteria for inclusion in the study sample were: over 18 years of age, a diagnosis of chronic illness or malignant tumour, surgery in the last five days for a chronic disease or cancer, and literacy skills sufficient to read and write. Exclusion factors included severe psychiatric and neurological illness. The research was carried out following the Declaration of Helsinki and with the approval of Regional Research Ethics Committee (RKEB) of the University of Szeged, Albert Szent-Györgyi Health Centre, approval number 145/2020-SZTE (World Medical Association, Helsinki, 1964).

Participants

Our study included 140 patients; 87 women (62.14%) and 53 men (37.86%), mean age 53.1 years (SD:12.03); who had undergone surgery and had a chronic disease or malignancy. We used access-based sampling. Their sociodemographic data showed marital status to be distributed as follows: 9.3% were single, 25% were an unmaried couple, 52.1% were married and lived with their spouse, 1.4% were married but not living with their spouse, 5.7% were divorced, 5% were widowed, and 0.7% indicated another marital status. For educational attainment: 11.5% had level eight primary qualifications, 61.1% had intermediate qualifications, and 27.4% had tertiary qualifications. Of the participants, 1.4% lived in the capital, 70% in a town, and 28.6% in

a village. Regarding employment status, 32.4% were active workers, 22.3% were on sick leave, 13.7% were on a disability pension, 3.6% were unemployed, 23% were retired, and 5% were other.

The subjects had been diagnosed with their disease for 2.62 years on average (SD: 5.05) and were classified into five main groups according to their diagnosis (Table 1). In our study, the primary criterion for the design of the study sample was the postoperative status, which for all patients was a successful elective postoperative status: our study sample did not include inoperable patients. It is a characteristic of all surgery that it is a burdensome experience for the patient that can bring permanent changes to his/her life, but the positive impact of successful surgery on recovery and physical health can be attributed to its positive psychological meaning, depending on the patient's perception [24, 40]. Although chronic disease and cancer have different courses, we combined our subjects with cancer and chronic disease into one group based on the assumptions described above. On the same basis, we did not further differentiate patients with cancer according to the stage of the disease: in general, the operability of a tumor and successful removal implies that the disease is not advanced, the stage of the disease makes the patient suitable for curative treatment, and the patient is not in the palliative phase [46].

Psychological measurement tools

Sociodemographic data

Within the test battery used, a block of sociodemographic questions was designed to assess the age, sex, employment status, place of residence, education, and marital status of the respondents.

Medical data

We recorded the type of surgical intervention and data on the somatic disease that justified the surgical intervention (diagnosis, onset of disease).

Emotional Graph of Illness Trajectory

This graphical elicitation technique was used to identify the type of emotion-focused illness narrative used and to explore the content of the narrative. The technique can discover the dominant emotion characterising the disease process and the emotional impact of disease-related events [52]. The technique used by our research team was based on the graphical procedure of [52] a graphical elicitation technique with a timeline structure that uses a grid-graphic tool, including a horizontal axis representing events in chronological order and a vertical axis with a 0-100% coverage to assess the intensity of the emotion experienced. The national validation article of the Emotional Graph of Illness Trajectory that our research group has prepared is under publication.

During the test, the patient was first asked to name the most potent emotion they had experienced during the illness. In the next step, the patient was asked to list, in chronological order along the horizontal axis, emotionally significant events they experienced in the course of the disease and then to rate, on a scale of 0-100%, the strength of the emotion experienced during these events along the vertical axis. It was up to the patient to construct the graph during the test session. While the patient was making the graph and sharing information about it, the investigator took notes of this information on a marking sheet developed by our research team. After the patient had named all the events he/she wished to indicate on the horizontal axis and rated the intensity value, as a percentage, of the emotion associated

Table 1 Description of the study sample by patient group

Patient group by diagnosis	*N*	Type of surgery (*N*)	Sex (*N*)	Mean age (SD)
Breast cancer	41	Mastectomy (16) Excision (25)	female (41) male (0)	53.5 (8.9)
Gastrointestinal tract cancer	36	Resection (27) Gastrectomy (2) Resection with stoma creation (7)	female (18) male (18)	56.7 (11.72)
Gasztrointestinal tract disease	21	Resection (10) Appendectomy (7) Stoma closure (2) Resection with stoma creation (2)	female (9) male (12)	40.52 (12.0)
Vascular disease	25	Stent placement (13) Amputation (4) Thrombendarterectomy (4) Bypass operation (4)	female (12) male (13)	56.12 (11.31)
Lung cancer or chronic lung disease	17	Lobectomy (10) Resection (7)	female (9) male (8)	54.41 (12.45)

with the events, the investigator calculated and recorded on the marking sheet the average value of the emotional intensity from the emotion intensity scores given by the subject. In this way, the quantification of the Emotional Graph of the Illness Trajectory was obtained as the average value of the emotional intensity of the graph.

Although our research was based on the original procedure and test-taking sheet of the elicitation technique created by [52], we made some modifications and innovations to enhance our tool: (1) the horizontal axis of our instrument does not contain predefined standard events characteristic of the disease process, (2) the patient determines the onset of the disease process, and (3) the grid covers the entire area between the two axes in the form of equally sized squares. The grid area given to the patient was A/4 sheet size, covering the entire sheet area, with the instructions included. In addition, we created a marking sheet on which the investigator records information related to the emotion selected by the patient (reason for the emotion, name of the associated events, description of the content and the intensity of the emotion experienced during the event). The changes made to the instrument were motivated by our research team's objective of using it to better understand the patient's subjective assessment of the onset of illness and to better understand the patient's self-constructed illness narrative that was structured around self-reported events that they considered significant, so we did not include formal events on the horizontal axis of the graph. A grid area covering the entire area between the axes was included to help plot the graph and to mark the numerical values more accurately.

The Emotional Graph of Illness Trajectory was further supplemented with a post-test based on the interview questions of the original method [52]. The questions were designed to find out what other individual or socio-environmental factors, beyond the impact of the events related to the illness experienced and described, might have played a role in the change in the intensity of emotion. The post-test questions are "*What could have caused the rise/fall of the graph?*"; "*If there were turning points, what caused them?*"; "*What did the patient do to change the low/high points?*". The investigator also recorded the answers in the space provided on the marking sheet (Fig. 1).

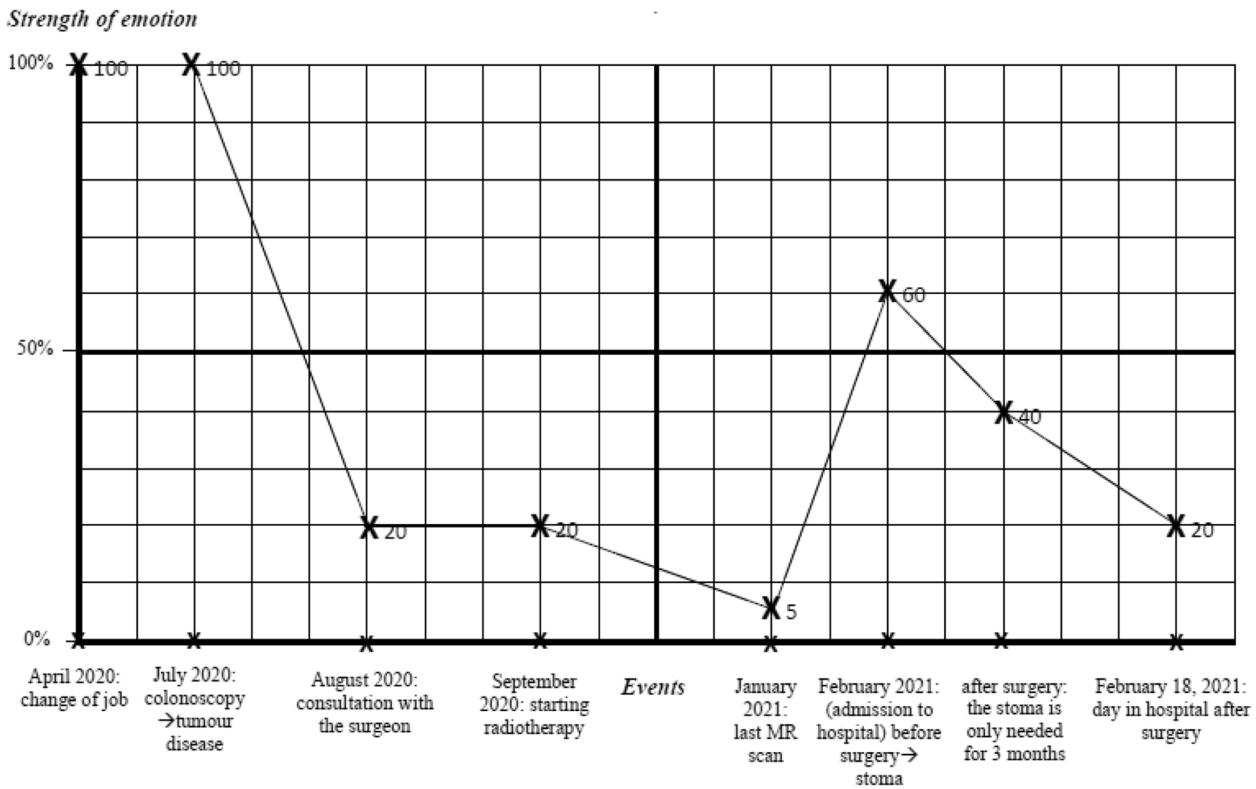

Fig. 1 The Emotional Graph of Illness Trajectory of patient A. *Note*: A was a 40 year old female patient in a surgical inpatient ward who did the graph within five days after the resection of a malignant rectal tumour. The patient's graph depicted the evolution of a feeling of hopelessness, with an average intensity value of 45.63% during the period of the disease that ended days after the surgical procedure

State-Trait Anxiety Inventory

Used to measure anxiety levels, we applied the Spielberger Trait and State Anxiety Scales (STAI-T and STAI-S). The 20 item trait scale assesses a person's general anxiety level (trait anxiety questionnaire) on a 4-point Likert scale and is scored from 0 to 80. The current anxiety level (state anxiety questionnaire), also includes 20 items and scored is from 0 to 80 [49]. In our study, the internal reliability of the questionnaire was found to be excellent for both the STAI-T (Cronbach's alpha = 0.89) and STAI-S (Cronbach's alpha = 0.91) scales.

Beck Depression Inventory-short form

The Beck Depression Inventory 9-item shortened version (BDI-9) was used to measure depression levels. The questionnaire measures the presence of certain symptoms of depression over the past month, such as social withdrawal, indecision, fatigue, sleep disturbance, inability to work, pessimism, lack of pleasure and satisfaction, and self-blame. It uses a 4-point Likert scale ranging from 0 to 27 points [3]. The internal reliability of the instrument was adequate in our study (Cronbach's alpha = 0.79).

Perceived Stress Scale

A shortened 10-item version of the Perceived Stress Scale (PSS-10) was used to measure stress levels and subjective stress perception. The respondent is asked to rate on a five-point Likert scale how often in the past month he or she has experienced a particular feeling or thought that characterizes stress [14] the questionnaire scores from 0 to 40. The reliability of the questionnaire in our study sample was also found to be adequate (Cronbach's alpha = 0.75).

EQ-5D-3L

The overall quality of life was measured by calculating the EQ-5D index of the European Quality of Life questionnaire. The questionnaire assesses health-related quality of life along five dimensions: mobility, self-care, ability to carry out usual activities of daily living, pain/discomfort, and anxiety/depression. Each dimension is assessed by a single question and is answered on a three-point scale [7, 54]. The internal reliability of the instrument was also found to be sufficient in our study (Cronbach's alpha = 0.72).

Brief Illness Perception Questionnaire

We explored attitudes to illness using the abbreviated Perception of Illness Questionnaire. The questionnaire distinguishes eight dimensions of illness perception: consequences, timeline, personal control, treatment control, identity, concern, comprehensibility, and representation of emotions. Responses are given on a 10-point Likert scale, with the score ranging from 0 to 80 points. The response score calculates a total score, which represents the perceived threat associated with the disease; the higher the score, the more negative the disease image [6]. The internal consistency of the measure in our study sample was slightly below the minimum expected value of 0.7 (Cronbach's $\alpha = 0.66$), but it does indicate acceptable internal reliability for attitude scales.

Analysis of the Emotional Graph of Illness Trajectory: Content analysis of qualitative data

During the Emotional Graph of Illness Trajectory test session the examiner recorded the following on the marking sheet: the dominant emotion of the illness trajectory and its justification, the main events of the illness process named by the patient, their content, their description, and finally the answers to the questions asked during the post-test. This data was subjected to thematic content analysis involving two independent coders. Our research team considered the aspects of Frank's concept of illness narratives [19, 20] as characteristic of illness narratives and used them as the criteria for content analysis, thus, the theoretical basis for the categorisation that helped to form the experimental groups also provided the standard for coding. Furthermore, relying on the analytical method of [52, 42] Interpretation Theory was helpful in the analysis process. Coding was performed by the two independent coders as part of the content analysis. We provided them with the literature on which our research was based, including a detailed description and relevant sources that commented on Frank's theory of disease narrative. Several consultations were held with independent coders to establish the appropriate theoretical knowledge, and the authors were satisfied that the coders were appropriately knowledgable.

The primary aim of the verbal content analysis was to determine the patient's dominant narrative of the illness currently at the forefront of the narrative. During the thematic content analysis, the coders assessed the content of the marking sheets in three steps. They marked the closest illness narrative type regarding content and narrative (chaos story, restitution story or quest story), as follows. (1) the emotion associated with the disease process and the reasons for the emotion; (2) the emotional content of experiences related to events in the disease process; and (3) the content of the answers to the post-test questions was assessed according to the Frank concepts. As a result, the subject's illness narrative was the narrative type that appeared most often in the verbal content.

Statistical analysis

Statistical analyses were performed using SPSS version 22.0 [27]. G-Power 3.1 was used to calculate effect size values [16]. Figures were prepared using R Studio [44]. The limit of statistical significance was set at $p < 0.05$. Before analysing the data, the Kolmogorov-Smirnov test was used for normality tests on the mean values of emotion intensity, obtained using the graphical technique, and on the results obtained from the questionnaires, both for the whole study sample and for our subgroups. The Shapiro-Wilk test was used for groups with fewer than 30 members. Pearson correlation tests and Spearman rank correlation tests without a normal distribution were used to analysing the strength and direction of the correlations between the psychological factors examined. For comparisons of several independent groups, after performing Levene's test, one-way ANOVA and Kruskal-Wallis H test were used, and Welch's test was applied for inequality of variances. An independent samples t-test and Mann-Whitney U test were used when comparing two independent groups. Post hoc pairwise comparisons of groups were performed using Hochberg's GT2 test for parametric tests. Mann-Whitney U test and Bonferroni test were used for non-parametric tests. Correlations between the groups were tested using the Chi-square test for variables at nominal or ordinal measurement levels.

Results

Descriptive statistics of the study sample

The descriptive statistics of the results obtained from the questionnaires and the graphical elicitation technique are reported for the total study sample ($n = 140$) in Table 2.

Table 2 Descriptive statistics of the results obtained for the total study sample. Mean scores and standard deviations (SD) of the results obtained by the use of the psychological measurement tools

Psychological variables	Mean	Standard deviation (SD)
Emotional intensity (Emotional Graph of Illness Trajectory)	59.26	20.90
Depression (BDI-9 scale)	5.74	4.30
State anxiety (STAI-S scale)	44.32	11.27
Trait anxiety (STAI-T scale)	45.02	10.51
Perceived stress (PSS-10 scale)	19.00	6.30
Illness perception (BIPQ scale)	38.50	13.68
Quality of life (EQ-5D index)	0.67	0.34

Note: *BDI-9* Beck Depression Inventory-Short Form, *STAI-S* State-Trait Anxiety Inventory – State anxiety questionnaire, *STAI-T* State-Trait Anxiety Inventory – Trait anxiety questionnaire, *PSS-10* shortened version of the Perceived Stress Scale, *BIOQ* Brief Illness Perception Questionnaire, *EQ-5D* European Quality of Life questionnaire

Examination of illness narrative types and their relation with psychological variables

Through analysis of the verbal content recorded using the graphic elicitation technique, we identified the illness narratives defined by A. W. Frank and classified each subject into the corresponding narrative type group [19, 20]. Two independent coders performed the grouping of narratives, and the results of these codings showed a discrepancy according to the results of the Chi-square test ($\chi^2(4) = 235.369$; $p < 0.001$), but it is important to note that this discrepancy appeared in 5% of the cases (7 subjects). In cases where the type of illness narrative identified by the two independent coders differed, the coding of the subject's narrative was determined based on the involvement and assessment of a third independent coder. The illness narratives of the overall study sample were distributed as follows: 60.7% restitution story (85 individuals), 24.3% chaos story (34 individuals), and 15% quest story (21 individuals). The association of illness narrative type with sociodemographic variables was examined using one-way ANOVA and Chi-square test, with sociodemographic variables as independent variables and narrative type as a dependent variable. The findings of our ANOVA analysis showed that there was no difference between the three disease-narrative type groups in terms of age ($F(2,137) = 0.498$, $p = 0.609$) or in terms of the Chi-square test for nominal and ordinal level sociodemographic variables (sex: $\chi^2 = 1.938$, $p = 0.379$; area of residence: $\chi^2 = 1.224$, $p = 0.874$; educational qualifications: $\chi^2 = 9.996$, $p = 0.616$; marital status: $\chi^2 = 16.382$, $p = 0.282$; activity: $\chi^2 = 6.8$, $p = 0.871$). The type of narrative did not show a significant correlation with any sociodemographic variable.

In our hypothesis testing, we used one-way ANOVA to compare the scores of the three narrative-type groups for normally distributed variables and Kruskal-Wallis H test to compare the scores of the BDI, BIPQ, and EQ-5D index scales for non-normal distribution. In our comparison of the groups, equality of variances was met for all dependent variables (STAI-S: $F(2,137) = 0.906$, $p = 0.406$; STAI-T: $F(2,137) = 2.292$, $p = 0.105$; BDI: $F(2,137) = 0.442$, $p = 0.644$; BIPQ: $F(2,137) = 0.044$, $p = 0.957$; EQ-5D index: $F(2,137) = 0.026$, $p = 0.974$; PSS: $F(2,137) = 0.446$, $p = 0.641$; Emotional Graph of Illness Trajectory: $F(2,137) = 1.138$, $p = 0.324$).

The testing of our three hypotheses was shown to be feasible by performing the same statistical test for each group, thus the description of the hypothesis testing results refers to the same results: they are presented once for each of the disease narrative groups, and a complex interpretation can be achieved by considering the results

together. Our hypothesis were that (1) patients who use chaos narrative would be characterized by the most negative psychological status and that they would be the most likely to show a great psychological burden as a result of their illness. We further hypothesized that (2) patients using the restitution narrative would be characterized by a moderate psychological state compared to the other two narrative types, with these patients showing less psychological distress than those using the chaos narrative. Finally, we hypothesize that (3) patients using the quest narrative would be characterised by the most positive psychological state, with the least psychological burden caused by their disease compared to the other two narrative types.

Our analysis showed a small effect, significant difference in the mean value intensity of the graphically depicted emotion when comparing the three narrative types ($F(2, 137) = 3.472$, MSE = 422.168, $p = 0.034$, $\eta^2 = 0.05$). Furthermore, perceived stress (PSS) ($F(2, 137) = 7.471$, MSE = 38.362, $p = 0.001$, $\eta^2 = 0.1$), state anxiety (STAI-S) ($F(2, 137) = 4.124$, MSE = 121.538, $p = 0.018$, $\eta^2 = 0.06$), trait anxiety (STAI-T) ($F(2, 137) = 5.796$, MSE = 103.403, $p = 0.004$, $\eta^2 = 0.08$), depression (BDI) ($H(2) = 7.946$, $p = 0.019$, $\eta^2 = 0.05$), and perception of illness (BIPQ) ($H(2) = 12.577$, $p = 0.002$, $\eta^2 = 0.08$) also showed significant differences with small and medium effects between the three groups of narrative types. (Table 3). Thus, our results show that the type of illness narrative has a small effect size, with a significant impact on the mean intensity of the emotion depicted in the Emotional Graph of Illness Trajectory and on the depression score, and a medium effect size, with a significant impact on the levels of trait anxiety, state anxiety, illness perception, and perceived stress.

According to the results of the pairwise comparison of the groups, for all the dependent variables that showed significant differences, there was no significant difference among the three groups in the mean value of the graphically depicted intensity of the emotion. However, Hochberg's GT2 test results showed a significant difference in perceived stress between the chaos story and restitution story groups ($p = 0.013$) and between the chaos story and quest story groups ($p = 0.001$). There was also a significant difference in state anxiety between the chaos story and quest story groups ($p = 0.022$), in trait anxiety between the chaos story and quest story groups ($p = 0.005$), and between the chaos story and restitution story groups ($p = 0.03$) (Table 3). Post hoc Mann-Whitney U tests showed a significant difference in the depression scores of the chaos story and restitution story groups ($p = 0.01$) and of the chaos story and quest story groups ($p = 0.018$). Furthermore, for illness perception, there was a significant difference between the chaos story and the restitution story ($p = 0.045$), between the restitution story and the quest story groups ($p = 0.011$), and between the chaos story and the quest story ($p = 0.001$) (Table 3). Thus, our results show that the type of illness narrative had a significant effect on the average intensity of the emotion depicted in the Emotional Graph of Illness Trajectory and the trait anxiety, state anxiety, depression, perceived stress and illness perception levels. Based on the analysis of our results, our first hypothesis was

Table 3 Mean scores and standard deviations (SD) of the emotional graph of illness trajectory and the questionnaires used, presented by illness narrative group

	Chaos story[a]	Restitution story[b]	Quest story[c]	F	H	*p*	η2	*P* value of signifficant post hoc test
Intensity value of emotion on the Emotional Graph of Illness Trajectory	64.27 (19.14)	55.6 (20.34)	65.96 (23.44)	3.472	-	0.034	0.05	-
BDI	7.41 (4.22)[b, c]	5.34 (4.41)[a]	4.67 (3.26)[a]	-	7.946	0.019	0.05	[a, b]0.01 [a, c]0.018
STAI-T	49.65 (9.14)[b, c]	44.28 (11.06)[a]	40.52 (7.53)[a]	5.796	-	0.004	0.08	[a, b]0.03 [a, c]0.005
STAI-S	48.59 (12.08)[c]	43.62 (11.07)	40.29 (8.80)[a]	4.124	-	0.018	0.06	[a, c]0.022
BIPQ	43.50 (13.44)[b, c]	38.42 (13.28)[a, c]	30.70 (12.46)[a, b]	-	12.577	0.002	0.08	[a, b]0.045 [b, c]0.011 [a, c]0.001
PSS	22.08 (5.20)[b, c]	18.54 (6.30)[a]	15.90 (6.17)[a]	7.471	-	0.001	0.10	[a, b]0.013 [a, c]0.001
EQ-5D	0.6 (0.33)	0.7 (0.34)	0.67 (0.33)	-	5.516	0.06	-	-

Note: *BDI-9* Beck Depression Inventory-Short Form, *STAI-S* State-Trait Anxiety Inventory – State anxiety questionnaire, *STAI-T* State-Trait Anxiety Inventory – Trait anxiety questionnaire, *PSS-10* shortened version of the Perceived Stress Scale, *BIOQ* Brief Illness Perception Questionnaire, *EQ-5D* European Quality of Life questionnaire; mean scores marked with „a", „b" and „c" indicate scores with significant difference in post hoc test

supported: the chaos story was characterised by the most negative perception of illness, with the highest levels of depression, state anxiety, trait anxiety and perceived stress. As regards quality of life, our first hypothesis was not confirmed. Our second hypothesis was also supported: the restitution narrative group had a moderate psychological state compared to the other two narrative groups and had more positive depression, trait anxiety, perception of illness and perceived stress scores than the chaos narrative group. In addition, the restitution story showed the lowest emotional intensity of the disease process. Our second hypothesis regarding state anxiety and quality of life was not confirmed. Our analysis also partially supported our third hypothesis: the quest story was characterised by the most positive perception of illness and the lowest perceived stress, depression, trait anxiety and state anxiety levels, which were associated with the highest emotion intensity values for the illness process. As regards quality of life, our third hypothesis was also not confirmed (Table 3).

We explored which emotions within each narrative type showed the strongest emotional intensity as expressed by the patients and found that for patients narrating the chaos narrative, although only for one person, the despair emotion showed the strongest average emotional intensity (100%), followed by feelings of uncertainty (average intensity: 72.4%; range: 50–85%) and fear (average intensity 71.0%; range: 25–92%). In the restitution narratives, several emotions were expressed with an average intensity of 100%; security, determination, and acceptance; but each of these emotions was expressed by only one person, with fear being the other most intensely expressed emotion (average intensity: 60.86%; range: 18.75–100%). In the quest narratives, hopefulness was the most intensely expressed emotion (mean intensity: 90.5%; range: 81–100%), along with confidence (mean intensity: 95%) and trust (mean intensity 93%), but the latter two emotions appeared in only one patient's narrative.

Our study used a Chi-square test to assess whether there is a difference in the prevalence of different narrative types between groups of patients with chronic disease and patients operated on for cancer. Our results showed no significant difference between the two groups of patients ($\chi^2(2) = 5.491$; $p = 0.064$).

Examining the structure of illness perception across illness narrative types

According to the hypothesis testing in the context of the investigation of the structure of illness perception across illness narrative types, our results showed that in addition to the significant difference in the overall illness perception scores described above, significant differences were found showing medium effect in the three dimensions of illness perception: treatment control ($H(2) = 7.479$, $p = 0.024$, $\eta^2 = 0.06$), illness-related concern ($H(2) = 10.116$, $p = 0.006$, $\eta^2 = 0.08$) and emotional representation ($H(2) = 13.182$, $p = 0.001$, $\eta^2 = 0.1$). Thus, our results show that the type of illness narrative has a medium effect size, with a significant impact on the treatment control, illness-related concern, and emotional representation dimensions of illness perception. According to the results of post hoc Mann-Whitney U tests, the chaos story scored significantly higher on overall perception of illness ($p = 0.045$) and on its scores for the treatment control dimension ($p = 0.049$) than did the restitution story.It also scored significantly higher, in other words, more negative scores compared to the quest story for the overall perception of illness ($p = 0.001$) and for the treatment control dimension ($p = 0.009$), as well as for the illness-related concern ($p = 0.001$) and emotional representation dimensions ($p < 0.001$) (Table 4).

Furthermore, comparisons of the restitution story and quest story groups were also performed using Mann-Whitney U post hoc tests, which showed that the restitution story group had a significantly higher overall illness perception score ($p = 0.011$) and significantly higher scores for the illness-related concern ($p = 0.012$) and emotional representation dimensions ($p = 0.006$) than were found for the quest story group (Table 4). Based on the results of hypothesis testing, each of our hypotheses was supported for the illness-related concern, treatment control, and emotional representation of illness perception dimensions. Our hypotheses were not confirmed for the other disease perception dimensions,.

To summarise the characteristics of disease perception for the three illness narrative types explored in our study, the group narrating the chaos story showed the most negative perception of the disease, hence, they had the highest level of perceived threat from disease. Furthermore, the chaos story had the highest scores for the disease perception dimensions that showed significant differences, such as treatment control, concern, and emotional representation (Table 4) (Fig. 2).

The restitution story group is a narrative type with so-called "intermediate" disease perception characteristics, as shown by its significantly higher overall score than that found for the chaos story but a significantly lower score than that of the quest story; therefore, it shows a more positive perception of illness and a lower level of a perceived threat than the chaos story but by a more negative perception of illness and a higher level of a perceived threat than the quest story (Table 4) (Fig. 3).

The individuals who narrated the quest story could be considered to have the most positive perception of illness, in other words, the group with the lowest perceived threat of illness. This group had the lowest scores on all

Table 4 Mean scores and standard deviations (SD) of the three groups of illness narrative types for the BIPQ scale total and its dimensions

	Chaos story[a]	Restitution story[b]	Quest story[c]	H	*p*	η2	*P* value of signifficant post hoc test
Total illness perception score	43.5 (13.44)[b, c]	38.42 (13.28)[a, c]	30.7 (12.46)[b, a]	12.577	0.002	0.08	a, b = 0.045 b, c = 0.011 a, c = 0.001
Consequences dimension score	7.73 (2.36)	7.35 (2.49)	6.09 (2.84)	5.107	0.078	-	-
Timeline dimension score	6.17 (2.92)	5.24 (3.29)	4.82 (3.26)	3.254	0.197	-	-
Personal control dimension score	5.2 (2.9)	4.21 (2.74)	3.71 (2.92)	4.223	0.121	-	-
Treatment control dimension score	2.82 (2.79)[b, c]	1.80 (2.08)[a]	1.19 (1.90)[a]	7.479	0.024	0.006	a, b = 0.049 a, c = 0.009
Identity dimension score	7.12 (12.83)	4.8 (3.0)	4.04 (2.92)	1.552	0.46	-	-
Concern dimension score	7.17 (2.55)[c]	6.38 (3.32)[c]	4.38 (2.71)[a, b]	10.116	0.006	0.08	a, c = 0.001 b, c = 0.012
Comprehensibility dimension score	2.44 (2.52)	2.21 (2.65)	2.95 (3.14)	1.558	0.459	-	-
emotional Representation dimension score	7.26 (2.48)[c]	6.36 (3.21)[c]	4.19 (2.82)[a, b]	13.182	0.001	0.10	a, c = < 0.001 bc = 0.006

Note: BDI-9 Beck Depression Inventory-Short Form, *STAI-S* State-Trait Anxiety Inventory – State anxiety questionnaire, *STAI-T* State-Trait Anxiety Inventory – Trait anxiety questionnaire, *PSS-10* shortened version of the Perceived Stress Scale, *BIOQ* Brief Illness Perception Questionnaire, *EQ-5D* European Quality of Life questionnaire; mean scores marked with „a", „b" and „c" indicate scores with significant difference in post hoc test

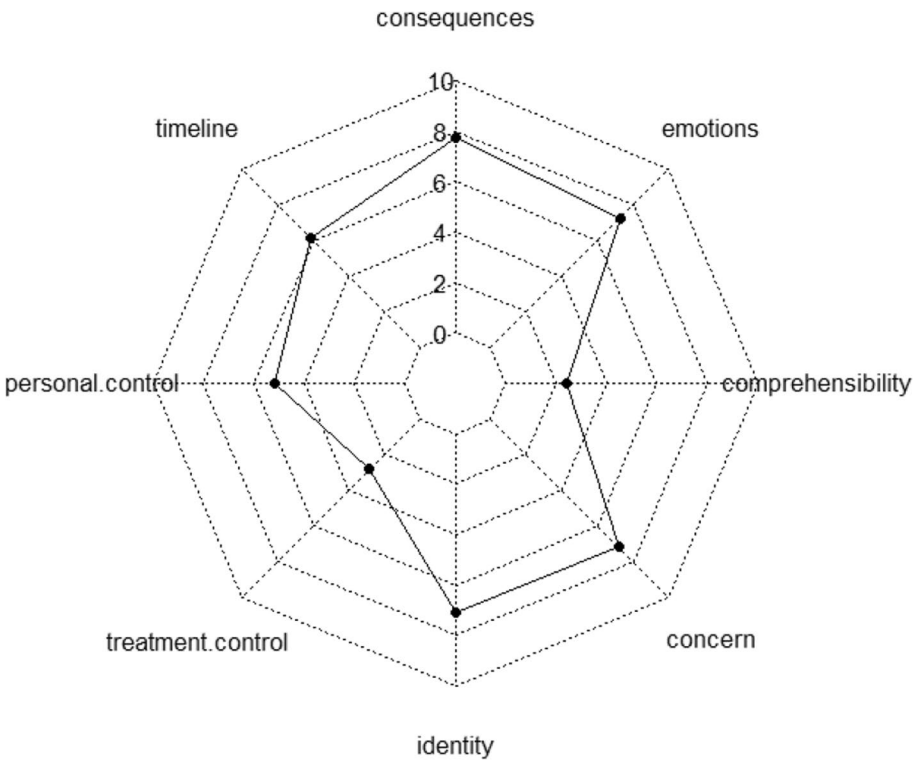

Fig. 2 Structure of the chaos story group's perception of illness according to the scores of the eight dimensions

dimensions when compared to the other two groups, except for the dimension of coherence (which asks about the patient's understanding of their illness), and significantly lower scores for illness-related concern and emotional representation when compared to the groups

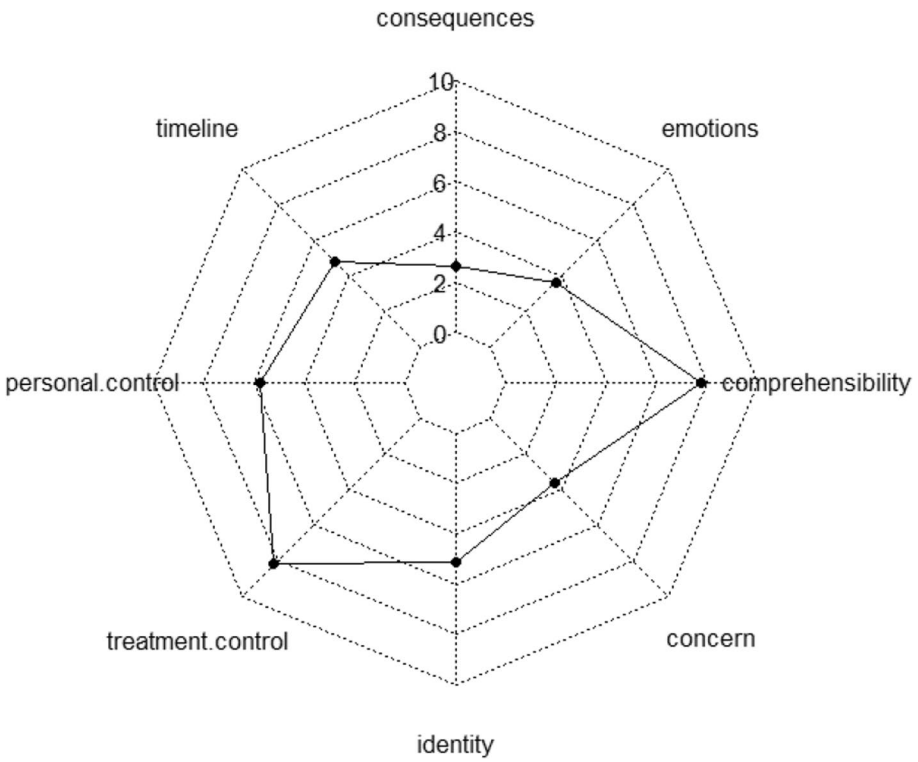

Fig. 3 Structure of illness perception of the restitution story group according to the scores of the eight dimensions

narrating the chaos and restitution narratives, according to the results of the post hoc tests, (Table 4) (Fig. 4).

Discussion

Our study employed a mixed quantitative and qualitative methodology to investigate the associations between illness narrative type and postoperative emotional and mood state, perceived stress, illness perception, and quality of life. We applied, at the same time, a graphical elicitation technique to map the emotional aspects of the disease narratives during the preoperative period of 140 patients with chronic disease or malignany who underwent surgery and quantitative questionnaires to assess their postoperative emotional and mood states, perceived stress level, illness perception, and quality of life.

Our results showed significant differences among the three types of illness narratives in the mean values of the intensity of the graphically depicted emotion, trait anxiety, state anxiety, depression, perceived stress and illness perception. Based on the results, our first hypothesis, that patients who narrate the chaos narrative would be characterized by the most negative psychological status and that they would be the most likely to show psychological burden as a result of the illness, was partially confirmed: our results highlight that individuals who narrated the chaos story had significantly more negative perceptions of illness and higher levels of recent depression, anxiety, and perceived stress than those who narrated the quest story. They also had significantly higher levels of anxiety, depression and perceived stress and more negative illness perception than those who narrated the restitution story, which confirmed our preliminary assumptions. Our second hypothesis, namely that the restitution narrative would be characterized by a more moderate psychological state than the other two narrative types, with these patients showing less psychological distress than the chaos narrative, was partially supported: for each of the psychological factors examined, there was an intermediate score for those narrating the restitutiton narrative and significantly lower scores for depression, trait anxiety, perceived stress, and illness perception than were found for those narrating the chaos narrative. Our third hypothesis, according to which the quest narrative would be characterised by the most positive psychological state and have the least psychological burden caused by the disease when compared to the other two narrative types was also partially supported: the patients presenting the quest story had the most positive image of their illness and more confidence in medical treatments. Their illness perception was more controllable, they felt fewer symptoms and less concern about their illness, and they were less emotionally distressed than the chaos or restitution

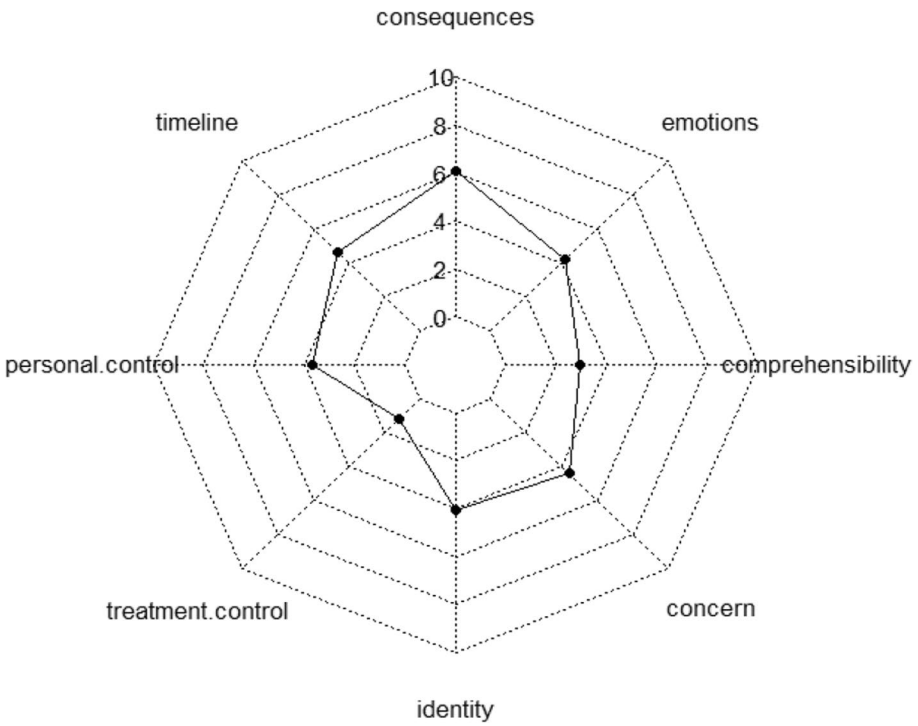

Fig. 4 Structure of illness perception of the quest story group according to the scores of the eight dimensions

narrative groups. We also found that the highest average value of the intensity of the graphically depicted emotion appeared among those narrating the quest story. In contrast, the lowest average value was found for the restitution story. Summarizing our results from the psychological state questionnaires, which confirmed our hypothesis, we can see that for all factors, patients reporting the chaos narrative scored the highest, followed by patients reporting the restitutiton narrative, with the patients reporting the quest story scoring the lowest, meaning that storytellers using the chaos narrative had the most negative psychological state, storytellers of the restitution narrative had a moderate psychological state, while the most positive psychological state was found for storytellers of the quest narrative. At the same time, we can see that the intensity value of the graphically plotted emotion change is highest for the quest story, almost the same, only 1.73% lower, for patients narrating the chaos story, and almost 10% lower for patients narrating the restitutiton narrative. These results are presumably due to the more effective emotion regulation processes associated with quest narratives, as opposed to the two other types of narratives. When using these effective emotion regulation strategies, the patient experiences the emotional impact of the event and change related to the disease, as indicated by the emotion intensity scores, however, at the same time as this experience, adaptive emotion regulation strategies, such as cognitive reframing or interpreting illness as a challenge, can be assumed to be activated, which may lead to a stabilisation of psychological well-being and a positive change in its direction, changes that were also seen in several dimensions of postoperative psychological state and perception of illness in relation to the quest story in another report [28].

Our results of the analysis of disease perception across the three illness narratives found three dimensions of difference. For the treatment control dimension, narrators of the chaos narrative had the highest scores, significantly different than narrators of the restitutiton and quest narratives; narrators of the restitution narrative had an intermediate value, significantly different than narrators of the quest story; and those who reported the quest narrative had the lowest scores, which means that patients who report the latter narrative type perceive their disease treatment to be most effective. In addition, there were significant differences among the narrative groups for the dimensions of illness-related concerns and emotional representation expressing the emotional impact of illness, but no significant differences were found between the chaos and restitution narrative types for these dimensions: only the quest story group showed significant differences with the chaos and restitutiton narrative groups. Our results for the disease perception dimensions of treatment control may be explained by the level of trust

and commitment to the success of recovery that is characteristic of the narrative types: the most negative picture is seen in the case of the chaos narrative, the restitutiton story presents illness as a recoverable condition, and the quest story presents illness as a challenge to be overcome [57, 19]. For the concern and emotional representation dimensions, as with the factors that explain the postoperative psychological states described above, it is suspected that the more adaptive emotion regulation processes characteristic of the quest narrative may explain the significant differences that emerged when compared to the chaos and restitution narratives, while the emotion regulation strategies of patients who narrate the latter two narrative types are presumably not significantly different [28]. Our findings that there were significant differences between narrative types for the treatment control, concern, and emotional representation of illness perception dimensions while no significant differences were found for the other dimensions of illness perception, is presumably because the dimensions with significant differences may be most related to emotion regulation processes, and these dimensions may express emotional involvement more significantly, with the other dimensions perhabs less [19, 28].

Our findings for the three types of illness narratives may be due to the appearance of the quest story as a mental process that involves psychological development related to adaptive emotion regulation and the restitution story as the patient's passive role in recovery [19, 20, 51]. In the chaos story, suffering is untold, the patient cannot find his old self nor can he build a new one, which is reflected in high levels of depression, anxiety and perceived stress, as well as in a more negative perception of illness [19, 20, 36, 51].

Our findings resonated with other research showing that the emotional aspect of the illness narrative is positively related to the emotional and mood states of the narrator [5, 41]. Results from a study of patients with breast cancer also showed that the representation of the illness during the disease process was strongly related to the degree of psychological distress [34]. Our findings for illness perception were also consistent with previous research findings, suggesting that adverse changes in illness perceptions among patients with chronic illness are associated with increased negative emotions and negative changes in perceived consequences and perceived control over the illness, which are consistent with the characteristics of illness perceptions of the group of individuals who narrated the chaos story [4]. The results of a study of patients with amyotrophic lateral sclerosis also showed a correlation between patients' representations of their disease and their mood and that psychological factors also significantly determine the adaptive or maladaptive nature of patients' adaptation to their disease [35]. However, in addition to the consistency with previous literature, it is important to highlight the novelty of our findings for a sample of chronic and cancer patients recovering from surgery: patients who reported a chaos narrative had the highest levels of psychological distress, patients narrating the restitution narrative had a moderate psychological state compared to the other two narrative types, and patients narrating a quest narrative can be considered to be in the most positive postoperative psychological state.

Consistent with the results of previous research, our findings showed that the restitution story was the most commonly reported in our sample of patients with chronic disease and cancer who are recovering from surgery, which differs from the study samples of previous research. According to Frank's theory, the restitution story is the most common narrative type [19]. Thomas-MacLean [51], in a study of patients diagnosed with breast cancer, also found that patients most often told their story of illness in the form of a restitution story. This phenomenon can be explained by the technological achievements in modern Western medicine and the messages of consumer culture and the media, which view the human body as an object [17, 53]. This process can be problematic psychologically, as it can create the illusion that we can quickly 'rebuild' ourselves or 'replace' sick body parts. The damaged, diseased 'subjective physical body' becomes modern Western medicine's 'objectifiable physical body', allowing the patient to be seen and treated as a disease. However, we cannot process the psychological changes caused by a serious physical illness from one moment to the next. Frank emphasizes that a critical strength of the narrative types is to assist professionals in building stronger relationships with their patients [20]. The goal is not to direct patients away from some narratives and toward others; instead, it is critical to emphasize that no one knows their stories better. Through listening to their stories, healthcare providers can create a space for new stories to be told.

In our study, there were no significant differences between the three disease narratives in terms of health-related quality of life as measured by the EQ-5D index: none of our hypotheses were confirmed for this psychological factor. This result may be explained by the measurement capabilities of the questionnaire. The EQ-5D score may not show significant differences because it is not an appropriate measure of differences between narratives. The EQ-5D measures health-related quality of life and is designed to compare overall quality of life across different diseases and conditions. It is, however, a very general measure and may lack sensitivity to some of the psychological or emotional factors examined in

this research. In particular, when the illness narrative is strongly related to the patient's psychological adjustment and emotions, the EQ-5D alone may not adequately capture differences, lacking sensitivity to the psychological and emotional characteristics of the groups from which the patients studied were drawn. Future research should use specific measures that are more sensitive to these differences.

Limitations

Limitations of our research include the appearance of different sample sizes for the narrative types, which may have limited the power of the statistical analyses conducted. However, the discrepancy in group sizes can be reconciled with the practice of daily clinical health psychology care. Only 21 patients in our study sample of 140 patients narrated the quest story over the 20-month duration of the study, a proportion that reflects the experience of health psychology practice: patients report significantly lower rates of positive emotional perspectives and successful physical and psychological adjustment to their chronic illness than the opposite, negative emotional perspectives, as a chaos or restitution story. A further limitation of our study is the heterogeneity of the study sample in terms of patient diagnosis and thus disease course. Future research should aim at homogeneity of the sample and separation of chronic disease and cancer patient groups.

Conclusions and summary

Our results provide evidence that the illness narratives of Frank's theoretical framework adequately reflect the patient's emotions about the disease process and his or her activity or lack of activity in the recovery process, in other words, the patient's psychological adjustment, which are related to the emotional and mood states and stress level and perception of the illness, which are specific to the recovery process, in this case during the recovery period after surgery.

According to a summary by [50], in expressing emotions, both verbally and in writing, we label and attribute our emotions. This psychological process can reduce the subjective intensity of the emotion experienced and help us understand and reframe the triggering stressor [50]. Our results align with previous findings, highlighting the importance of exploring emotional aspects accompanying the disease process, as the emotional perspective provides insights into the emotional side of coping style during the disease process [55].

Furthermore, it is essential to emphasise the importance of the Emotional Graph of Illness Trajectory we used in exploring and constructing an emotion-focused disease narrative. The present graphic technique, following other narrative psychological tools, can help to put the experience of illness into perspective, restructure it, re-evaluate it through remembering, and thus restore the disconnectedness of life history, a psychological process that adaptively contributes to reducing the traumatic impact of illness [11, 12, 22, 32]. When clinicians attend to which type of narrative seems more critical than others, they can hear where the patient is [20]. For the patients, change cannot be hurried: it is generally preferable to accept less change than to seek to hurry change by pressing a patient toward a "better" narrative. The quest story is not a goal toward which the patient should move, nor does the chaos story represent personal or social failure. When experience becomes an object, the patient gains some distance between what is being lived and what is being told. Only at this critical distance can possible actions be seen, thus making change imaginable. Stories of the body's pains and the mind's fears may have to be told repeatedly before the patient begins to sort out what can be reinterpreted and changed. Based on the results of our research, we can see that getting to know and understand the patient's illness narrative provides insight into the process of understanding and adapting to the changes caused by the illness, at the mental, emotional and social levels. By understanding these factors, the psychologist can help patients who are telling their illness narrative to realize for themselves where they are in the psychological process of recovery and to find the factors that help them cope.

In summary, storytelling can help to restore a sense of personal control and reduce feelings of suffering, which are intrapersonal needs that are fundamentally damaged when facing a severe illness [19, 39].

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13030-024-00318-4.

Additional file 1: The additional file contains the instructions for and the grid graphic of the Emotional Graph of Illness Trajectory and the marking sheet.

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Authors' contributions
TL was responsible for the design of the research, data collection, statistical processing, interpretation of the data, and writing the manuscript. EK was involved in the design of the research and data collection. GL assisted in the planning of the research, the statistical interpretation of the data, and the writing of the manuscript. ML assisted in the design of the research, statistical interpretation of the data, and writing the manuscript.

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Data availability
The datasets generated and analysed during the current study are available in the Open Science Framework repository, [URL: https://osf.io/sytf5].

Declarations

Ethics approval and consent to participate
The authors declare that the study was conducted with the written informed consent of the participants. The ethics approval was provided by the Regional Research Ethics Committee (RKEB) of the University of Szeged, Albert Szent-Györgyi Health Centre, under Nr. 145/2020-SZTE.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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Body and Mind Programme for recovery from breast cancer: Evaluation of the impact of health promotion intervention carried out in a multidisciplinary team on health-promoting behaviours: a quasi-randomised-controlled clinical trial

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Abstract

Background A growing body of evidence suggests that a healthy lifestyle strongly correlates with better prognosis and reduced mortality among breast cancer patients. However, cancer survivors often struggle to adhere to lifestyle recommendations for maintaining health, and there is currently a lack of evidence in the literature on how to maintain commitment to a health-promoting lifestyle in these patients. Therefore, we aimed to develop a multidisciplinary health promotion intervention programme to support health-promoting behaviours in patients recovering from malignant breast cancer.

Methods Our quasi-randomised-controlled clinical trial involved breast cancer patients who were enrolled in the study two weeks before their primary breast surgery and then completed our follow-up six months after surgery. We conducted a preliminary sample size estimate (64 participants per group), and the final sample size consisted of 80 participants; 40 patients were assigned to the intervention group (Mean age: 52.63, SD: 9.05), and 40 patients belonged to the control group (Mean age: 52.63, SD: 8.81). The drop-out rates ranged between 0 and 55% during the measurement sessions. To measure the health-promoting lifestyle, the primary outcome of the present study, we used the Health-Promoting Lifestyle Profile II. Other assessment instruments were the Beck Depression Inventory, Spielberger's State and Trait Anxiety Scale, Perceived Stress Scale, Breast Impact of Treatment Scale, and Functional Assessment of Cancer Therapy Breast Scale. The impact of the intervention on health-promoting lifestyle was assessed by analysing the interaction and main effects of Group and Time, using a multilevel model.

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Results Our study showed a significant Group and Time interaction for the summative health-promoting lifestyle ($p=0.007$), physical activity ($p=0.01$), spiritual growth ($p=0.049$), and emotional well-being ($p=0.02$) variables in the intervention group.

Conclusions The results of our study suggest that the period immediately preceding adjuvant oncological treatment after primary breast surgery is an ideal time for implementing a multidisciplinary health promotion intervention. Additionally, the intervention demonstrated effectiveness in enhancing both physical and mental activity levels, which are crucial components of the recovery process in breast cancer patients.

Trial registration ISRCTN, ISRCTN12745329. Registered on 1 March 2024. Retrospectively registered, https://www.isrctn.com/ISRCTN12745329.

Keywords Malignant breast cancer, Breast surgery, Health promotion psychological intervention, Multidisciplinary team, Dietetic advice, Physiotherapy, Quasi-randomised-controlled clinical trial

Background

Breast cancer in females now stands globally as the most frequently diagnosed cancer [1]. A growing body of evidence suggests that a healthy lifestyle, defined by adequate levels of physical activity, healthy diet, appropriate weight control and low levels of stress, is strongly correlated with better prognosis, fewer depressive symptoms and lower mortality [2–12].

Although these recommendations – such as regular physical activity and healthy, Mediterranean diet including fruits, vegetables, whole grains, olive oils, and lean protein—may seem simple to follow, recent studies have found that breast cancer survivors are struggling to adhere to them [10, 13–19]. Research on physical activity levels in breast cancer survivors during the immediate period after breast cancer diagnosis (first six months) has reported decreases in physical activity in the proximate post-diagnosis period [13, 20–25]. Based on the literature, it was confirmed that women who have been diagnosed and treated for breast cancer often have special issues, such as lower life quality, psychological distress, and treatment-related adverse effects, that can cause a high risk of low health-promoting behaviour. Due to this, interventions should be pursued to encourage physical activity and a healthy diet in early-stage breast cancer patients and survivors [9, 13, 26].

Previous research has highlighted the impact of psychological interventions and protocols (e.g., mindfulness-based stress reduction, art therapy, physical exercises, or web-based interventions) on positive body image, well-being, and personal strength among patients with breast cancer [27–32]. Despite the numerous benefits and evidence, the simultaneous and complex use of behavioural lifestyle interventions in the breast cancer population has been limited to date. Most interventions focus on one aspect of lifestyle change, such as weight loss through a healthy diet and physical activity, improving stress management with cognitive-behavioral techniques, or enhancing quality of life through nutritional and exercise improvements [11, 33–39]. Current research has shown that physical activity is a safe, effective, and also essential part of survivorship planning; however, the period after treatment presents a new phase of vulnerability, during which breast cancer survivors face significant health promotion challenges [40–42]. Findings from previous studies indicate that there are specific time points (i.e., teachable moments) throughout the breast cancer treatment journey—especially before the start of chemotherapy—that are ideal for introducing healthy lifestyle behaviour interventions [26].

Objectives

The available literature suggests that a variety of health-promoting activities are beneficial for better prognosis, reduced depressive symptoms and lower mortality among breast cancer patients [2, 9, 10]. And we can also find biological evidence of the long-term preventive effects of lifestyle interventions and mind–body practices among cancer survivors [43–49]. However, there is currently a lack of evidence in the literature on how to arouse commitment to a health-promoting lifestyle in breast cancer patients [50]. We aimed to develop a multidisciplinary health promotion intervention programme for patients recovering from malignant breast cancer to support health-promoting behaviours, which we called the Body & Mind Programme. In our intervention programme, health promotion was based on psychological support, with a focus on improving physical activity and a healthy diet. The novelty of the present intervention lay in its use of psychological tools to support motivation related to health promotion by scheduling this programme during the sensitive period preceding oncological treatment. Our aim was to examine its effect on health-promoting behaviour in the months following breast surgery (2 weeks, 3 months and 6 months post-op). Our primary research question was: Does the intervention result in a significant, positive change in patients' postoperative health-promoting behavior? We hypothesized that our multidisciplinary health-promoting intervention results in positive changes in patients'

health-promoting behaviors at the time points examined after surgery.

Methods

Trial design

To test the effects of the multidisciplinary intervention, our research took the form of a quasi-randomised-controlled trial, with a treatment group receiving a health promotion intervention ($n = 40$, 50% of the sample) and a control group matched for diagnosis, medical treatment process, age and gender, with no intervention ($n = 40$, 50% of the sample). Based on participant allocation, our study follows a parallel group design. Based on the trial scope, the present study is a quasi-randomised-controlled trial in terms of randomisation design.

Participants

Our study included 80 women with malignant breast cancer who underwent primary breast surgery and adjuvant oncological treatment. Inclusion criteria were: female gender, aged 18–65, recently diagnosed with primary malignant breast tumor without neoadjuvant therapy or metastasis, tumor stage ranging from in situ (DCIS) to TIIIA, Grade I–III, sufficient physical and mental capacity for participation (no severe psychiatric, neurological, or sensory disorders), and an expected survival of more than six months. Recruitment began by reviewing surgical schedules in the clinic's breast surgery departments, then verifying patient data in the medical documentation system. Eligible patients were contacted by phone, informed about the study, and those who verbally agreed provided written informed consent during their first in-person meeting. All participants were contacted two weeks before their scheduled surgery.

Sample size

Our primary outcome measure was the health-promoting lifestyle, which was measured with the Health-Promoting Lifestyle Profile II Questionnaire. To determine an estimated health-promoting lifestyle score, we calculated the sample size for each group using the formula of the independent sample mean tests. The calculation parameters were set at $\alpha = 0.05$ and $\beta = 0.20$, assuming a medium effect size, with a two-tailed test, using the G Power 3.1.9.7 software [51, 52]. The sample size for each group was calculated to be 64 patients. However, by taking into account the inclusion criteria and the drop-out rate that occurred, we were able to reach 40 individuals per group. Based on a preliminary assessment of sample sizes used in lifestyle interventions among breast cancer patients published in previous years, the sample size used in the present study can be considered comparable [11, 36, 53].

Sampling and random assignment

This clinical trial selected through purposive sampling. It is a single-centre, quasi-randomised-controlled clinical trial without blinding, conducted in accordance with the Declaration of Helsinki and approved by the Regional Research Ethics Committee (RKEB) at the University of Szeged, Albert Szent-Györgyi Health Centre [54]. The approval number is 50/2020-SZTE.

All of the breast cancer patients in our study sample had a prior Oncoteam decision to undergo primary breast surgery. After this decision, they were added to the waiting list of the clinic's breast surgery wards in chronological order. Patients were operated on according to their position on the waiting list. Breast surgeries are performed weekly in both breast surgery departments of the clinic, two days a week. Both breast-conserving and mastectomy surgeries are performed these days. When patients are added to the waiting list, their surgeon registers them in the surgical calendar for either the first (Day A) or second day (Day B) of breast surgery each week, depending on available capacity—that is, the number of breast surgery slots available on those days. The scheduling of each patient was determined solely based on surgical capacity; the clinical characteristics of the patient did not influence the scheduling decision. This method of surgical assignment provided the basis for the patient-level random allocation of our study sample. In designing the randomisation process, we prioritized pragmatic research aspects: the goal was to evaluate the intervention under real-world conditions, focusing on assessing its effectiveness. During the development of our research setup, we aimed to keep pragmatic considerations at the forefront to ensure that the intervention's design and testing reflected routine clinical practice as closely as possible [55]. Taking these practical considerations into account, we designed a quasi-randomised-controlled clinical trial. Patients scheduled for the first surgery day (Day A) were assigned to the intervention group, while those on the second day (Day B) went to the control group, based on random assignment by surgery day. This randomisation method was selected because group intervention sessions occurred the day before and after surgery, so patients operated on on the same day formed one group. The investigator responsible for the enrollment, provided information and assigned participants to groups.

New patients were enrolled weekly, with each week treated as one block, aiming for a 1:1 group ratio. Typically, 3–8 eligible patients were registered per surgery day; about 50% were approached, and 90% of those agreed to participate, with rates varying by block. Random allocation was determined by the surgical waiting list order and corresponding surgery day, which were set

by surgeons, ensuring allocation concealment and preventing investigator influence.

The health promotion intervention programme

The foundation of our intervention was based on the *Health Promotion Model* (HPM) developed by Nola Pender [56–58]. A five-session, multidisciplinary, health-promoting intervention designed to support recovery from breast cancer by enhancing the patient's physical and mental activity and by awakening their motivation and ability to change their lifestyle and improve their health. The structure of the intervention is based on psychological, dietetic, and physiotherapeutic theoretical and practical content. The intervention process spans three weeks, comprising of two pre-operative and three post-operative sessions, conducted in both individual and group settings. The first to fourth sessions were in a face-to-face format, in an individual or group setting. The fifth session took the form of a video that focussed on the further development of physiotherapy, delivered via an online platform. The face-to-face interventions took place in the psychological consultation room of the surgical clinic. In all cases, the psychological intervention sessions were conducted by the same investigating psychologist, who was a health psychologist employed by the surgical clinic. Similarly, physiotherapy interventions were carried out by the same physiotherapist working in the surgical clinic, in the patients' rooms. The recommended post-operative exercise routine was presented to all breast surgery patients on the day following surgery, and the intervention group received additional educational materials. The dietary advice was compiled by a dietitian employed by the clinic. Dietetic care is not part of the primary care for breast surgery; only members of the intervention group received this care. The same dietetic brochure was given to each participant, which also covers dietary guidelines for common metabolic diseases such as diabetes. The content of the intervention programme is presented in Table 1. Only members of the intervention group will benefit from the programme's elements.

Supportive psychological intervention

The content of the intervention is structured around the exploration of individual characteristics and experiences, with an emphasis on the patient's current recovery process (sessions 1 and 2). (Table 1). Subsequently, in the post-operative period of the intervention, the focus shifts to exploring and supporting behaviour-specific cognitions and emotions, such as perceived benefits of action, perceived barriers to action, perceived self-efficacy, and activity-related affect (sessions 3–5), which determine commitment to a plan of action. The supportive psychological intervention was conducted with a positive psychological approach, seeking to achieve the richest possible individual self-expression during individual and group intervention sessions.

Physiotherapy

It is important to begin moving as soon as possible while respecting the restrictions and protecting the surgical wound. The elements of physiotherapy include breathing exercises, venous exercises, increasing the range of motion, muscle strengthening and stretching. It is essential to avoid constraint, relieve restrictions on movement, prevent and treat lymphoedema, and prevent and relieve muscle flattening. The aim is to improve the range of motion of the shoulder girdle and hip, increase muscle strength and prevent possible complications (lymphoedema, abnormal protractile-elevators posture). The gymnastics consisted of exercises with short and then long load arms, increasing repetitions and speed. The gymnastics programme also included functional and complex exercises with equipment to enhance the efficiency of improved functions. An additional long-term goal of the exercise programme is to help patients establish a daily exercise routine with correct breathing techniques. For participants in the intervention, in addition to basic physiotherapy care, two weeks after the breast surgery, an extended exercise routine lasting 30 min was sent out in a video via an online interface, incorporating elements based on the currently recommended, previously known exercise routine. In addition to the exercise programme, patients also received a stretching exercise video that demonstrated a series of exercises to stretch the muscles, with the assistance of physiotherapists [63].

Dietetic advice

This aims to develop knowledge about optimal, healthy eating. The tool for the healthy eating recommendation is a paper brochure given to patients during a group health promotion intervention on the day after breast surgery. The contents of the brochure were compiled by a dietician working at the clinic and include the basic pillars of a healthy diet, such as the structure of a regular meal, the ideal quality and quantity of vegetables, fruit, cereals, dairy products and meat, adequate fluid intake, and suggestions for healthy meals to prepare at home, as well as further recommendations for metabolic diseases [59, 64].

Observed psychological factors and the applied measurement tools

During the baseline (T0) survey, we assessed the patients' basic *sociodemographic characteristics*, such as their age, type of residence, education, work activity, and marital status, before they completed the questionnaires. On this occasion, we also assessed the patients' *health behaviours* in relation to smoking, alcohol consumption, physical

Table 1 The content of the multidisciplinary intervention sessions

Intervention sessions	Timing of intervention	The framework of the session	Interventional content and aim
First	One week before breast surgery	Supportive psychological intervention, individually, lasting 90 min	Reassurance about the surgical intervention: Starting psychological preparation for a breast surgery, elaboration of emotions related to the surgery, increasing the patient's activity. Psychoeducation on the role of psychological factors in healing. Identification of individual risk behaviors and health risk habits Applied instruments: - Emotional Graph of Illness Trajectory [59]: The aim is to map the emotional representation of the disease process, to understand the patient's disease narrative - PRISM-D (Pictorial Representation of Illness and Self Measure – Drawing version) non-verbal drawing test [60]: Aims to map current psychosocial status, perception of illness and psychological resources - Autogenic training relaxation [61]: Learning the first element of the relaxation exercise sequence (relaxation). Brief introduction to the purpose of relaxation. Incorporating a positive, suggestive thought into the relaxation text. Suggestion for daily practice
Second	One day before breast surgery	Supportive psychological intervention, in a group, lasting 120 min	Reassurance about the surgical intervention: Continuing psychological preparation for surgery, elaboration of emotions related to surgery. Use of group discussion Applied instruments: - Using images that symbolise emotions as a projection surface for patients to express their emotions - Johari Window exercise [62]: to identify positive, empowering, healing personality traits and characteristics - Autogenic training relaxation [61]: repetition of the first element of the exercise sequence, practised together to conclude the intervention
Patients undergo breast surgery			
Third	One day after breast surgery	Postoperative physiotherapy, individually, lasting 15 min Health-promoting psychological intervention, in group, lasting 120 min	Physiotherapy: On this day, patients will receive physiotherapy as part of their ward care. During the group health promotion intervention session following the exercise on this day, the experience of physiotherapy and its role in health promotion is discussed in a group setting Applied instruments: Description of the therapeutic exercises for the next two weeks in printed form Mapping, supporting and educating about motivation for health promotion: In the introductory phase of the session, the experience of the surgery will be discussed. The aim of the intervention is to explore the patient's knowledge of health promotion. This session also aims to educate participants on the following health promotion topics: nutrition, exercise in relation to physiotherapy, stress management and sleep hygiene Applied instruments: - Strategies to enhance motivation: • Importance scale: how important does the patient consider the improvement of her health to be (using a scale of 1–10)? Aim to elicit change narrative • Self-confidence scale: how confident does the patient feel about her ability to implement the behavior change (on a scale of 1–10)? The aim is to achieve change narrative • Exploring health-related goals and values • Looking ahead: how would the patient's life change if behavior change were to occur? • Identify strengths or past successes • Exchange of information between group members and with the group leader psychologist • Autogenic training relaxation Dietetic information: During this session, patients will be given a brochure with information on healthy eating, taking into account the patient's current healing process, possible metabolic diseases (e.g. diabetes). The content of the brochure was prepared by a dietician Applied instruments: - Printed brochure: information on healthy eating
Fourth	One week after breast surgery	Health-promoting psychological intervention, individually, lasting 45 min	Supporting health promotion: To clarify and support the patient's individual goals and plans in the context of the postoperative condition. To review and summarise previous education on health promotion Applied instruments: - Drawing exercise: symbolizing the healing process in the form of a drawing made by the patient as a projective surface
Fifth	Two weeks after breast surgery	Video of a gymnastics exercise, shared online, lasting 30 min	Further development of gymnastics for recovery: For patients, after two weeks following breast surgery, the exercise routine can be made more difficult and extended. This extended exercise sequence is recorded on video, with a physiotherapist instructing the exercise sequence and another physiotherapist demonstrating it. This video was sent to the patients by e-mail Applied instruments: - Video: demonstration of the extended gymnastics training series

activity, nutrition and stress management. In addition, the patient's *medical data* at the baseline measurement were recorded, including the exact diagnosis, tumour stage classification, tumour nuclear grade, and the type of surgery the patient will undergo. The histological results of breast surgery (staging, grade) were recorded and refined. During the longitudinal study process, the type of adjuvant oncological treatment and the number of treatments received were also recorded.

In this study, we examined the dimensions of health-promoting lifestyle as the primary outcome measure, while our secondary outcome measures are anxiety, depression, perceived stress, quality of life, and the impact of breast treatment as screening outcomes for monitoring the psychological well-being of patients. The measurement timings for the different factors tested during the longitudinal study process are reported in Table 2.

The Health-Promoting Lifestyle Profile II (HPLP II) questionnaire was used to assess the *health promotion lifestyle behaviours* in our study [65]. The HPLP II measures health-promoting behaviours, conceptualised as a multidimensional pattern of self-initiated actions and perceptions to maintain or enhance an individual's well-being, self-actualisation and fulfilment. The 52-item, summative behaviour assessment scale uses a 4-point (1 = never, 2 = sometimes, 3 = often, 4 = routinely) response format to measure the frequency of self-reported health-promoting behaviours in six domains: health-related responsibility (9 items), physical activity (8 items), nutrition (9 items), spiritual growth (9 items), interpersonal relationships (9 items) and stress management (8 items)—the scale scores from 1 to 4 per item. The use of means rather than sums of scale items is recommended to preserve the 1–4 metric of item responses and to allow a meaningful comparison of scores between subscales. A higher score indicates a higher level of engagement in a health-promoting lifestyle. The questionnaire is suitable for use in research within the Health Promotion Model [66]. In our study, the internal reliability of the HPLP II questionnaire was found to be excellent (Cronbach's alpha = 0.92).

We assessed patients' *state anxiety* using the Spielberger State-Trait Anxiety Inventory (STAI-S). The current anxiety level (state anxiety questionnaire) includes 20 items, uses a 4-point Likert scale, and scores range from 20 to 80, in which a higher score indicates a higher level of current anxiety [67]. In our study, the internal reliability of the questionnaire was found to be excellent for the STAI-S scale (Cronbach's alpha = 0.95).

We also assessed depression level using the Beck Depression Inventory 9-item shortened version (BDI-9). The questionnaire measures the presence of certain symptoms of depression over the past month, such as social withdrawal, indecision, fatigue, sleep disturbance, inability to work, pessimism, lack of pleasure, self-blame, and satisfaction. It uses a 4-point Likert scale ranging from 0 to 27 points [68]. The internal reliability of the instrument was adequate in our study (Cronbach's alpha = 0.79).

We measured stress levels and subjective stress perception using a shortened 10-item version of the Perceived Stress Scale (PSS-10). The respondent is asked to rate on a 5-point Likert scale how often in the past month he or she has experienced a particular feeling or thought that characterizes stress [69]. The questionnaire scores from 0 to 40. The reliability of the questionnaire in our study sample was also found to be adequate (Cronbach's alpha = 0.87).

We assessed the *quality of life* of our study participants using the Functional Assessment of Cancer Therapy—Breast (FACT-B) scale. FACT-B is a 37-item questionnaire with 5-point Likert scale, designed to measure five domains of health-related quality of life in breast cancer patients, for the last seven days: Physical, social, emotional, functional well-being, and a breast-cancer subscale [70]. The reliability of the questionnaire in our study sample was also found to be excellent (Cronbach's alpha = 0.92).

We also measured the *impact of breast treatment* in our study sample, using the Breast-Impact of Treatment Scale (BITS). The 15-item, 4-point Likert scale questionnaire measures experiences and satisfaction with body image change and symptoms of traumatic stress associated with

Table 2 Timing of measurements of the variables

Variables	Baseline: Two weeks before surgery (T0)	One day before surgery (T1)	Two weeks after surgery (T2)	Three months after surgery (T3)	Six months after surgery (T4)
Health-promoting lifestyle	✓	-	✓	✓	✓
State anxiety	✓	✓	✓	✓	✓
Depression	✓	✓	✓	✓	✓
Perceived stress	✓	-	✓	✓	✓
Impact of breast treatment	-	-	✓	✓	✓
Quality of life	✓	✓	✓	✓	✓

body image change [71]. The reliability of the questionnaire in our study sample also proved to be adequate (Cronbach's alpha = 0.80).

Data collection procedure

The timing of the longitudinal study was aligned with the implementation schedule of the intervention sessions. Participants were first contacted two weeks prior to breast surgery (T0). Based on randomised surgical scheduling, individuals assigned to the control group were informed by telephone and, upon consent, received the baseline assessment package. Participants allocated to the intervention group were also contacted by telephone, provided with an introduction to the intervention program, and sent the same baseline assessment materials.

The first intervention session occurred one week before surgery. The second session took place the day before surgery, followed immediately by the second measurement session (T1). Subsequent intervention sessions were conducted the day after surgery, one week post-surgery, and two weeks post-surgery, coinciding with the third measurement session (T2). Follow-up assessments were administered three months (T3) and six months (T4) after surgery. The schedule of interventions and measurement points is presented in Fig. 1.

Recruitment, group allocation, and data collection were all conducted by the same investigator, who was aware of participant group assignments. Participants were also informed of their allocation, as the intervention was integrated into the perioperative process and required coordination with the patient. Following verbal consent, the baseline questionnaire, participant information sheet, and consent form were sent electronically or by post. Participants returned completed materials and signed consent forms at their first in-person meeting with the investigator. During the briefing prior to baseline measurement, both groups were provided only with information relevant to their respective study conditions to ensure procedural consistency.

Statistical methods

Our longitudinal study, conducted in a quasi-randomised-controlled trial design, employed a treatment control pre-post-follow-up (TCPPF) design to describe the data obtained [70]. Statistical analyses were performed using SPSS version 25.0 [72]. G-Power 3.1 was used to estimate the study sample size [51]. Graphs showing statistical results were created using R Studio [73]. The limit of statistical significance was set at $p < 0.05$. Before analysing the data, normality tests were performed on the mean values of all examined continuous variables, performing the normality test separately in the two groups to be tested, using the Kolmogorov–Smirnov test. To compare sociodemographic, health behaviour, and disease-related characteristics between the intervention and control groups, the independent t-test and Chi-squared test were used. Within the framework of descriptive statistics presenting the results for the groups studied, group comparisons were made using independent samples t-tests, and Mann–Whitney U tests for variables with non-normal distributions. Changes in health promotion lifestyle and psychological factors over time were examined using a multilevel model including random intercept per subject. In all cases, the intercept value of the model constructed for all variables under investigation is the last measurement value of the control group (Time 4), since this is how the variables are coded in the database. By default, SPSS considers the last category (i.e. Time = 4, Group = 2) as the reference category [74]. The covariance structure of the variance

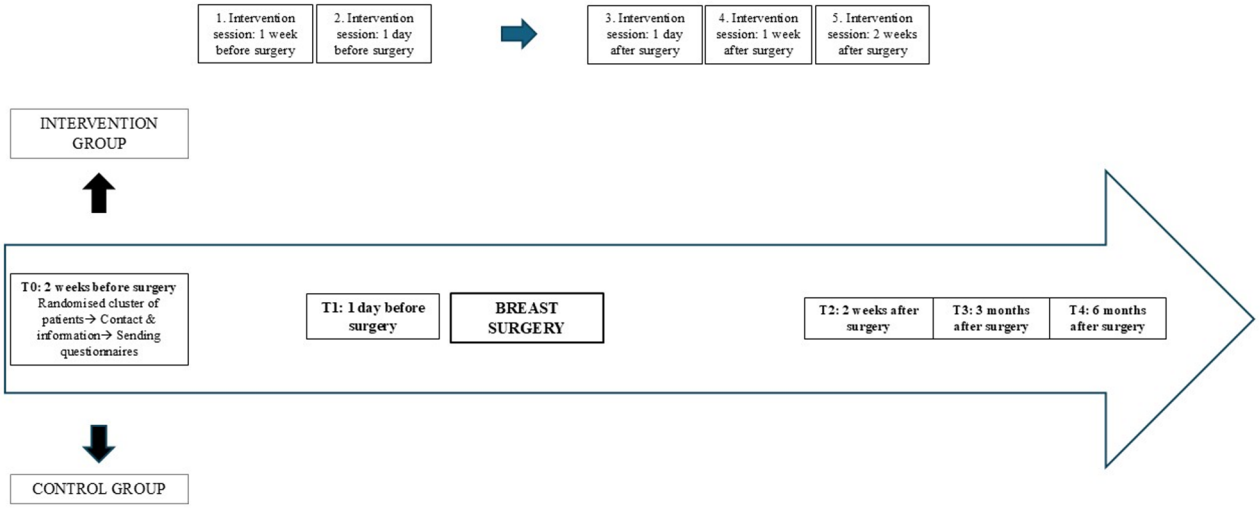

Fig. 1 Flowchart of timing of measurements and intervention sessions

components was selected. We chose to implement a multilevel model in order to optimally handle missing data [75, 76].

Results

Participants and descriptive statistics

Figure 2 presents the flowchart of the development of study sample. After verifying inclusion criteria and willingness to participate in the study, 80 eligible women out of a total of 86 women aged 18–65 were quasi-randomly allocated to the intervention ($n = 40$) and control ($n = 40$) groups. The number of participants remained constant in the preoperative period, but attrition occurred during the follow-up study period. The drop-out rates during the measurement sessions were as follows: T1:0%; T2:32,5%; T3: 47,5%; T4: 55%. The

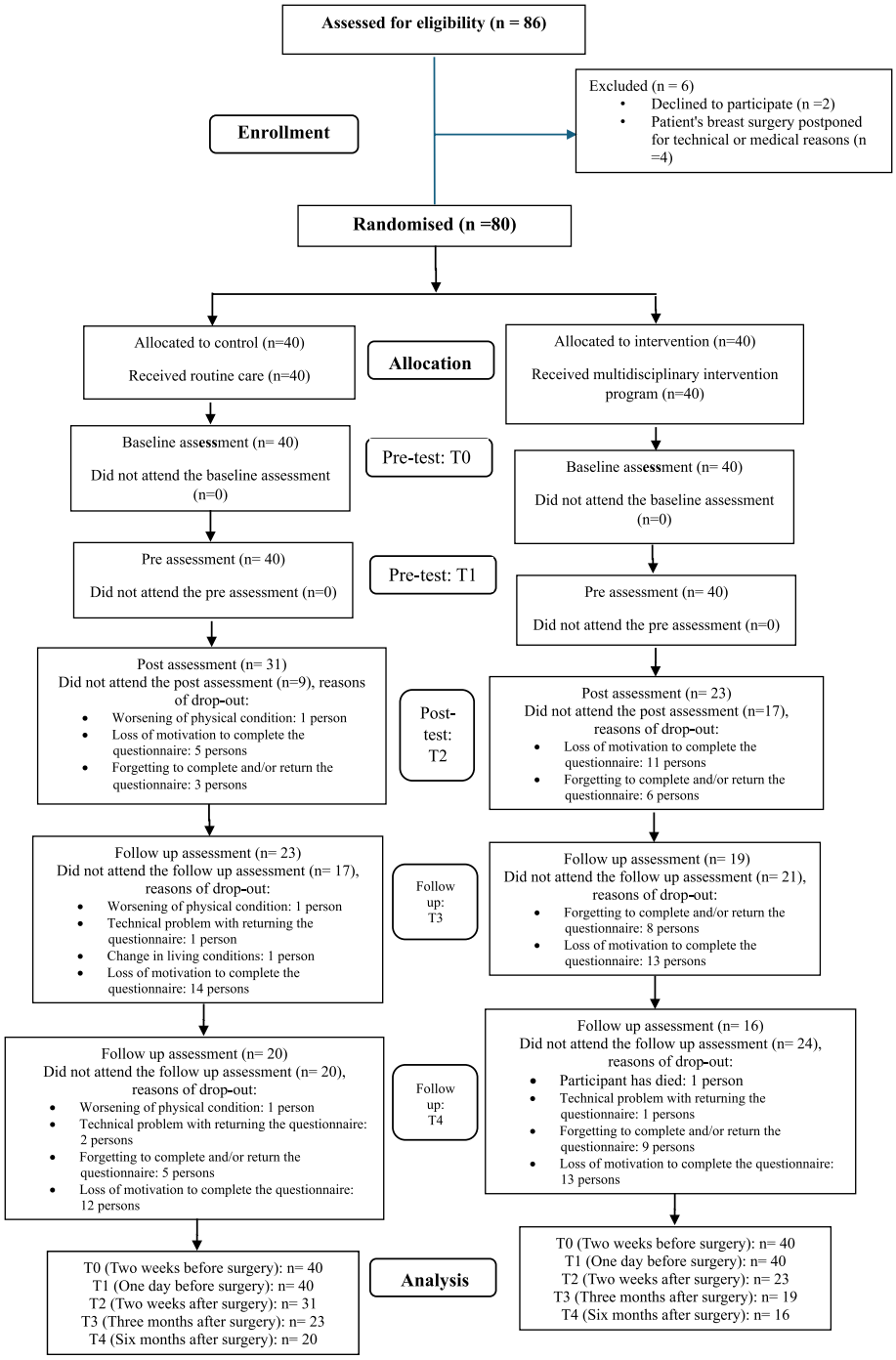

Fig. 2 Flowchart of development of the study sample

recruitment period for participants in this study lasted from January 19, 2022, to May 18, 2023. The follow-up period ended on December 15, 2023.

The mean age of the total sample was 52.63 years (SD: 8.88, range: 30.00–65.00 years), and the mean age of both the intervention and control groups was 52.63 years ($p = 1.00$) (Table 3). No significant differences were found between the intervention and control groups for sociodemographic factors ($p > 0.05$ in all cases), health behaviors ($p >= 0.05$ in all cases), and clinical data ($p > 0.05$ in all cases).

For the intervention group ($n = 40$) and the control group ($n = 40$), the descriptive statistics of the results and the comparisons of groups obtained from the questionnaires used are presented in Tables 4a and 4b (Supplementary material 1: Table 4a and 4b).

Effects of intervention on health promotion lifestyle behaviours

In our analysis, we examined the main effect of Group (intervention and control) as a between-subject factor and Time (baseline and four additional measurement occasions) as a within-subject factor, and the Group-by-Time interaction for the values of the health behaviour and psychological variables assessed. Our results for the main effects and the interactions are reported in Table 4. There were no significant differences between the intervention and control groups in the health-promotion lifestyle dimensions and psychological factors assessed at baseline ($p > 0.05$ in all cases) (Supplementary material 1: Table 4a).

Examining the health promotion lifestyle outcomes, the intervention group had significantly more positive health responsibility than the control group, for the *Health responsibility* dimension there was a main effect for Group, F (1,85.021) = 6.934, $p = 0.01$, and there was a main effect for Time, F (3, 140.897) = 3.044, $p = 0.03$, what means for this factor, significantly different results were obtained at the different time periods assessed (Table 4). However, no significant interaction was found between Group and Time. Our other results show no significant Time or Group main effect or Group-by-Time interaction for the health promotion lifestyle *Nutrition* dimension (Table 4).

There was no significant Group and Time main effects when examining the *Physical activity* dimension. However, significant Group-by-Time interaction appeared for this dimension, F (3, 141.78) = 3.88, $p = 0.01$, which means that the changes in the value of physical activity were significantly different between the two groups, whereby an increase was observed in the intervention group, as opposed to decreasing or no changes in the control group over time (Table 4). Statistically significant interaction (Group-by-Time) contrast was found between baseline (Time 0) and six months (Time 5), $\psi_{04} = -0.493$ ($SE = 0.206$), $t(146.287) = -2.394$, $p = 0.02$, 95% CI [−0.900, −0.086]. The physical activity scores of the investigated groups are presented in Fig. 3.

When examining the *Stress management* dimension, there was a main effect for Time, $F = (3, 130.72) = 6.719$, $p < 0.001$, which shows that there were significantly different results in the different time periods assessed. There was no significant main effect for Group and no significant interaction between Group and Time (Table 4).

The analysis of the *Interpersonal relationships* dimension revealed a significant Group main effect, F (1, 79.76) = 5.436, $p = 0.02$, which means that the intervention group has significantly more positive interpersonal relationships than the control group (Time 5). There was no significant main effect for Time and no significant interaction between Group and Time.

Examining the *Spiritual growth* dimension, there was a significant Group main effect, F (1, 80.578) = 5.528, $p = 0.02$, which means that the intervention group has a significantly higher level of spiritual growth experience than the control group (Table 4). No significant main effect was confirmed for Time. However, a significant Group-by-Time interaction was found for this dimension, F (3, 129.664) = 2.697, $p = 0.049$, which means that the changes in the value of spiritual growth were significantly different between the two groups, whereby an increase was observed in the intervention group, as opposed to decreasing or no changes in the control group over time (Table 4). Statistically significant interaction (Group-by-Time) contrast was found between baseline (Time 0) and six months (Time 4), $\psi_{04} = -0.292$ ($SE = 0.123$), $t(132.275) = -2.366$, $p = 0.02$, 95% CI [−0536, −0.047]. The spiritual growth scores of the investigated groups are presented in Fig. 4.

When assessing the *Total value of the health promotion lifestyle*, this value was significantly higher in the intervention group than in the control group, because a significant Group main effect was found, F (1, 82.63) = 6.263, $p = 0.014$, in addition, no significant main effect was found for Time. Still, the Group-by-Time interaction was significant, F (3,132.142) = 4.170, $p = 0.007$, which means that the changes in the value of the total value of health promotion lifestyle were significantly different between the two groups, whereby an increase was observed in the intervention group, as opposed to decreasing or no changes in the control group over time (Table 4). Statistically significant interaction contrast was not found between any time periods. The total value of health promotion lifestyle scores of the investigated groups is presented in Fig. 5.

Table 3 Detailed description of the study sample (n = 80) divided into intervention and control groups

	Intervention group (n =40)	Control group (n=40)	χ^2 or t	p
Sociodemographic characteristics				
Mean age in year ± SD	52,63 ± 9.05	52,63 ± 8.81	0.00	1.00
Employment activity, n (%)				
Active workers	23 (57.5)	26 (65)	3.05	0.69
On sick leave	6 (15.0)	2 (5.0)		
Disability pension	1(2.5)	2 (5.0)		
Unemployed	2 (5.0)	1 (2.5)		
Retired	6 (15.0)	6 (15.0)		
Others	2 (5.0)	3 (7.50)		
Domicile, n (%)				
Live in the capital	0 (0)	1 (2.5)	1.13	0.57
Live in a city	33 (82.5)	31 (77.5)		
Live in village	7 (17.5)	8 (20.0)		
Marital status, n (%)				
Single	3 (7.5)	5 (12.5)	8.44	0.13
In a relationship	6 (15.0)	9 (22.5)		
Married and lived with their spouse	26 (65.0)	18 (45.0)		
Married but not living with their spouse	2 (5.0)	0 (0)		
Divorced	1 (2.5)	6 (15.0)		
Widowed	2 (5.0)	2 (5.0)		
Level of education, n (%)				
Primary qualifications	5 (12.5)	0 (0)	8.28	0.22
Intermediate qualifications	22 (55.0)	22 (55.0)		
>College	13 (32.5)	18 (45.0)		
Health behaviors				
Smoking, n (%)				
Active smoker	9 (22.5)	6 (15.0)	5.63	0.23
Occasionally	3 (7.5)	0 (0)		
Quit smoking	9 (22.5)	11 (27.5)		
Never tried	18 (45.0)	19 (47.5)		
Otkers	1 (2.5)	4 (10.0)		
Alcohol consumption, n (%)				
Never consumed	14 (35.0)	9 (22.5)	5.38	0.15
Monthly or less	21 (52.5)	20 (50.0)		
Twice or four times a month	4 (10.0)	11 (27.5)		
Twice or four times a week	1 (2.5)	0 (0)		
Active physical activity, n (%)				
Very rarely, almost never	13 (32.5)	5 (12.5)	9.50	0.05
Less than once a week	8 (20.0)	11 (27.5)		
Once a week	9 (22.5)	11 (27.5)		
At least three times a week	4 (10.0)	11 (27.5)		
Every day	6 (15.0)	2 (5.0)		
Healthy nutrition, n (%)				
Moderately or less	21 (52.5)	21 (52.5)	1.82	0.79
Predominantly or entirely	19 (47.5)	19 (47.5)		
Stress management, n (%)				
Stress management exercises once a week or less frequent	37 (92.5)	32 (80.0)	7,83	0.19
Several times a week or every day	3 (7.5)	8 (20.0)		
Clinical characteristics				
Type of surgery, n (%)				
Excisio	25 (62.5)	20 (50.0)	1.28	0.53
Mastectomy	11 (27.5)	15 (37.5)		
Mastectomy and implantation	4 (10.0)	5 (12.5)		

Table 3 (continued)

	Intervention group (*n* =40)	Control group (*n*=40)	χ^2 or *t*	*p*
Stage of the tumor, n (%)				
i.s. (DCIS)	2 (5)	5 (12.5)	2.06	0.56
I	22 (55.0)	19 (47.5)		
II	14 (35.0)	15 (37.5)		
III	2 (5.0)	1 (2.5)		
Grade of the tumor, n (%)				
I	10 (25.0)	5 (12.0)	5.26	0.07
II	19(47.5)	25 (62.5)		
III	11 (27.59	10 (25.0)		
Adjuvant oncological treatment, n (%)				
Received chemotherapy	14 (35.0)	14 (35.0)	0.45	0.5
Mean number of chemotherapy treatments ± SD	5.64 ± 7.66	5.16 ± 7.01	0.27	0.78
Received radiotherapy	25 (62.5)	18 (45.0)	0.26	0.61
Mean number of radiotherapy treatment ± SD	9.64 ± 9.30	10.14 ± 9.83	−0.203	0.84

Effects of intervention on psychological factors

We also evaluated the main effect of Group (intervention and control) as a between-subject variable and Time (baseline and four additional measurement occasions) as a within-subject variable, and the Group-by-Time interaction for the psychological factors observed in conjunction with health behaviour, also based on random intercept values, using a multilevel model. The covariance structure of the variance components was selected. Our results on the analysis of main effects and interactions are presented in Table 4. There were no significant differences between the intervention and control groups in the psychological factors assessed at baseline ($p > 0.05$ in all cases) (Supplementary material 1: Table 4a).

For the assessment of *State anxiety*, there was a main effect for Time, F (4,211.397) = 15.778, $p < 0.001$, which means that for this factor, significantly different results were obtained at the different time periods assessed (Table 4). There was no main effect for Group and no significant Group-by-Time interaction. In the Depression assessment, there was a main effect for Time, F (4,210.029) = 3.191, p = 0.014, indicating that results differed significantly across the assessed time periods (Table 4). Furthermore, there was no main effect for Group and no significant Group-by-Time interaction. The *Perceived stress* analysis revealed a significant Time main effect, F (3, 136.355) = 7.056, $p < 0.001$, which means that for this factor, significantly different results were obtained at the different time periods assessed. No main effect was observed for Group and no significant Group-by-Time interaction was confirmed. In case of assessment for the *Impact of breast treatment* there was a main effect for Time, F (2, 68.064) = 4.242, $p = 0.018$, which means for this factor, significantly different results were obtained at the different time periods assessed (Table 4). No main effect of Group was observed, and no significant Group-by-Time interaction was observed.

The *Quality of life physical well-being dimension* revealed a significant Time main effect, F (4, 214.197) = 4.473, $p = 0.002$, which means that significantly different results were obtained at the different time periods assessed (Table 4). No significant main effect was found for Group, and the Group-by-Time interaction was not significant. For the *Quality of life social well-being dimension*, there was no Group or Time main effect, and the interaction of these factors was not found to be significant (Table 4). A significant Time main effect was found for the *emotional well-being dimension of Quality of life*, F (4,204.828) = 11.568, $p < 0.001$, what means for this factor, significantly different results were obtained at the different time periods assessed, but this main effect was not confirmed for the Group. However, significant Group-by-Time interaction appeared for this dimension, F (4, 204.828) = 2.807, $p = 0.02$, which means that the changes in the value of emotional well-being were significantly different between the two groups, whereby an increase was observed in the intervention group, as opposed to decreasing or no changes in the control group over time (Table 4). Statistically significant interaction (Group-by-Time) contrast was found between baseline (Time 0) and three months (Time 3), $\psi_{03} = -2.383$ ($SE = 1.173$), $t(202.265) = -2.032$, $p = 0.04$, 95% CI [−4.695, −0.070]. The emotional well-being scores of the investigated groups are presented in Fig. 6. There were no significant Time or Group main effects for the *Quality of life functional well-being and other concerns about breast cancer treatment dimensions*, and no significant Group-by-Time interaction (Table 4).

Discussion

In the field of oncology, postoperative health management plays a significant role in patient recovery and prognosis. For patients with breast cancer, active adherence to health behaviour, after receiving surgical treatment,

Table 4 The results of the analysis of main effects and interactions of Group and Time, for all variable examined

Variable	Group	Baseline: Two week before surgery (T0; before the intervention session)	One day before surgery (T1; immediately after the intervention session)	Two weeks after surgery (T2; immediately after the closure of intervention)	Three months after surgery (T3; 2.5 months after intervention)	Six months after surgery (T4; 5.5 months after intervention)	*F*	*p*
Health promotion lifestyle, mean ± SD								
Health responsibility	Intervention	2.36 ± 0.40	-	2.62 + 0.39	2.64 + 0.48	2.46 + 0.46	group = 6.93	0.01*
	Control	2.28 ± 0.41		2.22 ± 0.39	2.33 ± 0.49	2.34 ± 0.44	time = 3.04	0.03*
							group x time = 2.64	0.05
Nutrition	Intervention	2.72 ± 0.47	-	2.85 ± 0.47	2.86 ± 0.49	2.88 ± 0.47	group = 4.13	0.05
	Control	2.56 ± 0.43		2.58 ± 0.46	2.62 ± 0.41	2.72 ± 0.34	time = 1.36	0.26
							group x time = 0.67	0.57
Physical activity	Intervention	2.17 ± 0.58	-	2.51 ± 0.67	2.41 ± 0.62	2.65 ± 0.51	group = 0.89	0.35
	Control	2.35 ± 0.85		2.19 ± 0.51	2.33 ± 0.71	2.19 ± 0.62	time = 1.47	0.23
							group x time = 3.88	0.01*
Stress management	Intervention	2.29 ± 0.50	-	2.60 ± 0.46	2.59 ± 0.48	2.53 ± 0.37	group = 1.07	0.30
	Control	2.31 ± 0.55		2.37 ± 0.52	2.39 ± 0.48	2.39 ± 0.46	time = 6.72	< 0.001*
							group x time = 2.65	0.05
Interpersonal relationships	Intervention	3.27 ± 0.43	-	3.28 ± 0.44	3.22 ± 0.51	3.23 ± 0.49	group = 5.43	0.02*
	Control	3.10 ± 0.50		2.99 ± 0.46	3.03 ± 0.50	3.15 ± 0.52	time = 1.63	0.19
							group x time = 0.67	0.58
Spiritual growth	Intervention	2.94 ± 0.46	-	3.00 ± 0.50	3.00 ± 0.60	3.10 ± 0.50	group = 5.53	0.02*
	Control	2.85 ± 0.56		2.65 ± 0.47	2.82 ± 0.50	2.77 ± 0.42	time = 1.36	0.26
							group x time = 2.70	0.049*
Total score	Intervention	2.63 ± 0.32	-	2.82 ± 0.39	2.79 ± 0.38	2.81 ± 0.34	group = 6.26	0.01*
	Control	2.58 ± 0.39		2.51 ± 0.38	2.59 ± 0.38	2.61 ± 0.32	time = 2.33	0.08
							group x time = 4.17	0.007*
Psychological factors, mean ± SD								
State anxiety	Intervention	46.90 ± 11.56	45.10 ± 10.67	38.30 ± 10.84	37.26 ± 11.93	36.56 ± 8.28	group = 0.93	0.34
	Control	48.87 ± 11.87	46.63 ± 11.29	43.73 ± 11.63	40.65 ± 9.28	38.20 ± 8.59	time = 15.78	< 0.001*
							group x time = 0.31	0.87
Depression	Intervention	3.43 ± 2.84	2.48 ± 2.30	2.52 ± 3.62	2.89 ± 2.92	2.63 ± 2.13	group = 2.34	0.13
	Control	4.20 ± 3.57	3.68 ± 3.51	4.16 ± 3.63	4.26 ± 4.53	3.00 ± 3.04	time = 3.19	0.014*
							group x time = 0.61	0.66
Perceived stress	Intervention	16.38 ± 5.92	-	14.87 ± 7.21	12.84 ± 7.26	12.75 ± 6.90	group = 2.19	0.14
	Control	17.68 ± 5.52		17.81 ± 5.00	15.13 ± 6.86	13.55 ± 5.26	time = 7.05	< 0.001*
							group x time = 0.40	0.75
Impact of breast treatment	Intervention	-	-	24.5 ± 19.38	19.50 ± 16.83	20.19 ± 16.24	group = 0.05	0.83
	Control			27.47 ± 20.92	24.26 ± 22.05	24.21 ± 21.13	time = 4.24	0.02*
							group x time = 0.78	0.47
Qualitiy of life – physical well-being	Intervention	24.33 ± 3.43	25.24 ± 3.23	22.70 ± 6.01	21.58 ± 7.44	23.50 ± 5.20	group = 0.50	0.48
	Control	23.53 ± 4.66	23.66 ± 4.55	21.77 ± 4.65	22.09 ± 5.52	22.90 ± 5.01	time = 4.47	0.002*
							group x time = 0.41	0.80

Table 4 (continued)

Variable	Group	Baseline: Two week before surgery (T0; before the intervention session)	One day before surgery (T1; immediately after the intervention session)	Two weeks after surgery (T2; immediately after the closure of intervention)	Three months after surgery (T3; 2.5 months after intervention)	Six months after surgery (T4; 5.5 months after intervention)	*F*	*p*
Quality of life – social well-being	Intervention	22.82 ± 3.65	22.53 ± 3.66	22.35 ± 4.46	22.84 ± 4.32	23.00 ± 4.23	group = 2.35	0.13
	Control	21.79 ± 4.93	21.82 ± 4.65	21.35 ± 5.09	22.22 ± 4.62	21.80 ± 5.25	time = 0.49	0.74
							group x time = 0.69	0.60
Quality of life – emotional well-being	Intervention	17.46 ± 4.46	18.89 ± 3.76	20.00 ± 3.74	19.63 ± 4.68	20.94 ± 2.74	group = 0.46	0.498
	Control	17.46 ± 4.08	17.26 ± 4.13	18.74 ± 4.65	20.04 ± 3.32	20.37 ± 3.90	time = 11.57	< 0.001*
							group x time = 2.91	0.02*
Quality of life – functional well-being	Intervention	19.97 ± 4.92	20.42 ± 4.66	20.26 ± 7.32	21.16 ± 6.76	20.69 ± 5.63	group = 2.66	0.107
	Control	19.03 ± 4.87	19.07 ± 4.14	16.96 ± 5.64	19.83 ± 5.47	19.58 ± 6.03	time = 2.29	0.08
							group x time = 0.48	0.70
Quality of life – other concerns about breast cancer treatment	Intervention	26.15 ± 9.47	26.79 ± 9.69	25.48 ± 7.10	26.89 ± 8.18	28.69 ± 6.80	group = 0.45	0.50
	Control	24.87 ± 4.56	25.32 ± 4.03	24.39 ± 6.22	27.57 ± 6.10	25.80 ± 8.39	time = 1.23	0.30
							group x time = 0.32	0.86

is crucial. Although the mortality rate of breast cancer is low compared with other types of cancer, patients may experience lax self-management during the healing process. Therefore, we conducted a quasi-randomised-controlled clinical trial to investigate the impact of a multidisciplinary health promotion intervention on health-promoting lifestyle behaviours in patients recovering from malignant breast cancer.

Our intervention aimed to support recovery by enhancing both physical and mental activity, motivating patients, and equipping them with the tools to make lasting lifestyle changes and improve their overall health. We hypothesized that our multidisciplinary health-promoting intervention results in positive changes in patients' health-promoting behaviours at the time points examined after surgery (2 weeks, 3 months, and 6 months postoperatively). Our hypothesis was confirmed for the summarised health-promoting lifestyle and its two dimensions, physical activity and spiritual growth.

Our most outstanding results are that *the overall mean score of health-promoting behaviours* in the intervention group was higher than in the control group. Accordingly, our multidimensional intervention based on Pender's Health Promotion Model was proved to have a positive effect on the health-promoting behaviours. Carreno et al. [77] also revealed that the intervention based on HPM can lead to the improvement of health behaviours in the intervention group. In a systematic review, Mohebi et al. [78] suggest that Pender's Health Promotion Model is an effective method for patient education interventions, which is consistent with the results of our study. Previous studies have also shown that the HPM provides comprehensive theoretical support for promoting and maintaining healthy behaviours [79]. Other studies also demonstrate a trend that Pender's Health Promotion Model is effective in strengthening the health-promoting behaviours [80, 81]. Overall, Pender's HPM has achieved positive application in terms of health behaviours in chronic diseases, such as hypertension, end-stage liver disease, diabetic foot ulcers, haemodialysis, coronary heart disease, and within the general population [82–88].

Our results may have been also influenced by the *optimal timing* of the intervention. Kelly and colleagues [26] showed that there are time points during the breast cancer trajectory when it is appropriate to introduce healthy lifestyle interventions. Before the start of chemotherapy, researchers may consider introducing health behaviour interventions, as the lowest levels of health promotion behaviours and highest level of psychological distress, among breast cancer patients were observed during chemotherapy, and it may be useful to provide support before this period to help patients maintain optimal health promotion behaviours during chemotherapy [26]. During the three-week period of breast surgery, our

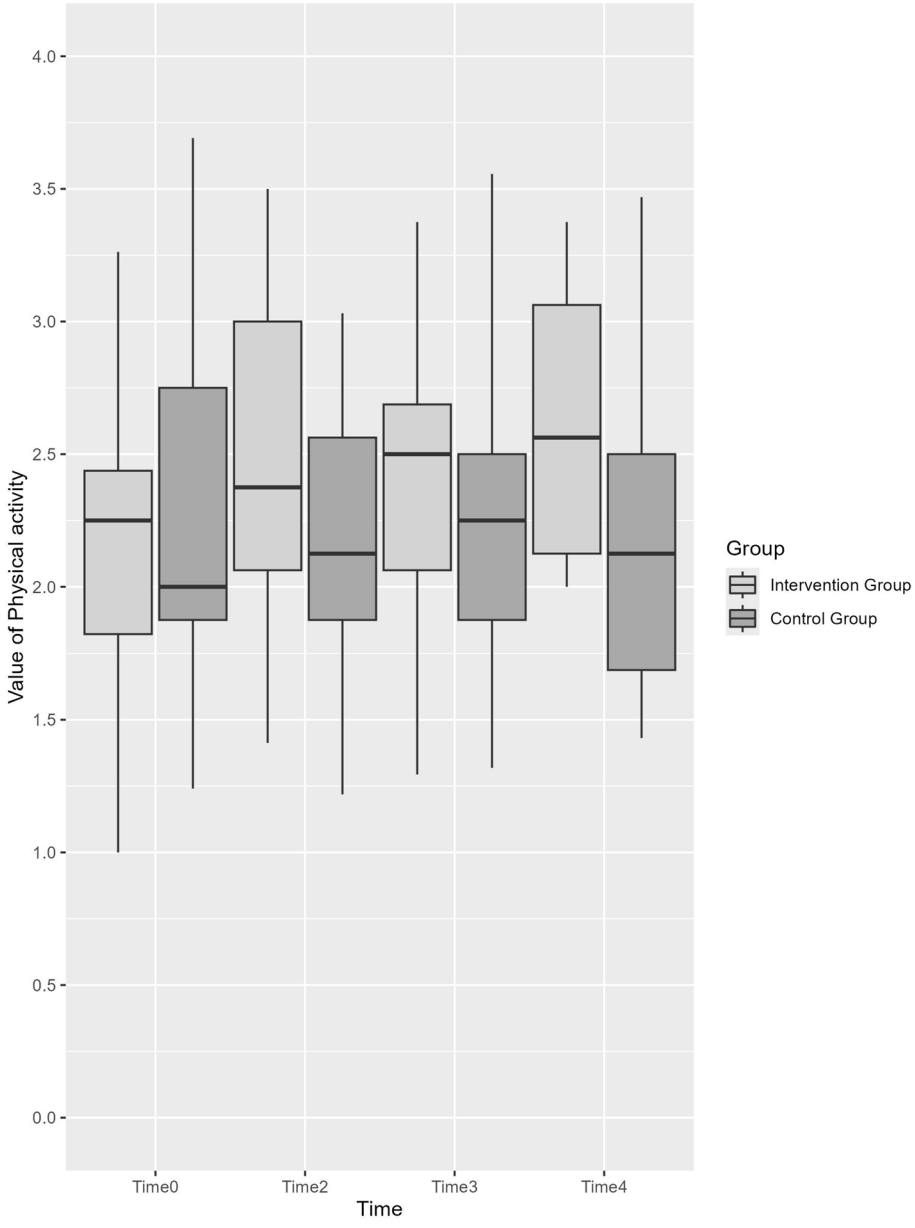

Fig. 3 Results on the Physical Activity dimension of Health-promoting Lifestyle Behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval

patients received five intervention sessions, a process that preceded adjuvant oncological treatments. Presumably, in our study the optimal timing may have enabled the educational and practical content of the supportive approach to health promotion to be effectively used by participants in the six months following breast surgery, covering the initial or full period of adjuvant oncological treatment.

In our assessment of the physical activity component of health promotion lifestyle, we found a statistically significant difference in the change in average score over time between the two groups. A notable difference was observed between the preoperative state and the state measured six months after surgery. Comparing related studies, a review by Torabi et al. [89] showed that health behaviour interventions effectively promote physical activity among breast cancer patients [89]. Recent studies have emphasised that motivating cancer patients to participate in physical activity is challenging, with numerous significant barriers to adopting and adhering to cancer rehabilitation programs. For example, in women with breast cancer, a major obstacle is their low confidence in the benefits of exercise to reduce long-term breast cancer and treatment effects [13, 36, 56]. Additionally, previous research indicates that breast cancer patients often need extra motivation after completing the prescribed exercise

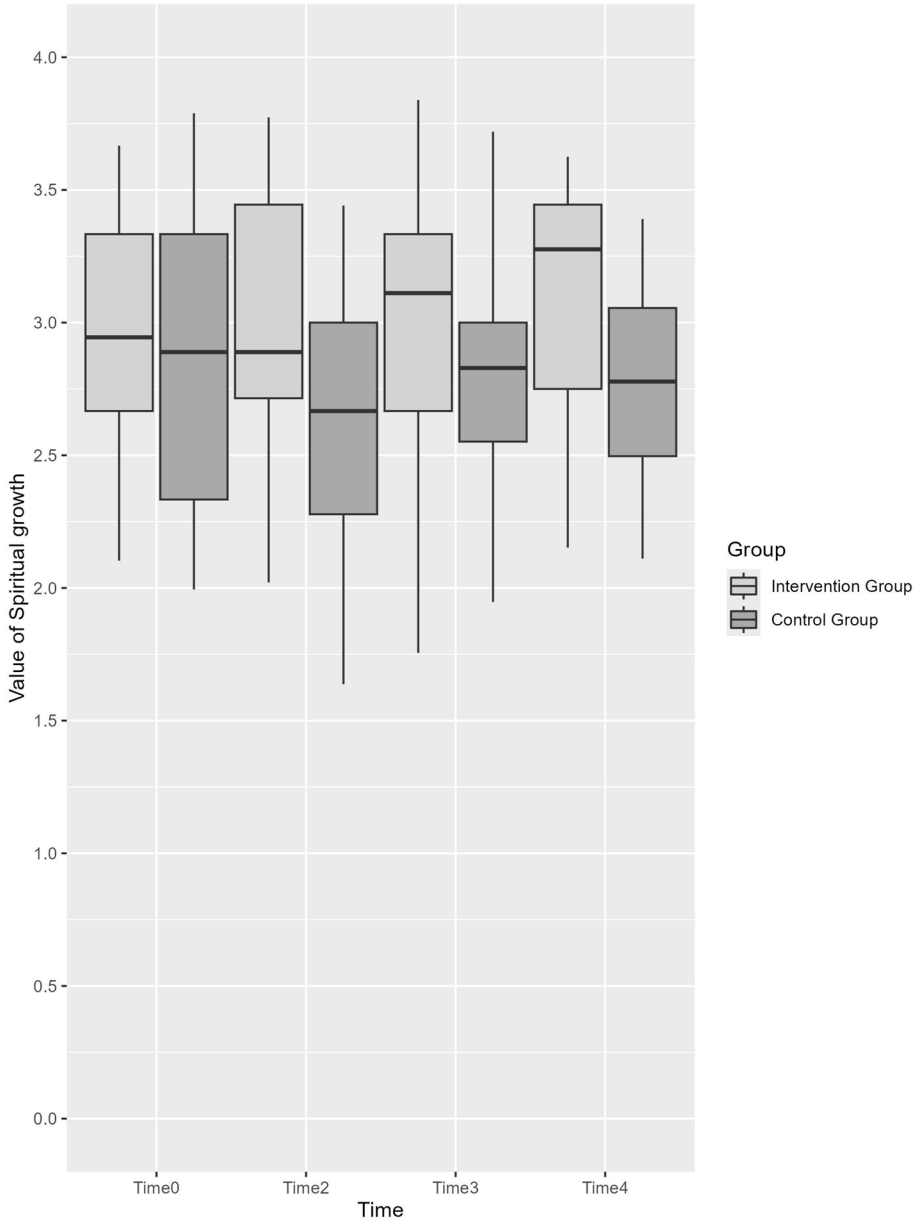

Fig. 4 Results on the Spiritual growth dimension of Health-promoting Lifestyle Behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval

program as part of their basic medical care, which may help increase their adherence to exercise afterward [90].

However, our result was inconsistent with the results of the study by Habibzadeh [91] since they found that there was no significant difference between the intervention and the control group in terms of physical activity. The above result is in line with the results of the study by Srisoongnern et al. [92]. In this regard, it should be noted that the target population of their research was made up of patients with heart failure, and it seems that the negative belief and attitude towards physical activity have been stabilized among patients.

As Walker and Hill-Polreczky [65] describe, the *spiritual growth dimension* of health promotion behaviour involves the development of inner resources that enable us to "become something more by going beyond what we are at present". According to the results of the present study, the change in score over time differs; the intervention group exhibits significantly more positive change in spiritual growth than the control group. The results of the present study suggest that our multidisciplinary program, based on Pender's Health Promotion Model, can alter the health behaviours of breast cancer patients. These findings may be explained by the support for empowerment

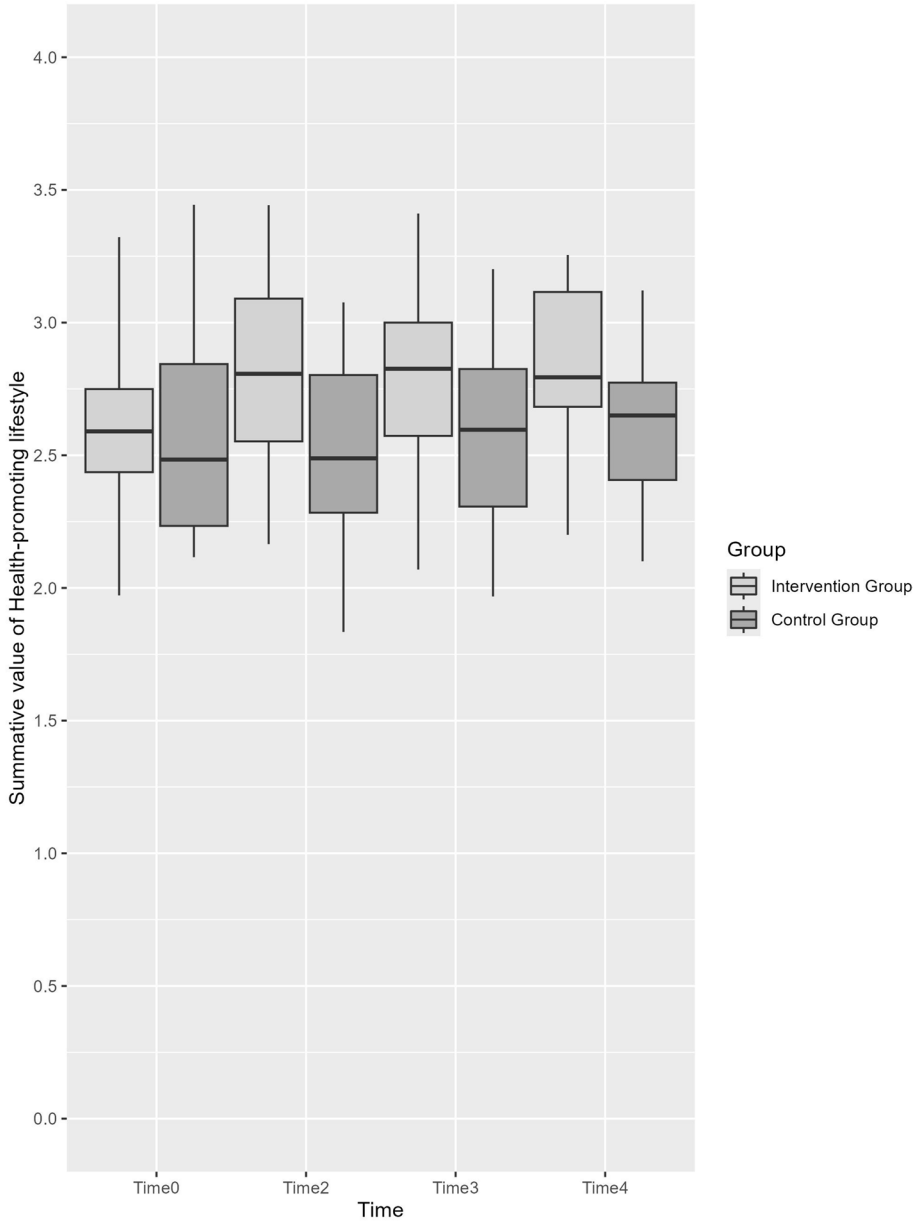

Fig. 5 Results on the Summative value of Health-promoting lifestyle behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval

in the pre-operative phase of the intervention, and the support for health promotion in the post-operative period may have facilitated this psychological change towards spiritual growth.

Qualitative research by Leão et al. [93] showed that for women diagnosed with breast cancer, spirituality was a source of support and well-being that allowed them to find themselves and make their diagnosis less distressing. According to the results of Wang et al. [94], breast cancer patients face not only the pain caused by the disease but also physical changes and defects, which may lead to greater mental pressure and emotional burdens, factors that increase patients' spiritual needs. Furthermore, previous studies have shown us that helping colorectal cancer survivors develop their spiritual abilities could reduce their psychological distress, improve their quality of life, and general health [95–97]. Research also has shown the impact of health promotion programs on self-efficacy and treatment adherence of hemodialysis patients [86].

In terms of the psychological factors examined, the change in the level of *emotional well-being dimension of quality of life* differed significantly between the two groups, with a significant increase in emotional well-being in the intervention group, while no significant

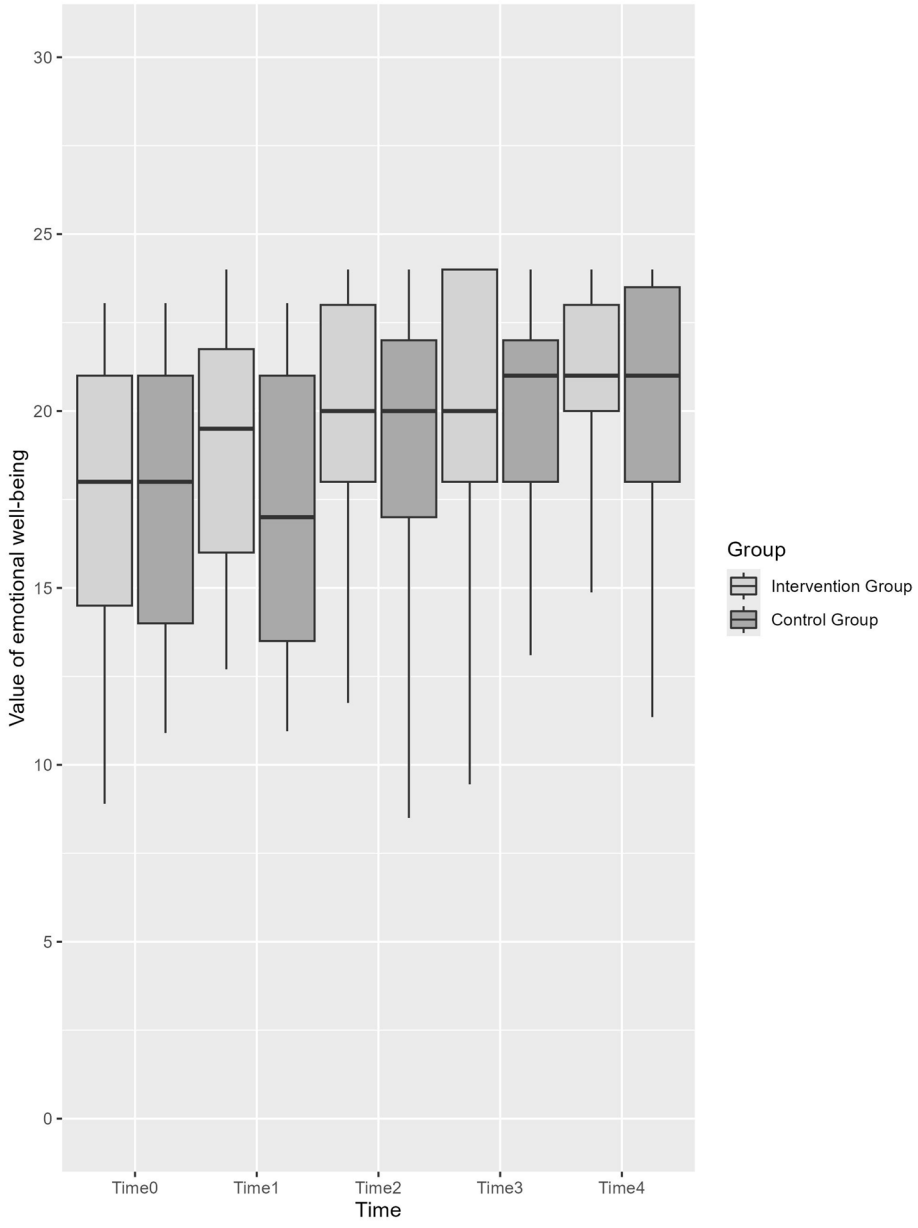

Fig. 6 Results on the emotional well-being dimension of the Quality of life for the two groups at the five measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval

positive change was observed in the control group over time. Patients express a greater need for emotional support due to the mental pressure and emotional burden of the illness, and their need for and openness to support is reflected in their positive response to the supportive intervention. The breast surgery period – in which the intervention was carried out – is a sensitive phrase in the recovery process when psychological distress increases and, presumably due to the increased need for support, patients have been able to benefit from the psychological and social support provided by the intervention in the long term [98, 99]. Furthermore, it is essential to highlight the findings from the literature over the past few decades, which indicate that certain health-promoting behaviours, most notably physical activity, have a significant positive impact on the psychological and emotional well-being of breast cancer patients. This process can be assumed to have taken place in the intervention subjects of the present study, as there was also a significant, positive change in the level of physical activity in the six months following surgery [100, 101]. In line with the results of our study, researchers demonstrated that the mean score of QOL increased significantly in the intervention group after the educational intervention compared to the

control group [102]. Furthermore, in a study by Chehri [103] on the effect of a program based on Pender's HPM, it was found that the use of this program had a significant impact on the quality of life among patients with heart failure. A study by Yavuz and Hacialioğluon [104] on the effect of an education program based on the HPM on the lifestyle behaviors of obese adolescents also reported that the program had a significant impact on adolescents' lifestyle [104]. The results reviewed above firmly suggest that education programs based on Pender's HPM can have significant impacts on different aspects of the well-being of chronic patients.

Furthermore, in this study, the positive change in the spiritual growth aspect of health-promoting behaviour resulting from the intervention is also significant due to increased emotional well-being, as several recent studies have shown that the spirituality experienced by cancer patients, and the spiritual needs that are met, serve as sources of strength and positive coping strategies that can enhance patients' psychological and emotional well-being [104, 105]. We believe there is circular causality among the variables studied.

In addition to testing our hypothesis, we also assessed the psychological status of patients at each measurement time point, serving as a screening function to ensure that participants' psychological status did not distort our health promotion outcomes over time. The main effect of Group and the cross effect of Group and Time were not confirmed for the assessed factors, such as state anxiety, depression, perceived stress, breast cancer treatment effect and physical well-being. However, the main effect of Time appeared, meaning that the value of these psychological factors changed over time. These results may be explained by the fact that, as the healing process progressed, patients' psychological state improved in a positive direction, even without intervention, which has been confirmed by several studies in recent years [12, 106]. For the dimensions of social well-being, functional well-being and other concerns, neither the Time or Group main effect, nor the Group and Time cross effect was confirmed. These results may be explained by the fact that patients experience a more general change in quality of life as a result of breast surgery and oncological treatments; however, the intervention did not provide a targeted approach to improve these specific aspects of quality of life.

To summarise our results, our multidisciplinary health promotion intervention led to positive psychological changes in patients' behaviours, thereby improving their emotional well-being and motivation to adopt a healthy lifestyle. Additionally, the intervention seems to have helped patients apply the knowledge they gained, particularly in the behaviuoral aspects of spiritual growth and physical activity. Among these psychological factors, we can assume a circular causality: an increase in emotional well-being may promote the development of health-promoting behaviours, and a positive change in health behaviours may, in turn, help maintain optimal emotional well-being.

Limitations

We consider the following limitations to be significant for our research: (1) The small group sizes ($n = 40$ in both groups) and the participant drop-out rate (0–55%) may have negatively affected the power of the statistical tests conducted. Furthermore, the drop-out rate may also have a biasing effect, as there may be differences between participants who drop out and those who do not. (2) The form of randomisation used prevents us from asserting that the only systematic difference between the two conditions is the intervention. The randomisation method follows a quasi-randomised-controlled trial approach, it does not fully meet the criteria for true and strict randomisation. It is based on the surgical day designated by the surgeon, without the control of the investigator, which can result in immeasurable, systemic scheduling biases, which may result in differences between Day A and B, and thus between the control and intervention groups. (3) The study does not have randomisation protection, as participants were informed during recruitment which group they would be assigned to, which may have had an implicit effect on their decision to participate, behaviour, and responses to the questionnaires, and may have influenced the composition of the groups (a person willing to enrol in the intervention group may systematically differ from a person willing to enrol in the control group). Additionally, (4) the risk of Type 1 error is quite high due to the large number of statistical tests performed; however, we carefully selected all questionnaires used. Finally, (5) the health promotion intervention we employed did not address all six dimensions of health promotion behaviour equally. A further goal of our research group is to improve our intervention program, especially focusing on the dimensions of nutrition, health responsibility, stress management, and interpersonal relationships.

Conclusions

The results of our study suggest that the period before adjuvant oncological treatment, following primary breast surgery, is an optimal time for implementing a multidisciplinary health promotion intervention. The findings of this study highlight the complex role and impact of multidisciplinary health promotion interventions, emphasising the educational value of the intervention and its supportive role in improving the health behaviour of patients recovering from breast cancer.

The strength of the study, it is important to highlight, as added value to the literature, is the embeddedness of the intervention in clinical practice and the significance of the fact that the intervention was led by a psychologist working in a clinic, which factors enhance the ecological validity of the study.

Abbreviations

HPM	Health Promotion Model
DCIS	Ductal carcinoma in situ
PRISM-D	Pictorial representation of illness and self measure – drawing version
HPLP II	Health-promoting Lifestyle Profile II
STAI-S	Spielberger State-Trait Anxiety Inventory – state anxiety
BDI-9	Beck Depression Inventory 9-item shortened version
PSS-10	Perceived Stress Scale 10-item version
FACT-B	Functional Assessment of Cancer Therapy – breast
BITS	Breast Impact of Treatment Scale
TCPPF	Treatment-control pre-post-follow up
i. s.	In situ
SD	Standard deviation
SE	Standard error
CI	Confidence interval

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions
TL was responsible for the research design, implementing psychological interventions, data collection, statistical processing, interpretation of the data, and writing the manuscript. GL assisted in the planning of the research, the statistical interpretation of the data, and the writing of the manuscript. ZS was involved in designing the research and interpreting the medical and surgical data. AP assisted in designing the research and interpreting the medical and surgical data. ZH was involved in designing the research and interpreting the medical data. AO assisted in designing the research and interpreting the medical data. AH was responsible for the statistical processing and interpretation of data. AG was responsible for the development and presentation of the physiotherapy exercise programme. NB was responsible for the development of the dietary recommendation and the brochure. GP participated in the statistical processing and presentation of the data. ML was responsible in designing the research, interpreting the results and writing the manuscript. All Authors read and approved the final manuscript.

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Data availability
The datasets generated and analysed during the current study are available in the Open Science Framework repository, [URL: https://osf.io/gv8qc/?view_only=2fb080c28ef64c03b4c8e40abe8a92dc.

Declarations

Ethics approval and consent to participate
The authors declare that the study was conducted with the written informed consent of the participants. The ethics approval was provided by Regional Research Ethics Committee (RKEB) of the University of Szeged, Albert Szent-Györgyi Health Centre, (approval number: 50/2020-SZTE). The research complied with the principles of the Helsinki Declaration.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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