DEVELOPMENT OF HEALTH PSYCHOLOGICAL INTERVENTION METHODS IN BREAST SURGERY CARE

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V. **Lévai, T**., Sándor, Z., Martos, T., Dávid, A., Horvát, B., Njers, S., Simonka, Z., Paszt, A., Horváth, Z., Ottlakán, A., Göncző, A., Börcsök, N., Lázár, G., Látos, M. (2022). Test & Lélek Program az emlődaganatból történő felépülésért - Multidiszciplináris intervenció alkalmazása a malignus emlődaganattal operált nőbetegek ellátásában. In *Táplálkozástudományi Szakemberek III. Országos Konferenciája,* (pp. 25–26).

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ABBREVIATIONS

BDI-9 – Beck Depression Inventory 9-item shortened version

BIPQ – Brief Illness Perception Questionnaire

BITS – Breast-Impact of Treatment Scale

CFS - chronic fatigue syndrome

CI – confidence interval

DCIS – ductal carcinoma in situ

EQ-5D-3L - European Quality of Life 5 Dimensions 3 Level Version

FACT-B – Functional Assessment of Cancer Therapy – Breast

HPM – Health Promotion Model

HPLP II – Health-Promoting Lifestyle Profile II

i. s. – in situ

ME - myalgic encephalomyelitis

MI – Motivational Interviewing

PRISM-D – Pictorial Representation of Illness and Self Measure – Drawing version

PSS-10 – Perceived Stress Scale 10-item version

SD – standard deviation

SE – standard error

STAI-S – Spielberger State-Trait Anxiety Inventory – State anxiety

STAI-T – Spielberger State-Trait Anxiety Inventory – Trait anxiety

TCPPF - Treatment-Control-Pre-Post-Follow up

WHO – World Health Organization

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I. BACKGROUND

I.1 Implementation of psychological interventions among cancer patients

According to data published by the World Health Organization (WHO) in 2025, breast cancer caused an estimated 670,000 deaths globally in 2022, making breast cancer the most common type of cancer in women, with the highest survival rate of all cancer types (Kim et al., 2025; Loh & Musa, 2015; World Health Organization, 2025). Accordingly, psychosocial interventions in breast surgery care must be adapted to the evolving needs of the recovery process and offer proactive tools for long-term survival and positive quality of life, alongside reactive psychological interventions that respond to the specific stage of recovery in the short term (Boland et al., 2018; Loh & Musa, 2015; Pinto et al., 2022).

Nowadays, several powerful disease- and method-specific psychological interventions and programmes for cancer patients are available, including supportive therapy, meaning-making therapy, cognitive-behavioural therapy, and relaxation-imagery techniques (Chen et al., 2015; Lin et al., 2022; Mukherjee et al., 2017). The aim of these interventions varies depending on the physical and psychological changes associated with the patient's condition, the phase of recovery, and the stage of the illness; however, the overarching goal is to reduce suffering and facilitate effective coping with the current condition (Chen et al., 2015; Lin et al., 2022; Mukherjee et al., 2017; Raingruber, 2011).

In recent years, a new field of psychosocial support for breast cancer patients has emerged, driven by the dramatic increase in breast cancer survivorship resulting from early detection, effective, combined treatments, and multidisciplinary rehabilitation methods (Kelly et al., 2020; Kim et al., 2025; Loh & Musa, 2015; Meade & Dowling, 2012). Nonetheless, improved survival is often accompanied by long-term side effects related to the disease and its treatment. Consequently, there is a growing need for comprehensive rehabilitation approaches that address the long-term consequences of oncological treatments (Loh & Musa, 2015; Pinto et al., 2022). This evolving field of intervention, which has been developing in recent years, focuses simultaneously on physical, psychological, and social factors over the long term and aims to promote positive lifestyle change; it is the field of health promotion intervention (Kelly et al., 2020; Runowicz et al., 2016; Torabi et al., 2025).

I.2 Breast cancer in the context of health promotion

Walker, Sechrist, and Pender (1987, p. 77) defined the health-promoting lifestyle as "*a spontaneous, multidimensional action and perception of an individual to maintain or enhance*

well-being, self-actualization, and satisfaction". Pender (1996) described health promotion behaviour as a complex pattern encompassing six dimensions: nutrition, physical activity, stress management, health responsibility, interpersonal relationships, and spiritual growth. Findings from several studies support the view that comprehensive and effective postoperative breast cancer rehabilitation should incorporate a patient self-management approach focused on lifestyle redesign and health promotion. Furthermore, optimal rehabilitation should involve collaboration among various healthcare professionals to restore impaired physical, psychosocial, and occupational functioning in women with breast cancer (Jia et al., 2022; Kelly et al., 2020; Kwan et al., 2012; Loh és Musa, 2015).

A growing body of evidence suggests that a healthy lifestyle - characterised by adequate physical activity, healthy diet, appropriate weight control, and reduced stress - is strongly correlated with improved prognosis, fewer depressive symptoms, and lower mortality among patients with malignant breast cancer (Barbaric et al., 2010; Carmichael et al., 2010; Holick et al., 2008; McKenzie et al., 2015; McTiernan et al., 2010; Patterson et al., 2010; Pierce et al., 2007; Ramirez et al., 2016; Rock et al., 2015; Schmid & Leitzmann, 2014; Stagl et al., 2015). Although recommendations such as regular physical activity and a healthy, Mediterranean-style diet may appear straightforward, research indicates that breast cancer survivors often struggle to maintain these behaviours (Escrich et al., 2006; Escrich et al., 2011; Holmes et al., 2005; Kwan et al., 2012; Liu et al., 2016; Pelucchi et al., 2011; Psaltopoulou et al., 2011; Ramirez et al., 2016).

Studies examining physical activity levels following diagnosis — particularly within the first six months — have reported notable declines during the immediate post-diagnosis period (Andrykowski et al., 2007; Devoogdt et al., 2010; Emery et al., 2009; Harrison et al., 2009; Irwin et al., 2003; Kwan et al., 2012; Littman et al., 2010). Moreover, women diagnosed and treated for breast cancer frequently encounter special challenges such as reduced quality of life, psychological distress, and treatment-related adverse effects, which may increase the risk of poor engagement in health-promoting behaviours. For this reason, interventions should be pursued to encourage commitment to a healthy lifestyle, as physical activity and a healthy diet in early-stage breast cancer patients (Kelly et al., 2020; Kwan et al., 2012; Patterson et al., 2010; Pinto et al., 2022).

Despite the numerous benefits, the clinical application of lifestyle interventions in breast cancer survivors has been limited to date (Jia et al., 2022; Torabi et al., 2025). Additionally, empirical evidence regarding the long-term effects of behaviour-change interventions in this population is still emerging (Jameel et al., 2025; Montagnese et al., 2023;

Rock et al., 2015; Reeves et al., 2014). Nonetheless, systematic reviews demonstrate that physical activity improves metabolic health and body composition, while healthy dietary patterns and optimal weight control confer additional benefits; together, these approaches offer the broadest range of positive outcomes (Buro et al., 2024; Jameel et al., 2025). Importantly, the post-treatment period is a phase of heightened vulnerability, during which breast cancer survivors face significant health promotion challenges (Hewitt et al., 2005; Ganz, 2009; Rock et al., 2015). Previous studies have identified time points (i.e., teachable moments) throughout the breast cancer trajectory - particularly prior to the initiation of chemotherapy - that have proven ideal for introducing healthy lifestyle behaviour interventions, as research findings indicate that patients' health behaviour deteriorates most significantly during chemotherapy and their psychological distress intensifies during this period (Kelly et al., 2020; Toohey et al., 2023).

I.3 Leading health promotion theories applied to cancer patients

One of the most influential theoretical frameworks in health promotion and behavioural change is the Health Promotion Model (HPM), developed by Nola Pender (Pender, 1996). The revised HPM conceptualises the health-promoting behaviour as a complex, dynamic process (Pender, 1996). The model considers individual characteristics and experiences as motivational, initial factors that influence the next level, which involves behaviour-specific factors. These variables form the critical "core" because they can be modified through interventions. They include perceived benefits, perceived barriers, perceived self-efficacy, activity-related affect, interpersonal influences, and situational influences (Pender, 1996).

Another crucial concept in health promotion is the Health Belief Model (HBM) (Hochbaum, 1958; Rosenstock et al., 1994). Among individuals diagnosed with breast cancer, the presence of illness often heightens perceived vulnerability (Tiedike et al., 2012). The HBM is structured around four dimensions of risk perception: susceptibility to risk, vulnerability and severity of risk, difficulty in implementing preventive behaviour, and benefits of preventive behaviour (Hochbaum, 1958). Mehrabizadeh and colleagues (2024) used interviews to examine women's perceptions of their own health status after completing oncologic treatment and recovering from breast cancer, integrating the HBM. According to their findings, survivors' perceived susceptibility and perceived severity played important roles in their recognition of late effects and in developing healthy behaviours (e.g., regular checkups, lifestyle changes).

There are several motivational psychology theories and techniques for understanding and promoting long-term adherence to healthy lifestyles, and Motivational Interviewing (MI) is considered particularly effective in reducing resistance to behaviour change among general cancer survivors by facilitating autonomous decision-making (Pudkasam et al., 2018; Markland et al., 2005; Pinto & Ciccolo, 2011). Through targeted questions and reflective dialogue about behaviour change, this technique helps reframe the need for behaviour change and reinforces motivation and support skills (Markland et al., 2005). According to the results of a study examining patients undergoing adjuvant endocrine therapy who were recovering from breast cancer, five sessions of MI-based counseling increased patient motivation, adherence, and improved their understanding of the therapy and management of side effects (Gagné et al., 2022).

According to Social Learning Theory, self-efficacy — introduced by Bandura (1977) — represents a central determinant of health behaviour. Perceived self-efficacy, defined as an individual's beliefs about their capabilities to produce desired outcomes, influences all aspects of behaviour, including learning new behaviours, inhibiting existing behaviours, or disinhibiting behaviours. Furthermore, self-efficacy influences emotional reactions to behaviour (Bandura, 1977; Bandura, 1986; Strecher et al., 1986). Hsia et al. (2024) found that breast cancer patients with low self-efficacy for health behaviours are less likely to engage in health-promoting lifestyle behaviours and may require guidance to improve overall health behaviours. According to another study, self-efficacy and identified motivation together explained the variance in physical activity levels among breast cancer survivors (Jones et al., 2023).

I.4 Exploring the subjective experience of illness: Focus on the Illness Narratives Theory

Explorative and therapeutic approaches to illness narratives have become increasingly prominent in health psychology care in recent decades, as they offer an innovative perspective on the subjective experience of chronic illness and cancer (Bakken et al., 2023; Charon, 2001; Frank, 1995; Houston, 2011; Kvåle et al., 2020; Mesa Freydell et al., 2023; Ratcliff et al., 2018). According to the guiding theory of Arthur W. Frank, illness narratives allow us to learn comprehensively about the subjective meanings constructed around illness (Frank, 1993; Frank, 1995; Frank, 1998). Based on Frank's definition, three illness narratives can be distinguished (Frank, 1993; Frank, 1995).

Illness narratives may take the form of fragmented, non-linear accounts that do not conform to a coherent narrative structure. In such narratives, emotional disruptions interrupt storytelling, reflecting the breakdown of previously stable self-images and systems of meaning (Frank, 1995; Frank, 1998). These so-called *chaos narratives* portray individuals as passive victims of illness, emphasizing experiences of vulnerability, powerlessness, and futility (Frank, 1995). Within this narrative form, illness is experienced as empty, purposeless, and stripped of meaning, offering little sense of direction or agency. In contrast, the *restitution narrative* centers on illness, suffering, and medical intervention, emphasizing recovery and the restoration of health through treatment. This narrative reflects a distinctly modernist worldview, grounded in the expectation that every form of suffering has a remedy and that illness represents a temporary malfunction of the body rather than a fundamental existential disruption (Frank, 1995; Frank, 1998; Whitehead, 2006). As Frank famously summarizes, the underlying plot of the restitution narrative follows the logic that "*yesterday I was healthy, today I am sick, but tomorrow I will be well again*" (Frank, 1995, p. 77). The third type of story is *quest*, which frames illness as a meaningful journey or mission through which insight, transformation, and knowledge may be gained. Within this narrative, illness becomes a condition from which lessons can be learned and subsequently shared with others, positioning the individual as an active and engaged agent in their own experience (Frank, 1995; Frank, 1998). Rather than focusing solely on recovery, the quest narrative is future-oriented and socially generative, portraying illness as a catalyst for personal growth and social action and casting the individual in a heroic role within the recovery process (Frank, 1995; Frank, 1998).

Whitehead (2006) examined the narratives of patients with chronic fatigue syndrome and myalgic encephalomyelitis (CFS/ME) and found that patients represented the chaos narrative as expressions of depression, anger, and isolation. The prolonged dominance of this narrative was likely explained by the uncertainty surrounding the patients' prognosis and the effectiveness of their treatments; patients did not believe they would be cured, in contrast to other patient groups such as those with HIV or breast cancer. People with CFS/ME do not actively embrace the restitution narrative, possibly due to the constant reminder of living with the illness; the body is never asymptomatic (Whitehead, 2006). Another research examining the narratives of patients with medically unexplained symptoms also found a dominant appearance of the chaos narrative, based on the assumption of a lack of accurate medical diagnosis, which prevented patients from adequately interpreting and reconstructing their condition (Nettleton et al., 2004). Schoenau (2022) 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. According to Frank's categorisation, Thomas-MacLean (2004) examined the illness narratives of breast cancer patients and found the restitution narrative to be the most desirable, followed in frequency by the chaos narrative and the quest narrative, which was the least frequent for patients. Ratcliff and colleagues (2018) investigated the recovery pathways of patients healing from different cancer types using both qualitative and quantitative methods. With patients in the 'Never the same path' – meaning that after the illness, there is no return to the previous "normal" life course - narrative group having the highest levels of anxiety and depression and the lowest levels of post-traumatic growth compared to the other groups. Mesa Freydell et al. (2022) analysed the narratives of breast cancer patients and found that the narratives often mentioned the side effects of treatment, issues of body image and identity, and the pressure of social expectations and the need to maintain a "positive attitude".

I.5 The advantages of timeline-based techniques in the study of illness narratives

A multifaceted understanding of the subjective experience of somatic illness and its physical and psychological characteristics can be facilitated by a narrative psychology approach, in which narrative serves as a tool for studying complex psychological processes (Bruner, 1991; Charon, 2001; Chocinov et al., 2005; Mesa Freydell et al., 2022; Thygesen et al., 2011; Thomas-MacLean, 2004; Pennebaker & Seagal, 1999; Whitehead et al., 2006). Graphic and visual elicitation methods can access—and, in some cases, actively elicit—previously unarticulated or implicit aspects of experience, thereby facilitating narrative construction. When using these techniques, the subject is asked to create a visual artwork, usually a picture or drawing (Leung, 2010; Orr et al., 2020; Thygesen et al., 2011). Drawing autobiographical timelines, which chronologically plot significant events, helps restructure an individual's life story, which is particularly important when coping with a chronic disease (Leung, 2010; Schubring et al., 2019; Thygesen et al., 2011). 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 (Leung, 2010; Schubring et al., 2019; Soundy, 2018; Thygesen et al., 2011). Such methods have been increasingly applied in research exploring illness narratives. For example, Leung (2010) examined processes of meaning-making among individuals diagnosed with cancer using autobiographical timelines, while Thygesen and

colleagues (2011) employed graphical representations to investigate changes in emotional states among patients with gynaecological cancers over the course of their illness.

Despite these methodological advances, to the best of our knowledge, existing research has not yet systematically applied graphic visual elicitation techniques to examine and map the content of Frank's three illness narrative types. In particular, no studies have explicitly used such visual methods to differentiate, represent, or analyse restitution, chaos, and quest narratives within Frank's theoretical framework (Leung, 2010; Thygesen et al., 2011; Whitehead et al., 2006).

II. AIMS AND HYPOTHESIS

In this doctoral dissertation, two studies were conducted to develop a health psychological intervention for breast surgery patients. This thesis addressed two main objectives. In the first study (STUDY 1), we assessed the effectiveness of a multidisciplinary health promotion intervention programme, developed by our research team, for patients recovering from malignant breast cancer. In the second study (STUDY 2), we examined the illness narratives of patients undergoing surgery for chronic disease or cancer, in relation to their postoperative psychological state, using the Emotional Graph of Illness Trajectory visual elicitation technique, developed by our research team.

AIM 1: 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 (Holick et al., 2008; Patterson et al., 2010; Ramirez et al., 2016). However, there is currently a lack of evidence in the literature on how to maintain long-term commitment to a health-promoting lifestyle in breast cancer patients (Pinto et al., 2022; Pudkasam et al., 2018). We therefore 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. We also aimed to investigate the effects of the intervention in a quasi-randomised-controlled trial, in the months following breast surgery (2 weeks, 3 months, and 6 months post-operatively). Our primary research question was: Does the intervention result in a significant, positive change in patients' postoperative health-promoting behaviour? Based on the available and previously presented literature, we hypothesized that:

(H1) The multidisciplinary health-promoting intervention will result in positive changes in patients' health-promoting behaviours at the assessed time points after surgery.

AIM 2: Our second study examined illness narratives and their emotional aspects from the perspective of their association with postoperative psychological status. 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 the chaos story, the restitution story, and the quest story groups regarding postoperative psychological status? Based on the available and previously presented literature, we hypothesized that:

(H2) Patients who narrate the chaos narrative are characterised by the most negative psychological status, and they are the most likely to show psychological burden as a result of the illness.

(H3) The restitution narrative is characterised by a moderate psychological state compared to the other two narrative types, with these patients showing less psychological distress than the chaos narrative.

(H4) The quest narrative is characterised by the most positive psychological state, with the least psychological burden caused by the disease compared to the other two narrative types.

III. DESCRIPTION OF THE STUDIES

III.1 STUDY 1: Body and Mind Programme for recovery from breast cancer: Evaluation of the impact of the health promotion intervention carried out in a multidisciplinary team on health-promoting behaviours: a quasi-randomised-controlled clinical trial

III.1.1 Material and methods

Trial design

To test the effects of the multidisciplinary intervention, our research adopted a quasi-randomised-controlled trial design, including 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, receiving 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, recent diagnosis of a primary malignant breast tumour without neoadjuvant therapy or metastasis, tumour 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 at their first in-person meeting. All participants were contacted two weeks prior to their scheduled surgery.

Sampling and random assignment

Our primary outcome measure was the health-promoting lifestyle, assessed using the Health-Promoting Lifestyle Profile II Questionnaire. To estimate the required sample size, we calculated the expected health-promoting lifestyle score for each group using independent sample mean test formulas. 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 (Erdfelder et al., 1996; Setyowibowo et al., 2022). The required sample size was calculated as 64 patients per group. However, by accounting for the inclusion criteria and the drop-out rate, we were able to enroll 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 in the present study is comparable (Rock et al., 2015; Gabel et al., 2024).

This clinical trial employed 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 (World Medical Association, Helsinki, 2013). The approval number is 50/2020-SZTE.

All of the breast cancer patients in our study sample had received a prior Oncoteam decision recommending primary breast surgery. Following this decision, they were added to the clinic's breast surgery wards' waiting list 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, on two days each week. Both breast-conserving and mastectomy surgeries are performed these days.

When patients were added to the waiting list, their surgeon scheduled 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 by surgical capacity; the patient's clinical characteristics did not influence the scheduling decision. This method of surgical assignment served as the basis for the patient-level random allocation in our study sample.

In designing the randomisation process, we prioritised pragmatic research considerations to evaluate the intervention in real-world conditions and assess its effectiveness. During the development of our research setup, we kept pragmatic considerations at the forefront to ensure that the intervention's design and testing closely reflected routine clinical practice (Omerovic et al., 2024). 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 scheduled for the second day (Day B) were assigned 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 the day after surgery, so patients operated 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 (Hirschey et al., 2017; Aycinena et al., 2017; Pudkasam et al., 2018; Pender, 1996). The intervention consisted of a five-session, multidisciplinary, health-promoting programme designed to support recovery from breast cancer by enhancing patients' physical and mental activity and strengthening their motivation and ability to change their

lifestyle and improve their health. The structure of the intervention integrates psychological, dietetic, and physiotherapeutic theoretical and practical content.

The intervention process spanned three weeks and included two pre-operative and three post-operative sessions, conducted in both individual and group settings. The first four sessions were conducted face-to-face, either individually or in groups. The fifth session took the form of a video that focused 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 at the surgical clinic. Similarly, physiotherapy interventions were carried out by the same physiotherapist working within the clinic, in the patients' hospital 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 dietetic advice was developed by a dietitian employed by the clinic. As dietetic care is not routinely included in standard breast surgery care, only members of the intervention group received this care. The same dietetic brochure was given to each participant and also covers dietary guidelines for common metabolic diseases, such as diabetes. The content of the intervention programme is presented in Table 1. Only participants in the intervention group benefited from the full programme.

Supportive psychological intervention – The intervention was structured to explore individual characteristics and experiences, with particular 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 adopted a positive psychology approach, aiming to facilitate rich individual self-expression during both individual and group intervention sessions (Kelly et al., 2020; Markland et al., 2005; Pender, 1996).

Physiotherapy – It is important to begin moving as soon as possible while respecting medical restrictions and protecting the surgical wound. Physiotherapy components included breathing exercises, venous circulation exercises, range of motion development, 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, a 30-minute exercise routine was delivered via video via an online interface, two weeks after breast surgery, incorporating elements of the currently recommended, previously known exercise routine. In addition to the exercise programme, patients also received a stretching exercise video demonstrating a series of exercises to stretch the muscles, with assistance from physiotherapists (Lauridsen et al., 2005).

Dietetic advice – The aim of the dietetic component was to increase knowledge of optimal healthy nutrition. The tool for the healthy eating recommendation is a printed brochure distributed during a group health promotion intervention session 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 (Post, 2011).

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 minutes	**Reassurance about the surgical intervention**: Starting psychological preparation for the breast surgery, elaboration of emotions related to the surgery, and increasing the patient's activity. Psychoeducation on the role of psychological factors in healing. Identification of individual risk behaviours and health risk habits. Applied instruments: - Emotional Graph of Illness Trajectory (Lévai et al., 2023; Lévai et al., 2024): 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 (Sándor et al., 2020): Aims to map current psychosocial status, perception of illness, and psychological resources. - Autogenic training relaxation (Schultz & Luthe, 1969): 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 minutes	**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 (Luft & Ingham, 1955): to identify positive, empowering, healing personality traits and characteristics.

			- Autogenic training relaxation (Schultz & Luthe, 1969): 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 minutes **Health-promoting psychological intervention,** in a group, lasting 120 minutes	**Physiotherapy:** On this day, patients will receive physiotherapy as part of their care in the surgical ward. During the group health promotion intervention session following the exercise on this day, the experience of physiotherapy and its role in health promotion are 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 (Markland et al., 2005): • Importance scale: How important does the patient consider the improvement of her health to be (using a scale of 1-10)? Aim to elicit a change narrative. • Self-confidence scale: How confident does the patient feel about her ability to implement the behaviour change (on a scale of 1-10)? The aim is to achieve a change narrative. • Exploring health-related goals and values. • Looking ahead: How would the patient's life change if behaviour 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, and 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 minutes	**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 minutes	**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.

Observed psychological factors and the applied measurement tools

During the baseline (T0) assessment, we collected participants' basic sociodemographic characteristics, including age, type of residence, education, work activity, and marital status, prior to questionnaire completion. At this stage, we also assessed patients' health behaviours related to smoking, alcohol consumption, physical activity, nutrition, and stress management. In addition, patients' medical data at the baseline measurement were recorded, including the exact diagnosis, tumour stage classification, tumour nuclear grade, and the planned type of surgery. Histological results following breast surgery (staging, grade) were subsequently recorded and refined. Throughout the longitudinal study, the type of adjuvant oncologic treatment and the number of treatments received were also recorded.

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

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	✓	✓	✓	✓	✓

The Health-Promoting Lifestyle Profile II (HPLP II) questionnaire was used to assess the *health-promoting lifestyle behaviours* (Walker & Hill-Polrecky, 1996). 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 (Pender, 1996). In our study, the internal reliability of the HPLP II questionnaire was excellent (Cronbach's alpha = 0.92). Our research group is currently working on publishing the Hungarian version of the questionnaire.

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 (Spielberger et al., 1970). In our study, the internal reliability of the STAI-S scale was excellent (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 (Beck et al., 1961). 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). Respondents rated on a 5-point Likert scale how often in the past month they had experienced a particular feeling or thought that characterizes stress (Cohen et al., 1983). The questionnaire scores from 0 to 40. The questionnaire's reliability in our study sample was also 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 a 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 (Brady et al., 1997). The questionnaire's reliability in our study sample was also excellent (Cronbach's alpha = 0.92).

In addition, we 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 body image change (Frierson et al., 2006). The questionnaire's reliability in our study sample was also adequate (Cronbach's alpha = 0.80).

Data collection procedure

The timing of the longitudinal study corresponded with the implementation schedule of the intervention sessions. Participants were first contacted two weeks prior to the 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 programme, 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 at 3 months (T3) and 6 months (T4) after surgery. The schedule of interventions and measurement points is presented in Figure 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 received only information relevant to their respective study conditions to ensure procedural consistency.

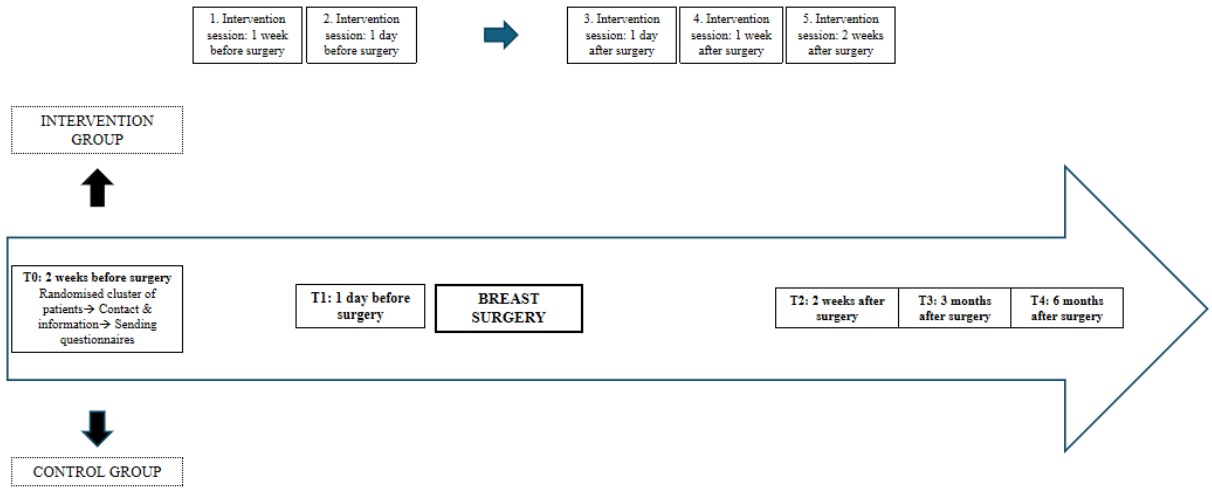

Figure 1. Flowchart of timing of measurements and intervention sessions

Statistical methods

Our longitudinal study, conducted using a quasi-randomised-controlled trial design, employed a treatment-control pre-post-follow-up (TCPPF) approach to describe the collected data (Sharpe & Cribbie, 2023). Statistical analyses were performed using SPSS version 25.0 (IBM Corp., 2017). G*Power 3.1 was used to estimate the study sample size (Erdfelder et al, 1996). Graphs showing statistical results were created using R Studio (Rs. Team, 2019). 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, results for the groups studied were presented, and 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 (Sharpe & Cribbie, 2023). The covariance

structure of the variance components was selected. We chose to implement a multilevel model in order to optimally handle missing data (Sharpe & Cribbie, 2023; Krueger et al., 2004).

III..1.2 Results

Participants and descriptive statistics

Figure 2 presents the flowchart illustrating the development of the study sample. After verification of inclusion criteria and willingness to participate in the study, 80 eligible women, out of a total of 86 screened participants, 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 recruitment period for participants in this study lasted from 19 January 2022, to 18 May 2023. The follow-up period ended on 15 December 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 observed between groups in sociodemographic factors ($p > 0.05$ in all cases), health behaviours ($p >= 0.05$ in all cases), and clinical data ($p > 0.05$ in all cases). Descriptive statistics and between-group comparisons derived from questionnaire data are presented in Supplementary Table 1.

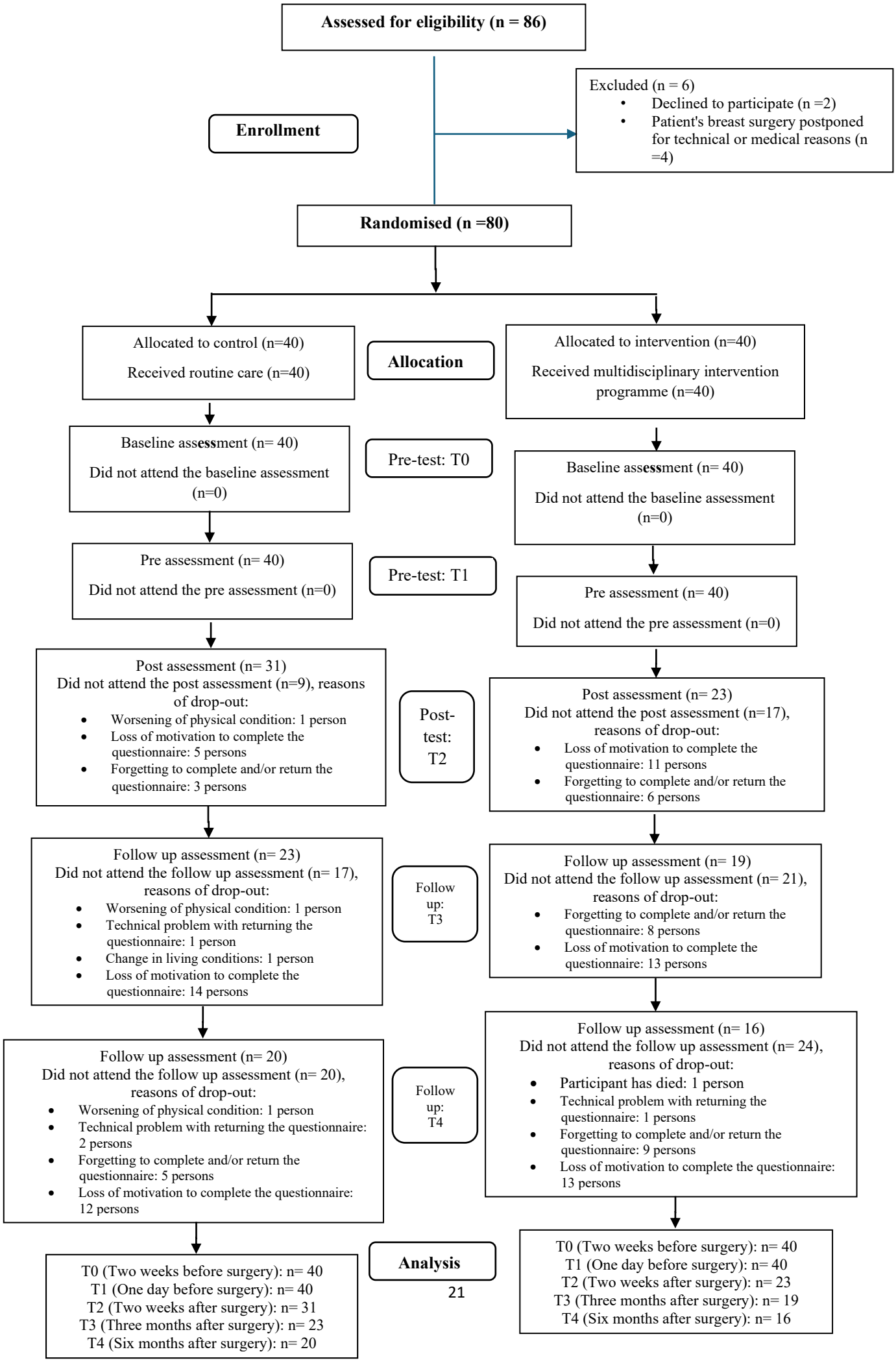
Assessed for eligibility (n = 86)
Enrollment
Excluded (n = 6)
• Declined to participate (n =2)
• Patient's breast surgery postponed for technical or medical reasons (n =4)
Randomised (n =80)
Allocated to control (n=40)
Received routine care (n=40)
Allocation
Allocated to intervention (n=40)
Received multidisciplinary intervention programme (n=40)
Baseline assessment (n= 40)
Did not attend the baseline assessment (n=0)
Pre-test: T0
Baseline assessment (n= 40)
Did not attend the baseline assessment (n=0)
Pre assessment (n= 40)
Did not attend the pre assessment (n=0)
Pre-test: T1
Pre assessment (n= 40)
Did not attend the pre assessment (n=0)
Post assessment (n= 31)
Did not attend the post assessment (n=9), reasons of drop-out:
• Worsening of physical condition: 1 person
• Loss of motivation to complete the questionnaire: 5 persons
• Forgetting to complete and/or return the questionnaire: 3 persons
Post-test: T2
Post assessment (n= 23)
Did not attend the post assessment (n=17), reasons of drop-out:
• Loss of motivation to complete the questionnaire: 11 persons
• Forgetting to complete and/or return the questionnaire: 6 persons
Follow up assessment (n= 23)
Did not attend the follow up assessment (n= 17), reasons of drop-out:
• Worsening of physical condition: 1 person
• Technical problem with returning the questionnaire: 1 person
• Change in living conditions: 1 person
• Loss of motivation to complete the questionnaire: 14 persons
Follow up: T3
Follow up assessment (n= 19)
Did not attend the follow up assessment (n= 21), reasons of drop-out:
• Forgetting to complete and/or return the questionnaire: 8 persons
• Loss of motivation to complete the questionnaire: 13 persons
Follow up assessment (n= 20)
Did not attend the follow up assessment (n= 20), reasons of drop-out:
• Worsening of physical condition: 1 person
• Technical problem with returning the questionnaire: 2 persons
• Forgetting to complete and/or return the questionnaire: 5 persons
• Loss of motivation to complete the questionnaire: 12 persons
Follow up: T4
Follow up assessment (n= 16)
Did not attend the follow up assessment (n= 24), reasons of drop-out:
• Participant has died: 1 person
• Technical problem with returning the questionnaire: 1 persons
• Forgetting to complete and/or return the questionnaire: 9 persons
• Loss of motivation to complete the questionnaire: 13 persons
Analysis
T0 (Two weeks before surgery): n= 40
T1 (One day before surgery): n= 40
T2 (Two weeks after surgery): n= 31
T3 (Three months after surgery): n= 23
T4 (Six months after surgery): n= 20
T0 (Two weeks before surgery): n= 40
T1 (One day before surgery): n= 40
T2 (Two weeks after surgery): n= 23
T3 (Three months after surgery): n= 19
T4 (Six months after surgery): n= 16

Figure 2: Flowchart of the development of the study sample

Table 3. Detailed description of health behaviours and clinical characteristics 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
Health behaviours				
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)		
Others	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 frequently	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)		
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 $\pm$ SD	5.64 $\pm$ 7.66	5.16 $\pm$ 7.01	0.27	0.78
Received radiotherapy	25 (62.5)	18 (45.0)	0.26	0.61
Mean number of radiotherapy treatment $\pm$ SD	9.64 $\pm$ 9.30	10.14 $\pm$ 9.83	-0.203	0.84

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, along with the Group-by-Time interaction, for the values of the health behaviour and psychological variables assessed. Our results for the main effects and 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 Table 1).

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 were no significant main effects for Group and Time on 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 4), ψ_{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 Figure 3.

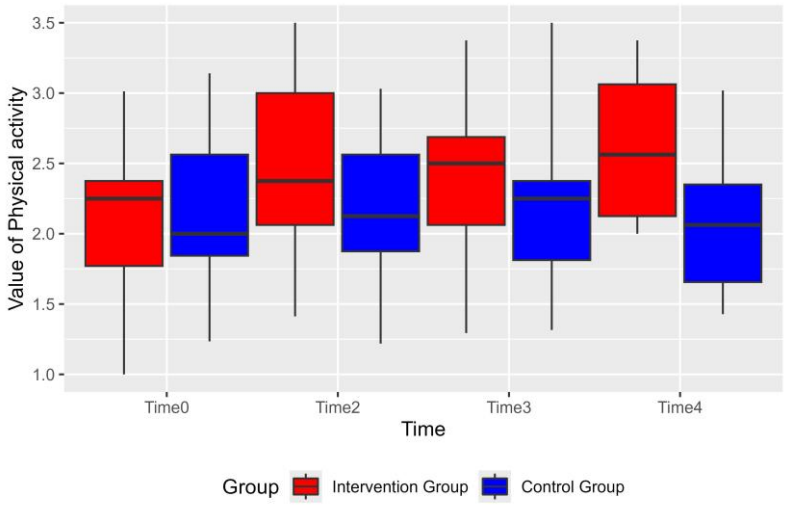

Figure 3. Results on the Physical Activity dimension of Health-promoting Lifestyle Behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval.

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, indicating that the intervention group had significantly more positive interpersonal relationships than the control group (Table 4). 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, indicating that the intervention group had a significantly higher level of spiritual growth experience than the control group (Table 4). No significant main effect of Time was found. 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), ψ_{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 Figure 4.

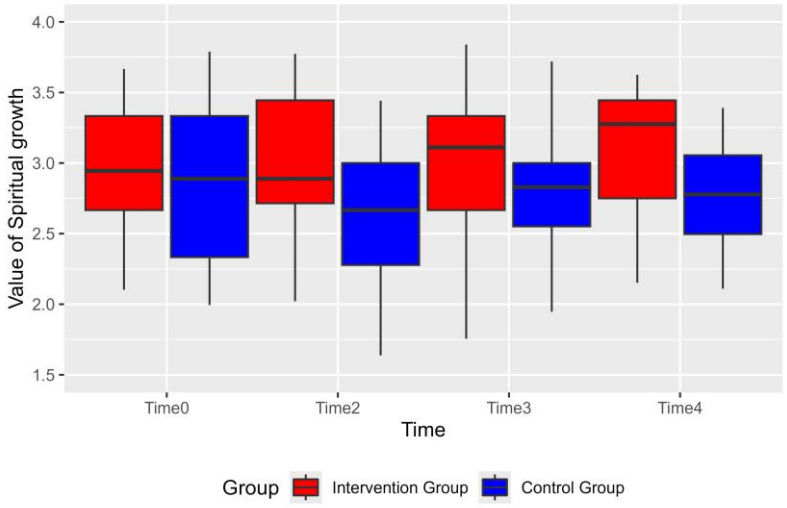

Figure 4. Results on the Spiritual growth dimension of Health-promoting Lifestyle Behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval.

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 of Time was found. 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). No statistically significant interaction contrast was found between any time periods. The total health promotion lifestyle scores for the investigated groups are presented in Figure 5.

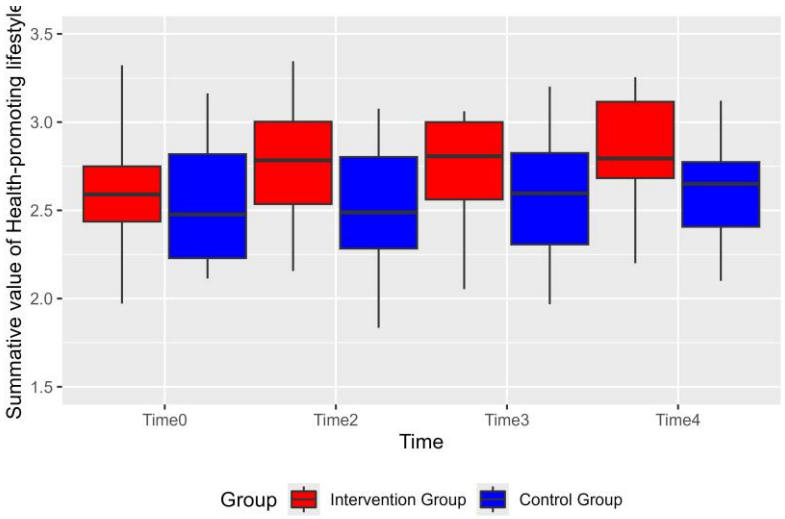

Figure 5. Results on the Summative value of Health-promoting lifestyle behaviour for the two groups at the four measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval.

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. No significant baseline differences were observed between the intervention and control groups across psychological variables ($p>0.05$ in all cases; Supplementary Table 1).

For the assessment of *State anxiety,* there was a main effect for Time, F (4,211.397) = 15.778, $p<0.001$, indicating that results differed significantly across the assessed time periods (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 of 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, indicating that results differed significantly across the assessed time periods (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 were no main effects for Group and Time, and the interaction between these factors was not 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, which means that 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), ψ_{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 Figure 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).

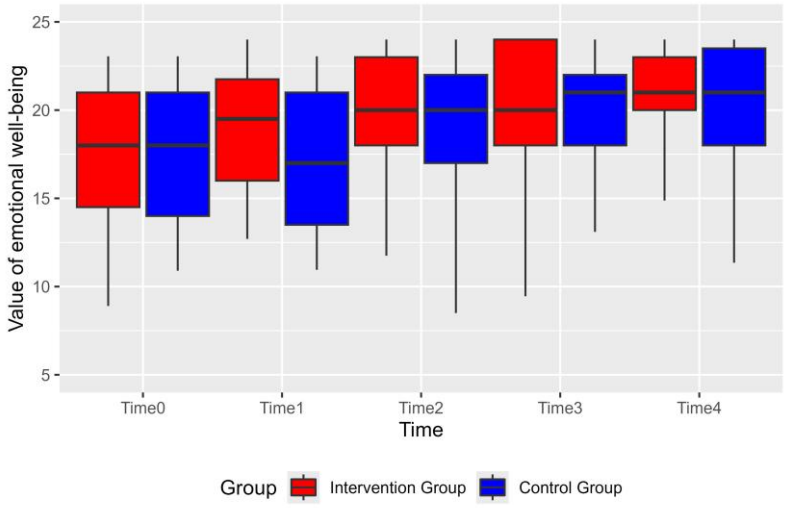

Figure 6. Results on the emotional well-being dimension of the Quality of Life for the two groups at the five measuring time points. The boxes illustrate the interquartile ranges, indicating the median values. The whiskers indicate the 95% confidence interval.

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

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 Control	2.36 ± 0.40 2.28 ± 0.41	-	2.62 + 0.39 2.22 ± 0.39	2.64 + 0.48 2.33 ± 0.49	2.46 +0.46 2.34 ± 0.44	group = 6.93 time = 3.04 group x time = 2.64	0.01* 0.03* 0.05
Nutrition	Intervention Control	2.72 ± 0.47 2.56 ± 0.43	-	2.85 ± 0.47 2.58 ± 0.46	2.86 ± 0.49 2.62 ± 0.41	2.88 ± 0.47 2.72 ± 0.34	group = 4.13 time = 1.36 group x time = 0.67	0.05 0.26 0.57
Physical activity	Intervention Control	2.17 ± 0.58 2.35 ± 0.85	-	2.51 ± 0.67 2.19 ± 0.51	2.41 ± 0.62 2.33 ± 0.71	2.65 ± 0.51 2.19 ± 0.62	group = 0.89 time = 1.47 group x time = 3.88	0.35 0.23 0.01*
Stress management	Intervention Control	2.29 ± 0.50 2.31 ± 0.55	-	2.60 ± 0.46 2.37 ± 0.52	2.59 ± 0.48 2.39 ± 0.48	2.53 ± 0.37 2.39 ± 0.46	group = 1.07 time = 6.72 group x time = 2.65	0.30 <0.001* 0.05
Interpersonal relationships	Intervention Control	3.27 ± 0.43 3.10 ± 0.50	-	3.28 ± 0.44 2.99 ± 0.46	3.22 ± 0.51 3.03 ± 0.50	3.23 ± 0.49 3.15 ± 0.52	group = 5.43 time = 1.63 group x time = 0.67	0.02* 0.19 0.58
Spiritual growth	Intervention Control	2.94 ± 0.46 2.85 ± 0.56	-	3.00 ± 0.50 2.65 ± 0.47	3.00 ± 0.60 2.82 ± 0.50	3.10 ± 0.50 2.77 ± 0.42	group = 5.53 time = 1.36 group x time =2.70	0.02* 0.26 0.049*
Total score	Intervention Control	2.63 ± 0.32 2.58 ± 0.39	-	2.82 ± 0.39 2.51 ± 0.38	2.79 ± 0.38 2.59 ± 0.38	2.81 ± 0.34 2.61 ± 0.32	group = 6.26 time = 2.33 group x time = 4.17	0.01* 0.08 0.007*

Psychological factors, mean ± SD								
State anxiety	Intervention Control	46.90 ±11.56 48.87 ±11.87	45.10 ± 10.67 46.63 ± 11.29	38.30 ±10.84 43.73 ± 11.63	37.26 ±11.93 40.65 ± 9.28	36.56 ± 8.28 38.20 ± 8.59	group = 0.93 time = 15.78 group x time =0.31	0.34 <0.001* 0.87
Depression	Intervention Control	3.43 ± 2.84 4.20 ± 3.57	2.48 ± 2.30 3.68 ± 3.51	2.52 ± 3.62 4.16 ± 3.63	2.89 ± 2.92 4.26 ± 4.53	2.63 ± 2.13 3.00 ± 3.04	group = 2.34 time = 3.19 group x time = 0.61	0.13 0.014* 0.66
Perceived stress	Intervention Control	16.38 ± 5.92 17.68 ± 5.52	- -	14.87 ± 7.21 17.81 ± 5.00	12.84 ± 7.26 15.13 ± 6.86	12.75 ± 6.90 13.55 ± 5.26	group = 2.19 time = 7.05 group x time = 0.40	0.14 <0.001* 0.75
Effect of breast treatment	Intervention Control	- -	- -	24.5 ± 19.38 27.47 ± 20.92	19.50 ± 16.83 24.26 ± 22.05	20.19 ± 16.24 24.21 ± 21.13	group = 0.05 time = 4.24 group x time = 0.78	0.83 0.02* 0.47
Qualitiy of life – physical well-being	Intervention Control	24.33 ± 3.43 23.53 ± 4.66	25.24 ± 3.23 23.66 ± 4.55	22.70 ± 6.01 21.77 ± 4.65	21.58 ± 7.44 22.09 ± 5.52	23.50 ± 5.20 22.90 ± 5.01	group = 0.50 time = 4.47 group x time = 0.41	0.48 0.002* 0.80
Quality of life – social well-being	Intervention Control	22.82 ± 3.65 21.79 ± 4.93	22.53 ± 3.66 21.82 ± 4.65	22.35 ± 4.46 21.35 ± 5.09	22.84 ± 4.32 22.22 ± 4.62	23.00 ± 4.23 21.80 ± 5.25	group = 2.35 time = 0.49 group x time = 0.69	0.13 0.74 0.60
Quality of life – emotional well-being	Intervention Control	17.46 ± 4.46 17.46 ± 4.08	18.89 ± 3.76 17.26 ± 4.13	20.00 ± 3.74 18.74 ± 4.65	19.63 ± 4.68 20.04 ± 3.32	20.94 ± 2.74 20.37 ± 3.90	group = 0.46 time = 11.57 group x time = 2.91	0.498 <0.001* 0.02*
Quality of life – functional well-being	Intervention Control	19.97 ± 4.92 19.03 ± 4.87	20.42 ± 4.66 19.07 ±4.14	20.26 ± 7.32 16.96 ± 5.64	21.16 ± 6.76 19.83 ± 5.47	20.69 ± 5.63 19.58 ± 6.03	group = 2.66 time = 2.29 group x time = 0.48	0.107 0.08 0.70
Quality of life – other concerns about breast cancer treatment	Intervention Control	26.15 ± 9.47 24.87 ± 4.56	26.79 ± 9.69 25.32 ± 4.03	25.48 ± 7.10 24.39 ± 6.22	26.89 ± 8.18 27.57 ± 6.10	28.69 ± 6.80 25.80 ± 8.39	group = 0.45 time = 1.23 group x time = 0.32	0.50 0.30 0.86

III.2 STUDY 2: Examining illness narratives in the context of postoperative psychological state

III.2.1 Materials and methods

Participants and procedure

Our study included 140 patients who had undergone surgery for a chronic disease or malignancy. On average, the subjects had been diagnosed 2.62 years earlier (SD = 5.05) and were classified into five main diagnostic groups (Table 5). The primary inclusion criterion was successful elective postoperative status: our sample did not include inoperable patients. Additional inclusion criteria were: a diagnosis of chronic illness or malignant tumour, surgery within the last five days for a chronic disease or cancer, over 18 years of age, and literacy skills to read and write. The exclusion criterion was the presence of severe psychiatric, neurological and sensory organ disease.

Participation in the study was voluntary and based on the patient's written informed consent. The research was conducted in accordance with the Declaration of Helsinki (1964) and approved by the Regional Research Ethics Committee of the University of Szeged, Albert Szent-Gyorgyi Health Centre, approval number: 145/2020-SZTE.

Although chronic disease and cancer follow different clinical courses, participants with cancer and those with chronic illness were analysed as a single group within the narrative analysis, based on the theoretical assumption that chronic disease patients and cancer patients share traumatic experiences, but the specific experiences of each disease have their own characteristics (Alonzo et al., 2000; Ratcliff et al., 2018; Rogers et al., 2021). Similarly, we did not further differentiate patients with cancer according to the stage of the disease: in most cases, the operability of the tumour and successful removal indicated that the disease was not advanced, and the stage of the disease makes the patient suitable for curative treatment, and the patient was not in the palliative phase (Schofield et al., 2006).

The study adopted an observational cross-sectional design using a qualitatively driven mixed-methods approach, integrating qualitative and quantitative measurement tools. Data collection took place at the University of Szeged, Albert Szent-Györgyi Health Centre, Department of Surgery, and assessments were conducted by psychologists working within the clinic. Each subject completed the assessment once within five days of surgery, adapting to the constraints of hospital stay length and considering the patient's physical condition.

The assessment session consisted of two main components: completion of a questionnaire package measuring postoperative psychological status, followed by a semi-

structured interview using the Emotional Graph of Illness Trajectory — a graphical elicitation technique designed to explore emotion-focused illness narratives. Participant recruitment for this study took place over a 20-month period, from September 2020 to May 2022.

Table 5. Description of the study sample by patient groups

Patient group by diagnosis	N	Type of surgery (N)	Gender (N)	Mean age (SD)
Breast cancer	41	Mastectomy (16) Excisio (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)
Gastrointestinal 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)

Measures

Within the test battery, a block of questions on sociodemographic data was designed to assess respondents' age, gender, employment status, place of residence, education, and marital status. Furthermore, we recorded medical data, including the type of surgical intervention performed on the patient and information on the somatic disease that justified the surgical intervention (diagnosis, onset of disease).

The Emotional Graph of Illness Trajectory was used to identify the *type of emotion-focused illness narrative* and to explore its content. The technique can identify the dominant emotion characterising the disease process and the emotional impact of disease-related events (Thygesen et al., 2011). The technique used by our research team was based on the graphical procedure of Thygesen and colleagues (2011): a graphical elicitation technique with a timeline structure, using a grid-graphic tool that includes a horizontal axis representing events in chronological order and a vertical axis with a 0-100% coverage to assess the intensity of

the experienced emotion. The Hungarian adaptation of the Emotional Graph of Illness Trajectory was conducted by our research team (Lévai et al., 2023).

During the test, the patient was first asked to name the most potent emotion she/he had experienced during the trajectory of illness. In the next step, the patient was asked to list, in chronological order along the horizontal axis, the emotionally significant events 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. After the patient has named all the events he/she wishes to indicate on the horizontal axis and has rated the intensity value in percentage of the emotion associated with the events, the investigator can calculate and record the average value of the emotional intensity from the emotion intensity scores given by the subject, on the marking sheet. In this way, the quantification of the Emotional Graph of Illness Trajectory, as the average value of the emotional intensity of the graph, is obtained (Lévai et al, 2023).

Compared to the original procedure and marking sheet of the elicitation technique created by Thygesen and colleagues (2011), we made some innovations to our enhanced tool, to understand the patient's self-constructed disease narrative: (1) the horizontal axis of our instrument does not contain predefined 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. 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 additional supplementation is the post-test based on the interview questions used in the original method (Thygesen et al., 2011). The questions were designed to determine whether other individual or socio-environmental factors might have contributed to a change in the intensity of emotion related to the illness. The 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 records the answers in the space provided on the marking sheet.

*T*o measure *anxiety levels*, we applied the Spielberger State-Trait Anxiety Inventory (STAI-T and STAI-S), which assesses the individual's general anxiety level (trait anxiety questionnaire) on a four-point Likert scale, scored from 0 to 80, using 20 items, and the individual's current anxiety level (state anxiety questionnaire), also using 20 items and scored

from 0 to 80 (Spielberger et al., 1970). In our study, the internal reliability of the questionnaire was excellent for both the STAI-T (Cronbach's alpha = 0.89) and STAI-S (Cronbach's alpha = 0.91) scales.

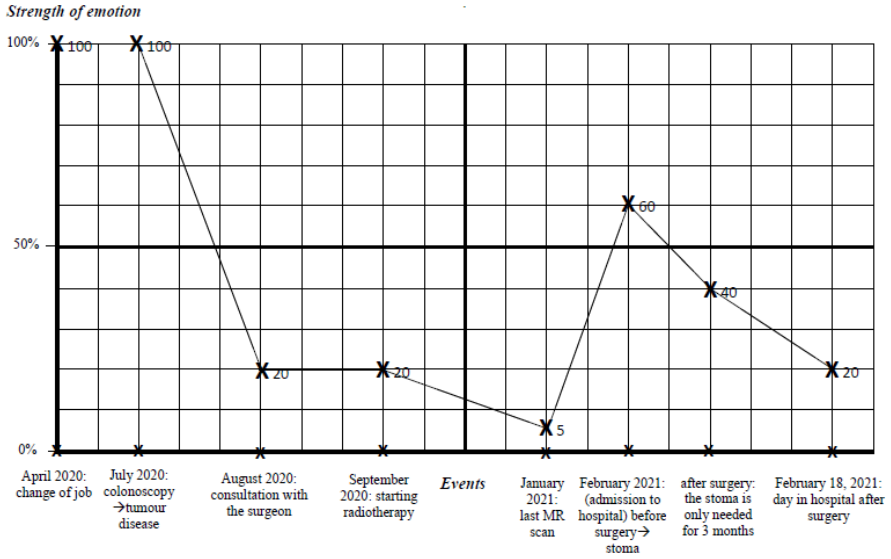

Figure 7. The Emotional Graph of Illness Trajectory of Patient A.

Note: A was 40 years old female patient, taken within five days after the resection of her malignant rectal tumour in a surgical inpatient ward. The patient's graph depicted the evolution of the feeling of hopelessness, with an average intensity value of 45.63% during the period of the disease, ending days after the surgical procedure.

The Beck Depression Inventory 9-item shortened version (BDI-9) was used to measure *depression level*. The questionnaire measures the presence of certain symptoms of depression, such as social withdrawal, indecision, fatigue, sleep disturbance, inability to work, pessimism, lack of pleasure and satisfaction, and self-blame, over the past month, using a four-point Likert scale ranging from 0 to 27 points (Beck et al., 1961). The internal reliability of the instrument was adequate in our study (Cronbach's alpha = 0.79).

The 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 they have experienced a particular feeling or thought that characterizes stress (Cohen et al., 1983). The questionnaire scores from 0 to 40. The internal reliability of the scale in our study sample was also found to be adequate (Cronbach's alpha = 0.75).

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 measured by a single question and is answered on a three-point scale (EuroQol Group, 1996). The internal reliability of the instrument was also sufficient in our study (Cronbach's alpha = 0.72).

We explored *attitudes to illness* using the Brief Illness Perception Questionnaire. The scale 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, ranging from 0 to 80 total points. The response score represents the perceived threat associated with the disease; the higher the score, the more negative the disease image (Broadbent et al., 2006). 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 test session of the Emotional Graph of Illness Trajectory, the examiner recorded on the marking sheet the following information from the subject: the dominant emotion of the illness trajectory and its justification, the main events of the illness process, their content, their description, and finally, the responses to the questions asked during the post-test. This data has been subjected to content analysis involving two independent coders. Our research team considered the aspects of Frank's concept of illness narratives (Frank, 1995; Frank 1998) as characteristic of illness narratives and as the content criteria for content analysis, thereby forming the theoretical basis for the categorisation that helped create the experimental groups and for coding. Furthermore, relying on the analytical method of Thygesen and colleagues (2011), Ricoeur's (1979) Interpretation Theory proved beneficial during the analysis process. Coding was conducted by two independent coders as part of the content analysis. Our research team provided them with the literature on which our research was based, including a detailed description and relevant sources on Frank's theory of the disease narrative.

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 content analysis, the coders assessed the marking sheets in three steps. They marked the closest illness narrative type regarding content and narrative (chaos story, restitution story, or quest story).

1) the emotion associated with the disease process and the reasons for it; 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 concept. As a result, the subject's illness narrative was the most frequently occurring type in the verbal content.

Statistical analysis

Statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA, 2017). G*Power 3.1 was used to calculate effect size values (Erdfelder et al., 1996). The limit of statistical significance was set at $p < 0.05$. Before analysing the data, normality tests were performed on the mean emotion-intensity values obtained using the graphical technique and on the questionnaire results, both for the total study sample and for the subgroups, using the Kolmogorov-Smirnov test. For groups with fewer than 30 members, the Shapiro-Wilk test was used. Pearson correlation and Spearman rank correlation tests, which do not assume a normal distribution, were used to analyse the strength and direction of correlations among the examined psychological factors. 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 a Mann-Whitney U test were used to compare two independent groups. Post hoc pairwise comparisons of groups were performed using Hochberg's GT2 test for parametric tests and Mann-Whitney U test, and Bonferroni test for non-parametric tests. The correlations between the groups were tested using the Chi-square test for variables at nominal or ordinal measurement levels.

III.2.2 Results

Examination of illness narrative types and their relationship with psychological variables

The sample of 140 individuals consisted of 87 women (62.14%) and 53 men (37.86%). The mean age of the sample was 53.1 years (SD: 12.03). The sample can be characterised by educational attainment: 11.5% had eight primary qualifications, 61.1% had intermediate qualifications, and 27.4% had a college/university degree.

While analysing 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 (Frank, 1995; Frank 1998). 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 involving different encodings, the subject's narrative was coded based on the involvement and assessment of a third, independent coder, and then assigned to the subject's narrative type, thereby correcting discrepancies between the two coders' assessments. The three types of illness narratives in 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 between illness narrative type and sociodemographic variables was examined using one-way ANOVA and a Chi-square test, with sociodemographic variables as independent variables and narrative type as the dependent variable. The findings of our 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 (gender: $\chi^2=1.938$, $p=0.379$; area of residence: $\chi^2=1.224$, $p=0.874$; educational qualifications: $\chi^2=9.996$, $p=0.616$; marital status: $\chi^2=16.382$, $p=0.282$; employment activity: $\chi^2=6.8$, $p=0.871$). The narrative type does not show a significant correlation with any sociodemographic variable.

In our hypothesis testing, we used one-way ANOVA to compare scores across the three narrative-type groups for normally distributed variables, and the Kruskal-Wallis H test to compare scores of the BDI, BIPQ, and EQ-5D index scales for non-normally distributed variables. When comparing 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 feasible by performing the same statistical test, so the description of the hypothesis testing results refers to the same results, so they are presented once, in terms of the different disease narrative groups, and a complex interpretation can be achieved by considering the results together. Our hypothesis are: (H2) patients who narrate the chaos narrative are characterised by the most negative psychological status, and that they are the most likely to show psychological burden as a result of the illness; (H3) the restitution narrative would be characterised by a moderate psychological state compared to the other two narrative types, with these patients showing less psychological distress than the chaos narrative; (H4) the quest narrative is characterised by the most positive

psychological state, with the least psychological burden caused by the disease compared to the other two narrative types. Our analysis showed a small effect with a significant difference in the mean intensity of the graphically depicted emotion across the three narrative types (F(2, 137) = 3.472, MSE = 422.168, p = 0.034, η^2 = 0.05). Furthermore, perceived stress (PSS) (F(2, 137)= 7.471, MSE= 38.362, p = 0.001, η^2 = 0.1), state anxiety (STAI-S) (F(2, 137)= 4.124, MSE= 121.538, p = 0.018, η^2 = 0.06), trait anxiety (STAI-T) (F(2, 137)= 5.796, MSE= 103.403, p = 0.004, η^2 = 0.08), depression (BDI) (H(2)= 7.946, p = 0.019, η^2 = 0.05) and perception of illness (BIPQ) (H(2)= 12.577, p = 0.002, η^2 = 0.08) also showed significant differences with small and medium effects between the three groups of narrative types. (Table 6). 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 pairwise comparisons of the groups, there were no significant differences in the mean graphically depicted emotion intensity across the three groups for any of the dependent variables that showed significant differences. However, Hochberg's GT2 test results revealed 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 6). Post hoc Mann-Whitney U tests indicated a significant difference in depression scores between the chaos story and restitution story groups (p = 0.01) and between the chaos story and quest story groups (p = 0.018). Furthermore, for illness perception, there was a significant difference between the chaos story and restitution story (p = 0.045), between the restitution story and quest story groups (p = 0.011), and between the chaos story and quest story (p = 0.001) (Table 6). Thus, our results demonstrate 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, as well as on the levels of trait anxiety, state anxiety, depression, perceived stress, and illness perception.

Based on the analysis of our results, the second hypothesis of the present thesis (H2) was 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. Regarding quality of life, our hypothesis (H2) was not confirmed. Our third hypothesis (H3)

is also supported; the restitution narrative group has a moderate psychological state compared to the other two narrative groups and scores more positively on measures of depression, trait anxiety, perception of illness, and perceived stress than the chaos narrative group. Additionally, the restitution story exhibited the lowest emotional intensity of the disease process. Our third hypothesis regarding state anxiety and quality of life is not confirmed. Our analysis also partially supports our fourth hypothesis (H4): the quest story was characterised by the most positive perception of illness and the lowest levels of perceived stress, depression, trait anxiety, and state anxiety, which were associated with the highest emotional intensity values for the illness process. Regarding quality of life, our fourth hypothesis was also not confirmed (Table 6). 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 show that there is no significant difference between the two patient groups ($\chi^2(2) = 5.491$; $p = 0.064$).

Table 6. Mean scores and standard deviations (SD) of the Emotional Graph of Illness Trajectory and the questionnaires used, presented by illness narrative groups

	Chaos story[a]	**Restitution sotry[b]**	**Quest story[c]**	**F**	**H**	***p***	**η^2**	***p*-value of a significant 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: Mean scores marked with „a", „b", and „c" indicate scores with a significant difference in post hoc test.

Examining the structure of illness perception across illness narrative types

According to the hypothesis testing in the context of investigation of the illness perception's structure 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 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 the dimension of 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, significantly affecting 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 the overall perception of illness ($p= 0.045$) and its scores on the treatment control dimension ($p = 0.049$) than the restitution story and also scored significantly higher, in other words, more negative scores compared to the quest story on the overall perception of illness ($p = 0.001$) and on treatment control dimension ($p = 0.009$), as well as on the dimensions of illness-related concern ($p = 0.001$) and emotional representation ($p < 0.001$) (Table 7).

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 ($p = 0.011$), illness-related concern score ($p = 0.012$) and emotional representation score ($p = 0.006$), than the quest story group (Table 7). Based on the results of hypothesis testing, each of our hypotheses was supported for the dimensions of illness-related concern, treatment control, and emotional representation of illness perception. For the other dimensions of disease perception, our hypotheses were not confirmed.

To summarise the characteristics of disease perception for the three illness narrative types explored in our study, the group narrating the chaos story shows 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 dimensions of disease perception that showed significant differences, such as treatment control, concern, and emotional representation (Table 7). The restitution story group is a narrative type with so-called "intermediate" disease perception characteristics, as it had a significantly higher overall score than the chaos story but a significantly lower score than 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 7). The individuals who narrated the quest story could be considered the group with the most positive perception of illness; in other words, the group with the lowest perceived threat. This group showed the lowest scores on all dimensions compared to the other two groups - except for the dimension of coherence (which asks about the patient's understanding of their illness) - and, according to the results of the post hoc tests carried out, significantly lower scores on illness-related concern and emotional representation compared to the groups narrating the chaos and restitution narratives (Table 7).

Table 7. Mean scores and standard deviations (SD) for the illness narrative types on the total BIPQ scale and its dimensions

	Chaos story[a]	**Restitution story[b]**	**Quest story[c]**	**H**	***p***	**η^2**	***p-value* of a significant post hoc test**
Total score of illness perception	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	7.73 (2.36)	7.35 (2.49)	6.09 (2.84)	5.107	0.078	-	-
Timeline	6.17 (2.92)	5.24 (3.29)	4.82 (3.26)	3.254	0.197	-	-
Personal control	5.2 (2.9)	4.21 (2.74)	3.71 (2.92)	4.223	0.121	-	-
Treatment control	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	7.12 (12.83)	4.8 (3.0)	4.04 (2.92)	1.552	0.46	-	-
Concern	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	2.44 (2.52)	2.21 (2.65)	2.95 (3.14)	1.558	0.459	-	-
Emotional representation	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: Mean scores marked with „a", „b", and „c" indicate scores with a significant difference in post hoc test.

IV. **DISCUSSION**

The purpose of the doctoral research was to develop a health psychological intervention for breast surgery patients. In the STUDY 1, we conducted a quasi-randomised-controlled trial to investigate the impact of a multidisciplinary health promotion intervention on health-promoting lifestyle behaviours in patients recovering from malignant breast cancer.

Observations began two weeks before breast surgery, and follow-up ended six months after surgery. The 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 overall health.

The primary hypothesis (H1)—that the multidisciplinary health-promoting intervention will result in positive changes in patients' health-promoting behaviours at the assessed time points after surgery (2 weeks, 3 months, and 6 months postoperatively)—was supported by the findings. According to the present results, the change in the level of summated health-promoting behaviour differed significantly between the two groups, with a significant increase in the intervention group over the six months following surgery. Across the dimensions of health-promoting behaviour, the same pattern was observed for physical activity and spiritual growth: changes in these factors differed significantly between the two groups, with significant increases in the intervention group and no significant positive change over time in the control group. Regarding the psychological factors examined, the change in the emotional well-being dimension of quality of life differed significantly between the two groups: the intervention group showed a significant increase in the three months following surgery, whereas the control group showed no significant positive change over time.

Our most outstanding finding is that the *overall mean score for health-promoting behaviours* in the intervention group was higher than in the control group. This finding aligns with previous research demonstrating the effectiveness of interventions based on Pender's HPM (Carreno et al., 2006; Mohebi et al., 2013). Earlier studies and systematic reviews have consistently shown that HPM provides a comprehensive theoretical framework for promoting and maintaining healthy behaviours across a range of chronic conditions, including hypertension, cardiovascular disease, diabetes-related complications, end-stage liver disease, haemodialysis and cancer survivorship (Chen & Hsich, 2021; Farsi et al., 2019; Karataş & Polat, 2021; Masoudi et al., 2020; Mohammadipour et al., 2015; Omidi et al., 2016; Vakilian et al., 2021; Zhong et al., 2023). The present study adds to this body of evidence by confirming the model's applicability in the context of postoperative breast cancer recovery.

The success of the intervention may also be attributed to its optimal timing. Kelly and colleagues (2020) 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 the highest levels of psychological distress among breast cancer patients were observed. Providing support to patients before this critical phase can help

them maintain optimal health-promoting behaviours during chemotherapy (Kelly et al., 2020; Mukherjee et al., 2017). During the three-week period around breast surgery, our patients received five intervention sessions, which preceded adjuvant oncologic treatments. Presumably, in our study, the optimal timing enabled participants to effectively use the educational and practical content of the supportive approach to health promotion in the six months following breast surgery, covering the initial or full period of adjuvant oncologic treatment.

Research has shown that many breast cancer patients underestimate the role of exercise in reducing treatment-related complications and improving survivorship outcomes (Gabel et al., 2024; Hirschey et al., 2017; Kwan et al., 2012). However, in recent years, numerous epidemiological studies have shown that regular physical activity of at least 150 minutes per week can reduce breast cancer-specific mortality by 42% among patients diagnosed with breast cancer and reduce the risk of recurrence by 16-35% (WCRF, 2025; Zagalaz-Anula et al., 2022). In our study, *physical activity* emerged as one of the most responsive components of the health-promoting lifestyle. A statistically significant difference in the trajectory of physical activity was observed between the intervention and control groups, with the most pronounced improvement occurring between the preoperative assessment and the six-month postoperative follow-up. These results are consistent with prior evidence indicating that targeted health behaviour interventions can effectively increase physical activity among breast cancer patients (Torabi et al., 2025). However, motivating cancer survivors to engage in regular exercise remains challenging due to persistent barriers such as fatigue, treatment side effects, and limited confidence in the long-term benefits of physical activity. The present findings suggest that structured, motivational, and supportive interventions may help overcome these barriers.

Another key outcome was a significant improvement in *spiritual growth* among participants in the intervention group. Spiritual growth, as conceptualized within the HPM framework, involves developing internal resources that enable individuals to transcend their current state and find meaning, purpose, and personal growth (Pender, 1996; Walker & Hill-Polreczky, 1996). Patients receiving the intervention showed significantly greater positive change in spiritual growth than controls. This effect may be explained by the programme's emphasis on empowerment during the preoperative phase and sustained psychological support in the postoperative period. Such support appears to facilitate adaptive psychological changes that foster resilience and inner growth. Qualitative and quantitative studies in oncology have highlighted spirituality as a vital coping resource for women diagnosed with breast cancer

(Leão et al., 2021; Wang et al., 2024). Qualitative research by Leão et al. (2021) showed that for women diagnosed with breast cancer, spirituality was a source of support and well-being that helped make the diagnosis less distressing. According to the results of Wang et al. (2024), 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. Spiritual engagement has been associated with reduced distress, enhanced well-being, and improved quality of life among colorectal cancer patients (Chen et al., 2018; Hoon et al., 2013; Vissers et al., 2017). The present findings reinforce the notion that addressing spiritual needs as part of a structured health promotion programme can yield meaningful psychological benefits.

Among the examined psychological factors, the change in the emotional well-being dimension of quality of life differed significantly between the two groups: the intervention group showed a significant increase, whereas the control group showed no significant positive change over time. This result suggests that the intervention's supportive elements effectively addressed patients' heightened emotional needs during the vulnerable postoperative period. Breast surgery represents a psychologically sensitive phase in the cancer trajectory, often accompanied by anxiety, emotional burden and uncertainty (Fong et al., 2017; Grocott et al., 2023). The intervention's long-term impact on emotional well-being may reflect patients' openness to receiving psychological and social support during this critical time window. Moreover, the observed increase in emotional well-being may be partly mediated by improvements in physical activity. A growing body of evidence indicates that physical activity plays a crucial role in enhancing emotional and psychological health among breast cancer survivors (Aguiñaga et al., 2018; Courneya et al., 2014).

The study also assessed various psychological factors — including anxiety, depression, perceived stress, and treatment-related concerns — at each measurement point to ensure that changes in health behaviour were not confounded by psychological deterioration. While no significant group or interaction effects were observed for these variables, a significant time effect was detected. 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 (Gosain et al., 2020; Jamie et al., 2015). However, the intervention appeared to selectively enhance emotional well-being beyond this general recovery trend. 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.

We consider the following limitations to be significant for our research: (1) The small group sizes and the participant drop-out rate may have negatively affected the power of the statistical analyses conducted. (2) Due to the form of randomisation used, we cannot claim that the only systematic difference between the two conditions is the intervention. The study uses a quasi-randomised design rather than true randomisation, as group allocation is based on surgeon-assigned operating days beyond the investigator's control, potentially introducing unmeasured systematic scheduling biases between Day A and Day B and thus between 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. 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.

In summary, the results of STUDY 1 showed that the 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 behavioural aspects of spiritual growth and physical activity. Among these factors, we can assume 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 (Du et al., 2024; Yavuz & Hacıalioğlu, 2018).

Finding meaning in life is a key element in improving well-being, reducing emotional distress, and better adapting during and after experiencing a traumatic event such as cancer (Elekes, 2017; Krok & Telka, 2018; Supriati et al., 2023). According to Supriati et al. (2023), two variables affect the meaning of life among women undergoing treatment for breast cancer: communication from healthcare workers and spirituality. A longitudinal study by Brassai et al. (2015) found that, in a healthy population, the presence of meaning and the search for meaning were predictive of physical activity and healthy eating. Based on the literature, the intervention examined in STUDY 1 may support the search for meaning by

promoting spiritual growth, which may further facilitate the development of a healthy lifestyle among breast cancer patients and serve as an opportunity to reinforce the meaningfulness of a healthy lifestyle in life (Gravier et al., 2020; Krok & Telka, 2018).

In STUDY 2 of the present thesis, we applied the Emotional Graph of Illness Trajectory to explore the illness narratives of patients who had undergone surgery in the context of their postoperative psychological state. The starting point of the study was the results of the method validation research of this graphical elicitation technique related to postoperative psychological state (Lévai et al., 2023). The aim of this study was to investigate whether the Emotional Graph of Illness Trajectory is suitable for exploring emotional aspects of patients' illness narratives. Following the implementation of Hungarian validation, we applied this technique to map the emotional aspects of disease narratives from the preoperative period of 140 patients with chronic diseases or malignancies who underwent surgery, along with quantitative questionnaires to assess their postoperative emotional and mood states, perceived stress levels, 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 and - state anxiety, depression, perceived stress, and illness perception. Using this visual technique, we learned about the emotional aspects of patients' illness narratives, the individual characteristics of the disease process and the patients' characteristics and experiences that influenced their coping with the illness and their emotional changes. Therefore, we effectively used this visual technique during the preoperative phase of the health promotion intervention, as presented in the first study of the present thesis..

The STUDY 2 examined differences in postoperative psychological state and illness perception across Frank's three illness narrative types - chaos, restitution and quest - and partially confirmed the proposed hypotheses. The second hypothesis (H2) of the doctoral dissertation; patients who narrate the chaos narrative are characterised by the most negative psychological status, and they are the most likely to show psychological burden as a result of the illness, was partially supported. Patients narrating the chaos story reported significantly more negative illness perceptions and higher levels of recent depression, anxiety and perceived stress than those narrating either restitution or quest stories, confirming the association between chaos narratives and heightened psychological distress. The third hypothesis (H3), proposing that the restitution narrative would be characterised by a moderate psychological state compared to the other two narrative types, with these patients showing less psychological distress than the chaos narrative, was also partially supported. Across all

examined psychological variables, restitution narrators consistently scored in the intermediate range. They showed significantly lower levels of depression, trait anxiety, perceived stress and illness perceptions than chaos narrators, yet did not reach the more favourable psychological profile observed among quest narrators. This pattern suggests that restitution narratives reflect partial psychological adaptation without the deeper meaning-making processes characteristic of quest narratives (Frank, 1995; Frank 1998; Nettleton et al., 2004; Thomas-MacLean, 2004; Whitehead, 2006). Fourth hypothesis (H4), which states that the quest narrative is characterised by the most positive psychological state, with the least psychological burden caused by the disease compared to the other two narrative types, was likewise partially confirmed. Patients narrating the quest story reported more controllable illness perceptions, fewer perceived symptoms, reduced illness-related concerns and lower emotional distress compared to both chaos and restitution narrators. Another noteworthy result is that the quest narrative group exhibited the highest average intensity of graphically depicted emotional change, whereas the lowest emotional intensity was observed in the restitution narrative group.

A clear trend emerged for all psychological factor measures: chaos narrators scored highest, restitution narrators intermediate, and quest narrators lowest, indicating progressively more adaptive psychological functioning. In contrast, emotional intensity did not follow this linear pattern. Emotional intensity was highest among quest narrators, nearly equivalent among chaos narrators (only 1.73% lower), and substantially lower—by approximately 10%—among restitution narrators. This dissociation suggests that high emotional intensity does not necessarily indicate psychological burden but may instead reflect emotionally engaged and adaptive processing. These findings are consistent with the assumption that quest narratives are associated with more effective emotion regulation processes (Bakken et al., 2023; Whitehead, 2006). In line with Frank's conceptualisation of the quest narrative, patients narrating this story type appear to experience the emotional impact of illness-related events while simultaneously engaging adaptive emotion regulation strategies, such as cognitive reframing and construing illness as a meaningful challenge. This dual process may facilitate the stabilisation of psychological well-being and promote positive changes in postoperative psychological state and illness perception (Bakken et al., 2023; Frank, 1995; Kangas & Gross, 2020).

Analysis of illness perceptions revealed significant differences among the three narrative types in three dimensions: treatment control, illness-related concern and emotional representation. The most pronounced differences were observed in treatment control. Chaos

narrators reported the highest scores, indicating the lowest perceived effectiveness of treatment and differed significantly from both restitution and quest narrators. Restitution narrators occupied an intermediate position, while quest narrators reported the lowest scores, reflecting the most positive treatment-related perceptions. Significant differences were also found in illness-related concern and emotional representation. In these emotionally laden dimensions, only quest narrators differed significantly from the chaos and restitution groups, whereas no differences emerged between chaos and restitution narratives. These findings mirror the pattern observed for psychological state and suggest that quest narratives are uniquely associated with adaptive emotional engagement. Differences in treatment control perceptions can be understood in relation to the defining characteristics of the narrative types. The chaos narrative reflects a fragmented and disempowered illness experience; the restitution narrative frames illness as a temporary disruption with an expectation of recovery; and the quest narrative presents illness as a meaningful challenge to be confronted and integrated into one's life story (Bakken et al., 2023; Frank, 1995; Whitehead, 2006; Mesa Freydell et al., 2022). Trust in treatment and commitment to recovery appear strongest in the quest narrative, which may explain the more favourable perceptions of treatment control in this group. For illness-related concern and emotional representation, the findings suggest that the more adaptive emotion regulation processes characteristic of quest narratives underlie the observed differences. In contrast, emotion regulation strategies associated with chaos and restitution narratives appear to be less differentiated and less adaptive (Kangas & Gross, 2020). The absence of differences in other illness perception dimensions likely reflects their weaker association with emotional processing, whereas treatment control, concern, and emotional representation are more directly linked to emotion regulation and emotional involvement (Frank, 1995; Kangas & Gross, 2020).

Overall, the results support the conceptualisation of the quest narrative as a psychological process involving meaning-making, identity reconstruction and adaptive emotion regulation, while the restitution narrative reflects a more passive orientation toward recovery. The chaos narrative, in contrast, is characterised by unarticulated suffering, loss of the former self, and the inability to construct a coherent new identity, which is reflected in elevated depression, anxiety, perceived stress levels, and negative illness perceptions (Frank, 1995; Frank, 1998; Nettleton et al., 2004; Thomas-MacLean, 2004; Whitehead, 2006). These findings are consistent with prior research demonstrating strong associations between emotional aspects of illness narratives and emotional or mood states (Breccia et al., 2016; Ratcliff et al., 2018), as well as studies linking illness representations to psychological distress

in breast cancer, chronic illness, and amyotrophic lateral sclerosis populations (McCorry et al., 2012; Bijsterbosch et al., 2009; Miglioretti et al., 2008).

No significant differences were found among narrative types in health-related quality of life as measured by the EQ-5D-3L. This may reflect the instrument's generic nature, which may lack sensitivity to narrative-related psychological and emotional distinctions (EuroQol Group, 1996). Future research should use specific measures that are more sensitive to these differences. Furthermore, the study has a number of limitations that should be also mentioned: unequal group sizes, heterogeneity in diagnoses and disease trajectories. However, the relatively low proportion of quest narratives reflects routine clinical experience, where positive emotional perspectives and successful psychological adaptation are less frequently reported.

In summary, the Emotional Graph of Illness Trajectory used in this study may serve as a clinically valuable tool for restructuring illness experiences, restoring narrative continuity, and reducing the negative emotional impact of illness, which are skills considered essential in health psychology patient care (Charon et al., 2001; Chocinov et al., 2005; Garnefski et al., 2009; Levine et al., 2010). In our opinion, this technique allows professionals to make a relatively quick analysis. The graph can help put the experience of illness into perspective, restructure it, re-evaluate it through remembering, and thus restore the disconnectedness of life history.

V. CONCLUSIONS AND MAIN FINDINGS

Our results from STUDY 1 suggest that the period before adjuvant oncological treatment, following primary breast surgery, is an optimal time window to implement a multidisciplinary health promotion intervention for malignant breast cancer patients. The findings of this study highlight the complex role and impact of a multidisciplinary health promotion intervention, emphasising its educational value and its support for improving patients' health behaviours during recovery from malignant breast cancer. A key strength of the study lies in the integration of the intervention into routine clinical practice. This enhances the ecological validity and practical relevance of the findings. Overall, the results provide strong support for using Pender’s Health Promotion Model (1996) as a guiding framework for comprehensive, multidisciplinary interventions to improve behavioural and psychological outcomes in breast cancer survivors.

Our results from STUDY 2 provide evidence that the illness narratives interpreted within Frank's theoretical framework include the patient's emotions about the disease process, his or her activity or lack of activity in the recovery process, in other words, the patient's psychological adjustment, which is related to emotional and mood states, stress levels, and perceptions of the illness, all of which are specific to the recovery process, in this case, to the postoperative state. The Emotional Graph of Illness Trajectory can help put the experience of illness into perspective, restructure it, and re-evaluate it through remembering, a psychological process that adaptively helps reduce the traumatic impact of illness. In summary, this technique explores and constructs an emotion-focused disease narrative that can help restore a sense of personal control and reduce feelings of suffering, which are intrapersonal needs that are fundamentally damaged when facing a severe illness.

Main findings:

1. The multidisciplinary, health-promoting intervention (Body and Mind Programme) was effective in increasing health-promoting behaviours in breast cancer patients in the six months following surgery.
2. Three weeks surrounding breast surgery is an effective time window for health promotion for patients recovering from malignant breast cancer.
3. Due to the intervention's multidisciplinary perspective, it was able to influence behavioural and psychological factors simultaneously.
4. The Emotional Graph of Illness Trajectory is an effective emotion-focused exploratory and intervention tool for exploring Frank's illness narratives in the patient's recovery process.
5. The patient's emotion-focused illness narrative has an impact on the postoperative psychological state.

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Supplementary Table 1

Descriptive statistics for the intervention and control groups on the results of the health behaviour and psychological factors assessed in the preoperative period. Note: Values marked with * indicate a significant difference, $p < 0.05$

Variable	**Group**	**Baseline: Two weeks before surgery (T0)**	***t***	***U***	***p***	**One day before surgery (T1)**	***t***	***U***	***p***
Health promotion lifestyle, mean ± SD									
Health responsibility	Intervention Control	2.36 ± 0.41 2.28 ± 0.41	-	704.50	0.46	-	-	-	-
Nutrition	Intervention Control	2.72 ± 0.47 2.57 ± 0.43	1.54	-	0.13	-	-	-	-
Physical activity	Intervention Control	2.17 ± 0.58 2.35 ± 0.85	-1.14	-	0.26	-	-	-	-
Stress management	Intervention Control	2.29 ± 0.50 2.31 ± 0.55	-	766.50	0.89	-	-	-	-
Interpersonal relationships	Intervention Control	3.27 ± 0.43 3.10 ± 0.50	1.64	-	0.11	-	-	-	-
Spiritual	Intervention	2.94 ± 0.46	0.78	-	0.44	-	-	-	-

growth	Control	2.85 ± 0.56							
Total score	Intervention Control	2.63 ± 0.32 2.58 ± 0.39	0.61	-	0.55	-	-	-	-
Psychological factors, mean ± SD									
State anxiety	Intervention Control	46.90 ± 11.57 48.87 ± 11.87	-	740.5	0.57	45.10 ± 10.67 46.63 ± 11.29	-0.621	-	0.54
Depression	Intervention Control	3.42 ± 2.84 4.2 ± 3.57	-	723.0	0.46	2.48 ± 2.30 3.68 ± 3.52	-	666.0	0.19
Perceived stress	Intervention Control	16.38 ± 5.82 17.68 ± 5.52	-1.03	-	0.31	-	-	-	-
Effect of breast treatment	Intervention Control	-	-	-	-	-	-	-	-
Qualitiy of life – physical well-being	Intervention Control	24.33 ± 3.42 23.52 ± 4.66	-	695.50	0.64	25.24 ± 3.23 23.66 ± 4.55	-	554.50	0.08
Quality of life – social well-being	Intervention Control	22.82 + 3.65 21.79 ± 4.93	-	693.0	0.63	22.53 ± 3.66 21.82 ± 4.65	0.74	-	0.46

Quality of life – emotional well-being	Intervention Control	17.46 ± 4.46 17.46 ± 4.07	0.00	-	1.00	18.89 ± 3.76 17.26 ± 4.13	1.82	-	0.07
Quality of life – functional well-being	Intervention Control	19.97 ± 4.92 19.02 ± 4.87	0.855	-	0.40	20.42 ± 4.66 19.10 ± 4.14	1.34	-	0.19
Quality of life – other concerns about breast cancer treatment	Intervention Control	26.15 ± 9.57 24.87 ± 4.56	-	735.50	0.96	26.79 ± 9.70 25.32 ± 4.03	-	714.0	0.93

Descriptive statistics for the intervention and control groups on the results of the health behaviour and psychological factors assessed in the postoperative and follow-up periods. Note: Values marked with * indicate a significant difference, $p < 0.05$

Variable	**Group**	**Two weeks after surgery (T2)**	***t***	***U***	***p***	**Three months after surgery (T3)**	***t***	***U***	***p***	**Six months after surgery (T4)**	***t***	***U***	***p***

Health promotion lifestyle, mean ± SD													
Health responsibility	Intervention Control	2.62 ± 0.39 2.22 ± 0.39	3.743	-	<0.001*	2.64 ± 0.48 2.33 ± 0.49	-	145.0	0.06	2.46 ± 0.45 2.34 ± 0.44	0.817	-	0.42
Nutrition	Intervention Control	2.85 ± 0.46 2.59 ± 0.46	2.093	-	0.04*	2.86 ± 0.49 2.62 ± 0.41	1.784	-	0.08	2.88 ± 0.46 2.72 ± 0.34	1.166	-	0.25
Physical activity	Intervention Control	2.51 ± 0.67 2.19 ± 0.51	1.942	-	0.06	2.41 ± 0.62 2.33 ± 0.71	-	191.5	0.49	2.65 ± 0.51 2.19 ± 0.62	2.354	-	0.03*
Stress management	Intervention Control	2.60 ± 0.46 2.37 ± 0.52	1.702	-	0.1	2.59 ± 0.49 2.39 ± 0.48	1.349	-	0.19	2.53 ± 0.37 2.39 ± 0.46	0.95	-	0.35
Interpersonal relationships	Intervention Control	3.29 ± 0.44 2.99 ± 0.46	2.415	-	0.02*	3.22 ± 0.51 3.03 ± 0.50	1.194	-	0.24	3.23 ± 0.49 3.16 ± 0.52	0.426	-	0.67
Spiritual growth	Intervention Control	3.00 ± 0.50 2.65 ± 0.47	2.673	-	0.01*	3.00 ± 0.50 2.59 ± 0.49	1.097	-	0.28	3.09 ± 0.50 2.77 ± 0.42	-	85.00	0.03*
Total score	Intervention Control	2.82 ± 0.39 2.51 ± 0.34	3.088	-	0.003*	2.79 + 0.38 2.59 + 0.38	1.691	-	0.09	2.81 ± 0.34 2.61 ± 0.32	1.844	-	0.07*

Psychological factors, mean ± SD												
State anxiety	Intervention Control	38.30 ± 10.84 43.73 ± 11.63	-1.734	-	0.09	37.26 ± 11.93 40.65 ± 9.28	-1.036	-	0.31	36.56 ± 8.28 38.20 ± 8.59	-0.578	-	0.57
Depression	Intervention Control	2.52 ± 3.61 4.16 ± 3.63	-	239.00	0.04*	2.89 ± 2.92 4.26 ± 4.53	-	192.0	0.50	2.63 ± 2.13 3.00 ± 3.04	-0.418	-	0.68
Perceived stress	Intervention Control	14.87 ± 7.21 17.81 ± 5.00	-1.632	-	0.11	12.84 ± 7.26 15.13 ± 6.87	-1.048	-	0.30	12.75 ± 6.90 13.55 ± 5.26	-	140.50	0.54
Impact of breast treatment	Intervention Control	24.50 ± 19.28 27.47 ± 20.92	-0.521	-	0.61	19.50 ± 16.83 24.26 ± 22.05	-	193.5	0.72	20.19 ± 16.24 24.21 ± 21.13	-	143.00	0.78
Qualitiy of life – physical well-being	Intervention Control	22.70 ± 6.01 21.77 ± 4.64	-	287.50	0.23	21.58 ± 7.44 22.0ö ± 5.52	-	213.5	0.9	23.50 ± 5.2 22.90 ± 5.01	0.351	-	0.73
Quality of life – social well-being	Intervention Control	22.35 ± 4.46 21.35 ± 5.09	-	318.50	0.50	22.84 ± 4.32 22.22 ± 4.62	0.449	-	0.66	23.00 ± 4.23 21.80 ± 5.25	0.742	-	0.46

Quality of life – emotional well-being	Intervention Control	20.00 ± 3.74 18.74 ± 4.65	-	306.0	0.37	19.83 ±4.68 20.04 ± 3.32	-	214.0	0.91	20.94 ± 2.74 20.37 ± 3.90	-	149.5	0.94
Quality of life – functional well-being	Intervention Control	20.28 ± 7.33 16.97 ± 5.64	1.887	-	0.07	21.16 ± 6.76 19.83 ± 5.47	0.706	-	0.48	20.69 ± 5.63 19.58 ± 6.03	0.558	-	0.58
Quality of life – other concerns about breast cancer treatment	Intervention Control	25.48 ± 7.10 24.40 ± 6.22	0.60	-	0.55	26.90 ± 8.18 27.57 ± 6.10	-0.304	-	0.76	28.69 ± 6.81 25.80 ± 8.38	1.114	-	0.27