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**Self-representations in breast cancer patients
and survivors: Body Image, Injured self, and
available psychological interventions**

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List of Abbreviations

BI: Body Image
BIS: Body Image Scale
BC: Body Compassion
BCS: Body Compassion Scale
BSC: Bodily Self-Consciousness
DM: Decision making
EWB: Emotional Well-Being
FACT-B: The Functional Assessment of Cancer Therapy-Breast
FBI: Full Body Illusion
FCR: Fear of Cancer Recurrence
FWB: Functional Well-Being
HADS: Anxiety and Depression Scale
I-OBCS: Objectified Body Consciousness Scale
MCQ-30: Metacognition Questionnaire
PE: Physical Exercises
PHQ: Patient Health Questionnaire
PWB: Physical Well-Being
QoL: Quality of Life
SMS: Self-Memory System
STAI: State Trait Anxiety Inventory
SWB: Social Well-Being
VR: Virtual Reality
VRFBI: Virtual Reality Full Body Illusion

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Abstract

In recent years, research on the Self has burgeoned in the psychological field; however, knowledge gaps still exist because most studies have failed to acknowledge the multidimensional nature of self-representations in breast cancer patients and survivors. My Ph.D. thesis focuses on the impact of the Self on the Quality of Life in breast cancer patients and survivors. The current project proposes the need for a renovated definition of the Self with the integration of a new self-representation based on the association between autobiographical memory and the cancer experience. A specific and illness-related self-representation, called “Injured Self”, has been conceptualized and explored on a practical level. Specifically, five studies addressed the Self, Body Image, and the Injured Self through quantitative and qualitative methods. In particular, the first study reported the impact of bodily representations on decisions in a healthy population. Given the relevance of bodily self, a review and meta-analysis study demonstrated the effectiveness of mixed-methods interventions on Body Image in breast cancer patients and survivors. However, Body Image did not appropriately address all of the bodily’ issues in breast cancer patients and survivors. Starting from the definition of the Injured Self, a program of both physical exercises sessions and psychological interventions tailored to the Injured Self’ issues was proposed. Findings evidenced the benefits of this intervention for breast cancer patients and survivors’ well-being. Then, in order to promote the implementation of a holistic approach and further explore constructs related to the Injured Self, the fourth exploratory study demonstrated the influence of bodily compassion and metacognition on breast cancer survivors’ bodily self. Starting from these findings, the last study proposed new psychological interventions to promote a positive Injured Self by addressing body compassion’s contents. In conclusion, findings of this Ph.D. project suggest that addressing Body Image may be insufficient to promote body-related well-being in breast cancer patients and survivors. Psycho-oncology may benefit from further research on more complex constructs, such as the Injured Self. Finally, the present thesis gives future directions to increase breast cancer survivors' well-being based on their experience of the body and the Self.

1. Introduction

1.1 The Self

The self has been conceptualized in several disciplines among psychology, neuroscience, and philosophy (Strohinger, Knobe, & Newman, 2017) over the years. As a system of cognitive and affective structures (“schemas”), the self-concept lends coherence and structure to one’s significant experiences. Moreover, it maintains homeostasis between individuals and their social context by promoting subjective well-being (Sui & Humphreys, 2015). In other words, the self acts as an integrative hub linking information and cognitive processing to pursue goals and regulate emotions and behaviors (Markus & Kunda, 1986^b; Mancha & Yoder, 2015; Riesmeyer, Hauswald & Mergen, 2019). Psychological studies usually define the self as one’s representations of personality traits, values, and social preferences (Choi, Cho, Seo & Bechtoldt, 2018; Thagard & Wood, 2015). According to this view, individuals have multiple and context-dependent self-representations expressed in an interrelated memory network (McConnell, Shoda & Skulborstad, 2012). Different self-representations can be activated by social encounters as well as environmental and personal circumstances (Tajfel, 1986) and experimental priming (Tanti et al., 2011). On a social level, group-belonging (e.g., “social identity”) (Tajfel, 1974) and self-perception (Higgins, 1987) impact multiple selves, which can be indeed defined as fluid and could change due to external stimuli (e.g., contexts) (Markus, 1977; McConnell et al., 2012; Thomas et al., 2012). According to this view, Higgins (1987) theorized the *self-discrepancy theory*. In this theory, the author stated that the more the distinction between the actual self (i.e., what they are) and the ideal self (i.e., what they want to be in the future), the more the person is likely to develop emotional issues and psychopathologies, such as eating disorders (Strauman, 1991), problematic substance use, addiction (Wolfe et al., 2007), and other compulsive behaviors (Dittmar et al., 2005; Li et al., 2011).

In cognitive science, a possible differentiation among multiple selves is related to bodily and narrative selves (James, 2011). Firstly, the bodily self is “an integrated system characterized by matching of sensory–motor information, not detached from experience (Legrand, 2006, p. 111). It highlights an idea of the *embodied self*, which is based on the body as an expression of implicit knowledge about body-effectors and actions (Frassinetti, Ferri, Maini, Benassi & Gallese, 2011). Experimental evidence showed the integration of bodily stimuli within the peri-personal space (Salomon et al., 2017). Consistently, brain areas reflect appearance and location of the body in terms of self-identification or body-ownership (e.g., limbs are part of my body), self-location (that is the experience of the self

in the own body in a specific location in the space; e.g., where my body is in space), and first-person perspective (that is one's subjective perception of the world) (Blanke, 2012). On the other hand, the narrative self refers to stored knowledge about experience and/or anticipated ideas about the future, linking to historical aspects of one's life (Sui & Humphreys, 2015). In particular, the narrative self is based on personality traits (e.g., being honest) and retrieving memories about one's biographical information (for example, ranging from identity-relevant facts, such as date and place of birth, to life events) (Araujo, Kaplan, Damasio & Damasio, 2015). Regarding the narrative self, the role of episodic memory is essential. Sensory-perceptual-affective reconstruction of experiences is indeed the result of information exchanged between the self and the episodic memory system in order to sustain long-term self-representations (Singer, Blagov, Berry & Oost, 2013). This memory system model is based on retrieving autobiographical narratives that emerged from memory storage which integrate specific episodes into the subjective life story (Merrill, Waters & Fivush, 2016). At the same time, the narrative history of shared social interactions with others is a central component of the self (Dominey et al., 2017). Starting from biographical and historical events, individuals generate an account of their ongoing body states, directly influenced by interoceptive signals from body changes (e.g., the perception of thirst and hunger) as well as exteroceptive signals from the context (e.g., external pressure on the body) at a specific moment in time (Araujo et al., 2015). A study by Dominey and colleagues (2017) evidenced that a narrative companion (e.g., a robot) can accompany individuals with impaired narrative memory in the recording and sharing of memories. In other words, a new level of alternative and augmentative communication can help to maintain positive social interactions.

1.1.1 Self and Decision-Making

As a general definition, Decision Making (DM) is how people make choices among available alternatives (Edwards, 1954; Thokala et al., 2016). DM plays a significant role daily by affecting everyday activities; many studies have focused on understanding DM processes by assessing why people choose one option instead of another in a set of alternatives (Marasso et al., 2014). In order to understand DM, there are many factors that have to be considered. Firstly, the amount of information can stimulate individuals' critical thinking to reach an accurate decision (Gréhaigne et al., 2001). Similarly, it is paramount to consider the continuous exchange between the Self and the environment, in terms of internal and external sensations that people perceive constantly. Individual perceptions are a mix of interoceptive and exteroceptive influences simultaneously (Mirams et al., 2013); cognitive and somatic reactions are indeed the result of both internal and external stimuli, which can

be assessed as the target of self-regulation processes (Birrer & Morgan, 2010). Being aware of emotions and, even more, being aware of the subjective judgments on our emotions (which could be pleasant or unpleasant, for instance), is essential to recognize available resources and how to recruit them over a DM process (Hanin, 2013). At the same time, not only are emotions important during this process but intrusive thoughts play a relevant role too. To sum up, the awareness of inner sensations, emotions, and intrusive thoughts are some of the essential steps that affect DM, in terms of distractors and available instruments to make a good decision (Toner et al., 2015).

Regarding self-representations, multiple selves and related characteristics impact DM, in that people make choices relying on thoughts related to their different selves (Jamison & Wegener, 2010). Werner and colleagues (2009) stated that inner self-perceptions are relevant in evaluating of available alternatives. Specifically, authors demonstrated that high interoceptive abilities allow better performances in DM tasks. Bodily feedback theories evidenced that anticipatory bodily signals can impact decisions (Price & Harmon-Jones, 2015). Dunn and colleagues (2010) sustained that anticipated bodily signals are associated with intuitive decisions and may lead to advantageous or disadvantageous decisions. Specifically, Baumeister (1984) demonstrated that focused attention on inner sensations and dispositional self-consciousness affect cognitive function, by impairing performance due to distraction during a task. Studies show that introspection can negatively influence DM. “Thinking too much” about one’s own sensations and feelings could decrease the systematic process of information as well as the capacity to discriminate between more and less important features (Tordesillas & Chaiken, 2007). Furthermore, some scholars affirm that people with high interoceptive abilities show increases in *loss aversion* (Sokol-Hessner et al., 2015), which is the tendency to overweight losses compared to equivalent gains (Gal & Rucker, 2018; Tversky & Kahneman, 1992). Generally assessed as a stable personality traits (Sokol-Hessner & Rutledge, 2019), it can be influenced by the awareness of inner sensations. Specifically, the individual's emotional intensity associated with a specific choice can increase the weight of losses (Sokol-Hessner et al., 2015).

In conclusion, inner information orientates and improves decisions, becoming a reference point for assessing individuals’ motivation and values. In addition, people who are more able to stay in contact with the sensorial and interoceptive processes are more aware of their “gut” responses, which affect next decisions. On the contrary, perception disorders, such as overall amygdala damage (De Martino, Camerer & Adolphs, 2010) and alexithymia (Sokol-Hessner & Rutledge, 2019), showed lower loss aversion.

1.1.2 The self in breast cancer patients and survivors

Nowadays, most of the main challenges emerging from the healthcare systems worldwide regard long-term care of chronic conditions. Diseases once lethal are today treatable, but still deeply affect patients and survivors' Quality of Life (QoL); indeed, patients require continual healthcare management even after recovery. In chronic disease, breast cancer is the most common cancer in women worldwide, with an estimated 1.7 million new cancer cases diagnosed in 2012, representing 25% of all cancers. Breast cancer is also the most frequent cause of death for women aged <55 years, representing 15% of total cancer cases (Lahart et al., 2015; Bower et al., 2015). On a physical level, oncological treatments may lead to several physical changes, such as skin discoloration, dermatitis, soreness, and hair loss (Gorini et al., 2016; Parker et al., 2017). Chemotherapy and hormonal therapy are associated with weight increase and early menopause (Parker et al., 2017; Trusson & Pilnick, 2017) and surgery may remove one or both breasts and leave scars (Park, 2017). These changes can also affect individuals' perception of themselves and their own Body Image (BI) (Brunet et al., 2022; Sowa et al., 2018; Słowik et al., 2017). Referring to bodily changes, adverse effects as dizziness, nausea, a tingling sensation in the fingers and feet, swollen joints and swelling of the affected limb and range of motion as consequences of chemotherapy and anti-hormonal therapy are commonly mentioned (Kim et al., 2020) and disturb women even five years later (Fang et al., 2016). Thus, bodily sensations (e.g., hitching, occasional pain, any unexpected nociceptive or interoceptive event) can be constant reminders of the illness experience and, especially, of the distressing possibility that cancer may have returned and spread with consequences on behaviors. For example, Thewes and colleagues (2012) showed that breast cancer survivors declared a higher frequency of breast self-examination due to high Fear of Cancer Recurrences (FCR). On a psychological level, studies have provided evidence that cancer diagnosis and treatments can produce adverse effects, including mood disorders and cognitive dysfunctions (Arnaboldi, et al., 2014; Dietrich et al., 2008; Lim et al., 2011; Park et al., 2017). Breast cancer diagnosis often comes at an age when women are in the middle of career development or child-rearing. Women do not feel ready and able to face a chronic risky illness for life (Hermann et al., 1996). The American Psychiatric Association recognized cancer diagnosis as a traumatic stressor possibly generating impairments in different areas of functioning, such as the ability to work and intimate and social relationships, because of negative moods (e.g., anxiety, anger, sadness, suffering, guilt, and fear of death) (Arnaboldi et al., 2014) with notable consequences on breast cancer's women QoL (Falk et al., 2010; Słowik et al., 2017; Soo et al., 2016) and even in the disease progression (Renzi et al., 2016^a). Similarly, the anticipation

of adverse outcomes, uncertainty about the future, and changes in the lifestyle post-diagnosis can lead to higher emotional distress (Ng et al., 2017). On a cognitive level, living with breast cancer can also lead to impairments in attention, executive function, learning, and memory (Ibrahim et al., 2017). Many patients undergoing cancer treatment complain about so-called “*chemobrain*” (McAllister et al., 2004), a cognitive decline associated with brain intoxication (Butler & Haser, 2006). Symptoms of “*chemobrain*” often persist after the completion of therapy and cause discomfort to survivors who are unable to return to daily life or find difficulties at work and in other everyday life activities. Finally, another relevant issue for cancer patients is DM during their cancer care process. The cancer continuum is characterized by several stages (prevention, screening, diagnosis, treatment, survival, or end of life) and each of them requires at least one specific decision (Reyna et al., 2015; Gorini et al., 2018). Good cognitive skills and flexibility to make the right choice *per se* and lead to appropriate changes in lifestyle are needed (Arnaboldi et al., 2016). Ideally, along this cancer continuum, decisions should be based on clear benefits and fully understood drawbacks associated with an understanding of alternative courses of action (Reyna et al., 2015). Breast cancer patients must be aware of what is happening to them and the current state of the disease, comparing all the different notions and ideas and the multiple representations of illness (Renzi et al., 2016^b).

In conclusion, life events and experiences deeply influence people's self-representations. Specific traumatic experiences, such as breast cancer, could affect self-representations strongly (Sebri, Triberti & Pravettoni, 2020^b; Sebri et al., 2019). However, not all chronic diseases are the same from a psychological point of view (Bahrami et al., 2018). Breast cancer patients and survivors have to deal with important daily challenges; some are common in chronic health conditions, while other experiential issues are specific to breast cancer (Gudenkauf et al., 2015). For instance, the perception of a sense of powerlessness and frequently alters patients' self-conception (Chung et al., 2017). Possible consequences could be an altered self-esteem and a less perception of womanhood (Wilmoth, 2001). Thus, it is important to explore self-representation issues in breast cancer patients and survivors and available interventions to promote well-being and health management.

1.2 From “Body Image” to the “Injured Self”

As aforementioned, oncological disease does not only affect the body and its aesthetic appearance (Trusson et al., 2016). A growing body of literature shows that breast cancer seriously infringes on patients' and survivors' general sense of the self and, in particular, BI (Jabłoński et al., 2019), even until years after diagnosis and treatments (Falk Dahl et al., 2010). Specifically, BI can be defined as an “internal representation of one's own outer appearance” (Thompson et al., 1999, p. 4). It is a complex representation of one's own body and related emotions within an overall sense of bodily self (Lewis-Smith et al., 2018) at several levels: attitudinal (such as the subjective satisfaction about one's own body), affective (i.e., sensations and emotions), perceptual (for example, being able to estimate the body size), cognitive (in terms of involvement in appearance belief about the body, for instance), and behavioral dimensions (i.e., compensatory behaviors such as physical activity and dieting) (Cash & Smolak, 2011). BI is the result of integration of multiple inputs; some of them coming from the perception of the body itself (*somatic perception*, influenced by body position in space, interoceptive and exteroceptive inputs); others come from cognitive representations, which are influenced by culture (*somato-representation* or the semantic knowledge of the body) (Longo et al., 2010).

Referring to the cancer context, the body and its changes after illness impact QoL strongly. The body can become a source of fear and danger: interoceptive sensations and pain within the breast and chest once ignored are now suddenly salient and disruptive (Falbjork et al., 2013; Paterson et al., 2016). In other words, women associated interoceptive sensations with threats to one's own life and safety (Harris et al., 2017). Thus, “checking behaviors” (i.e., touching sensitive areas of their own bodies and looking for nodules or anomalies daily) can be a typical behavioral feature after diagnosis that represents a strong FCR (McGinty et al., 2016). Women often reported that, even if they try to reconcile their FCR, bodily marks (e.g., tattoo and burn marks from radiotherapy, the complained of weight gain resulting from hormone therapy or the lost either part, or the whole, of one or both breasts) are constant reminders of their illness experience (Trusson et al., 2016; Fang et al., 2016). This could lead to different reactions: for some women, physical alterations are not wholly a negative experience, but a source of being proud of their strength to cope with illness; otherwise, the majority reported physical alterations as a permanent embodied reminder that with high distress for the negative impact on the sense of femininity and sexuality (Thomas-MacLean, 2005; Young, 1990). In this regard, oncological treatments can also have consequences on the body about induced menopause, vaginal dryness, and loss of

fertility, which can threaten overall self-satisfaction. Being dissatisfied with one's own body affects sexuality and femininity too on several dimensions. Cancer can affect eroticism (sexual identity) and the possibility of intimacy with the partner due to the embarrassment for the body (Male et al., 2016; Phillips et al., 2008; Woertman & Van den Brink, 2012). In general, breast cancer patients experience a decreased sexual attractiveness and sense of womanliness. This could be associated with the fear related to insecurity in one's body resulting from changes in the shape and sensitivity of breasts as well as the fear that the partner does not accept these bodily changes (Fioretti et al., 2017). The relationship with the partner is often threatened by the impossibility of pregnancy too (Rowland et al., 2009).

Women feel often inappropriate (Falk Dahl et al., 2010; Dua et al., 2015) due to the tendency to constantly self-scrutinize their physical appearance and related signs of oncological treatments (Hunter, 2015; Triberti et al., 2017; 2019^b). Some survivors described the considerable effort involved in pretending to be as she once was, yet never fully succeeding. On a behavioral level, the everyday act of clothing becomes a charge. Efforts to camouflage defects with hats or makeup, excessive grooming (e.g., hair combing), and changes in dieting and clothing could be expected behaviors to cope with oncological signs (Phillips, 2008). Similarly, women reported the measures they took to conceal the surgery results, such as avoiding low necklines, which might reveal a scar or the top of their prosthesis, and certain situations where they were not confident there. For instance, social relationships are sometimes experienced with a certain amount of shame and anxiety for the distressed apprehension of the self as inadequate and seemed worried that this inadequacy may come suddenly to light (Bartky, 1990). Impairments in emotion regulation and QoL also impact the abilities to face diagnosis and oncological treatments. However, studies reported that capacities in managing the diseases could be compromised if oncological patients and survivors are apprehensive about their bodies (Speck et al., 2010).

To sum up, the experience of a familiar sense of the body, the self, and social interactions combine to integrate a view of "me". From this "me," an expectation develops of how the body would function and respond in certain situations and the physical changes of cancer can interrupt this familiar self-definition (Hungr et al., 2017). Treatments constituted much more than the loss of a body part because it profoundly affected self-esteem and social relationships. Therefore, one main risk could be linked to the reframing of women's identity, which is affected by storylines articulated around the relationship between self-representations and autobiographical memories as a patient and/or a survivor

(McGannon & Spence, 2012; Nieto et al., 2019). In other words, breast cancer survivors' well-being also depends on intrapsychic negotiation within their social and relational context (Male et al., 2016). Despite the relevance of assessing breast cancer patients and survivors' evaluation of their own physical appearance as well as attitudes towards the body (Maass et al., 2015; Sherman et al., 2018; Torres et al., 2020), a theory to define what BI means for breast cancer patients and survivors, what factors influence it, and its consequences is lacking in literature. A new self-representation, so-called Injured Self, is proposed (Sebri et al., 2020^b).

1.2.1 The Injured Self: definition and clinical implications

As previously reported, breast cancer patients and survivors are affected by “injuries” to the self, although they received successful treatment. However, there is not a specific self-representation associated with illness experience. The present project proposes the integration of a new self-representation, namely the Injured Self, into the overall Self. The Injured Self actively affects the overall self and everyday life decisions; breast cancer patients and survivors have to integrate the Injured Self into a renovated self to promote an overall and coherence sense of the Self, in terms of BI especially (Sebri et al., 2020^b).

The episodic memory system, in particular, plays an essential role in defining of the Injured Self (Conway, 2005). On a cognitive level, interoceptive and exteroceptive perception resulting from the body during and after a cancer experience can affect the Self-Memory System (SMS). Specifically, SMS is involved in the closely knit and reciprocal interconnection between the Self and autobiographical memories (Conway, 2005) and is characterized by vividness, connection to concern or unresolved conflict, and a high rehearsal (Singer & Salovey, 1993). This way, illness-relevant information, which belongs to SMS, becomes more salient and accessible than others (Clemmey & Nicassio, 1997), leading to strong consequences on emotions and behaviors and meaning-making of life events (Conway, 2005; Franco et al., 2017). The flexibility of SMS is essential to allow emotion regulation and reach individuals' goals (Josephson et al., 1996). In contrast, a greater identification as a cancer patient/survivor predicts maladaptive autobiographical thinking processes can emerged (Sansom-Daly et al., 2018). Nieto and colleagues evidenced that intrusive memories of cancer experiences and avoidance are associated with autobiographical memory issues and depressive thinking. Additionally, the experience of inability to perceive the correspondence between autobiographical memories, self-representations, and real-life experiences can destroy any delineated sense of Self (Conway

et al., 2005). Thus, the experience of breast cancer, also in terms of alterations within the SMS, has relevant consequences on mental health, involving high levels of anxiety, depression, and distress until some years after acute treatments (Gandubert et al., 2009; Woertman & Van den Brink, 2012).

Women must recognize and manage the Injured Self as a new self-representation that affects attitudes and behaviors (Zacks et al., 2001). In this sense, it has to be integrated into the overall self by following the self-coherence request (Markus & Nurius, 1986^a). Six relevant areas could be affected by an Injured self-representation:

- *adherence to treatments*: the Injured Self may lead women to depression symptoms and, then, to a low engagement in healthy behaviors (Kaplan et al., 2010) by adhering to treatments in a passive and lacking manner. This is evident when they struggle or refrain from actively making decisions, despite the relevance of their active role in the process of care (Kondylakis et al., 2017);

- *view on the future*: positive future representations of themselves are essential to adopt adaptive coping styles (Zhang et al., 2010). On the contrary, the Injured Self may highlight the fear of thinking and dreaming about the future, leading women to focus on their self-representation as patients only (Sansom-Daly et al., 2018). Yet, goals are seriously limited because of an overall perception of hopelessness grounded in the self-representations;

- *daily lifestyle and relationships*: the Injured Self seriously impairs routine, relationships, and the lack of independence (Jacobs et al., 2018). Breast cancer patients and survivors might remain trapped in the idea of being not self-sufficient or, on the contrary, the desire to demonstrate their willingness to be healthy could increase distress;

- *emotion regulation*: the Injured Self may lead to impairments in autobiographical memories and self-representations (Giffard et al., 2013). However, not all women are aware of one's own inner sensations and feelings; this decreases the ability to attenuate emotional arousal leading to disrupted self-representation and related emotions (Herwig et al., 2010);

- *coherence and flexibility of the overall Self*: the Injured Self may cause a breakdown in life continuity. This affects self-identity, making the cancer event an important part of self-representations (Cheung & Delfabbro, 2016).

As a clinical implication, psychological interventions should aim to reintegrate self-coherence among self-representations and the Injured Self. Mainly, the Injured Self could be addressed about one's changes, time of appearance, and the subjective interpretation of the events, breast cancer firstly. An example of an efficacy intervention could be the life review therapy, based on retrieving positive memories and re-evaluating of patients' life events (Kleijn et al., 2018). However, the exploration of other characteristics associated with chronic illness-related alterations to the self as well as a specific and appropriate psychological treatment for the Injured Self is needed.

1.2.2 The Impact of Unsupportive Social Support on the Injured Self in Breast Cancer Patients

Speaking about Injured Self and its characteristics, it is relevant also to consider social support (Sebri et al., 2021^o). Social support is a human need associated with believing that others have positive or negative views about us (Wills, 1991). From a constructionist point of view (Lakey et al., 1992), studies demonstrated that social support is impacted by the recipient's perception of the others' evaluation of themselves and their personality characteristics (e.g., attachment style). The perceived social support is influenced by receiver, supporter, and their relationship characteristics (Haber et al., 2007). As known from life-span approaches (Uchino, 2009), pre-existing familial environment (e.g., family affection, which is helpful to build a stronger Self based on psychological skills, such as proactive coping) impacts perceived social support. Thus, perceived social support has been linked to positive health outcomes. At the same time, the current social and relational network influence received social support, which is context-related. In other words, it is situational and, therefore, less grounded in relationships and related social self-representations over time. In other words, the cultural and social context of supportive interactions may influence the perception of support (e.g., restrictive cultures may limit possibilities of developing supportive relationships outside of the family nucleus) (Badr et al., 2001). This way, not all forms of social support are beneficial (Breuer et al., 2017), but they can be divided into positive and negative ones. Firstly, positive support is conceived as interactions that promote affection (Ahn et al., 2017). On the contrary, negative support is related to support perceived as unhelpful or social constraints by others. This second one received less attention from scholars over the years (Breuer et al., 2017). Four main types of social support were identified by Suurmeijer and colleagues (1995): social-emotional or relationships based on affection and companionship; instrumental (e.g., advice and practical suggestions); problem-oriented or actual supportive interaction, which related to the

resolution of a specific problem; and daily support, focused on the full-time assistance for both socio-emotional and instrumental means. A distinction between perceived and received social support is theoretically needed.

Breast cancer patients are particularly susceptible to the availability of social support at specific times of the cancer experience (e.g., diagnosis). For example, high social support could be strongly relevant for breast cancer patients, survivors, and their health management. Positive social support can promote illness adjustment by decreasing distress and distress and lowering the risk of recurrence (Drageset et al., 2016; Martos-Méndez, 2015). Similarly, patients may perceive that others will provide the resources to redefine the harmful events, which can attenuate distress thanks to the assurance of esteem, emotional, and a sense of security as well as protection from negative feelings (e.g., helplessness and loss of self-esteem) (Zhang et al., 2017). This is in line with the *buffering model*, which is a process of support that protects individuals from potentially adverse effects of stressful events (Cohen & Wills, 1985). It is paramount to note that negative social support affects breast cancer patients' QoL (Shiozaki et al., 2011). A similar phenomenon has been defined in terms of “oppressive support” (Mazzoni et al., 2017), “problematic support” (Revenson et al., 1991), and “negative support” (Shiozaki et al., 2011). In these cases, social interactions that are perceived as detrimental can promote disengagement coping strategies, despite the perception of the supportive intent of the provider (Nouman & Zanbar, 2020). Moreover, low physical well-being and high depressive symptoms emerged (Yu & Sherman, 2015). Patient-and-caregiver communication is one of the main points involved in a supportive interaction. For example, avoidant communication about cancer issues generally increases lower relationship satisfaction, anxiety, and depression (Donovan-Kicken & Caughlin, 2011). Unsupportive social support is not just the lack of support, but social interactions that do not meet the needs of patients. The unintentional nature of unsupportive social support leads to not knowing what kind of supportive actions are needed. This is relevant to know because also providers may experience further stress, which results in a vicious cycle of detrimental interactions (Shiozaki et al., 2011).

Following Injured Self, positive social support may help breast cancer patients to integrate various self-schemas into a coherent one. For example, peers can promote group belonging to overcome patients' stigmatization (Pardede et al., 2021) and partner support is relevant to face sexual disturbances caused by changes in BI (Yu & Sherman, 2015). On a general level, being treated as a person, and not just as a patient, is fundamental to restore

the overall Self; therefore, some cognitive, emotional, and behavioral features have to care, such as the promotion of patient treatments' adherence (Schulman-Green et al., 2016). Similarly, breast cancer patients who perceive a sense of autonomy are actively involved in a shared DM process. This means they become more able to adopt adaptive coping styles (Sebri et al., 2020^a). Accordingly, mechanisms' sensitivity to patients' expectations, needs, and personal characteristics are determinants in the final reception of social support (Collins & Feeney, 2004). Considering the four types of social support provision previously presented (social-emotional, instrumental, problem-oriented, and daily social support proposed by Suurmeijer et al. (1995)), four types of negative social support that may further aggravate the Injured Self features were explored (see Table 1). Specifically:

- *illness denial*: diagnosis can highly burden family members who may tend to avoid problems to keep patients far from distress (Sauer et al., 2019). For instance, patients and caregivers may tend to suppress thoughts and sensations and underestimate the effects of oncological (Shiozaki et al., 2011). Patients cannot handle their concerns directly, promoting an experience of self-fragmentation characterized by features of low self-esteem as well as negative BI. In conclusion, illness denial may protect patients from the overwhelming experience of cancer diagnosis and its treatment in the short term; however, it will cause damage by delaying or hindering health management in a long run, with difficulties in the integration of the Injured Self into the overall Self;

- *taking over*: if caregivers are overly involved in patients' affairs (e.g., medical appointments), patients' loss of control, perception of inability to be self-sufficient, coping resources, and vulnerability may increase (Boutin-Foster, 2005). This is more likely to happen after diagnosis, when patients may live an "emotional blackout" (Graffigna et al., 2016). Consequently, they could be more likely to accept caregivers' behaviors and decisions in a passive manner, for example rejecting oncological treatments or accepting them just passively without shared DM;

- *poor communication with caregivers*: communication with caregivers sometimes finds trouble sensitively and openly regarding breast cancer topics (Goldsmith & Miller, 2013). On the one hand, patients tend to protect both themselves and others from the discomfort of discussing cancer-related issues. For example, sexual concerns and fears about disease progression and death could be hidden (Yu & Sherman, 2015). On the other hand, oncological patients may avoid open communication due to the experience of unwelcome suggestions, unsolicited information, or critiques about how they should cope (Boutin-Foster, 2005).

However, the fewer people are open to talk about cancer-related issues, the fewer possibilities patients have to elaborate on their cancer experience, which can increase anxiety, distress, and depression (Munro et al., 2014). This could be defined as a disengaged type of instrumental support in which patients perceive not being worthy of attention regarding desires and needs;

- *illness-centered view*: interacting just about the cancer experiences may promote the stigma of being only a patient (Penner et al., 2018). Although patients needing to be supported in developing attentional focus on their disease (Pene & Kissane, 2019), they require a positive life project beyond the disease to develop intrinsic motivation and hope (Graffigna et al., 2016). Not asking breast cancer patients what their future goals and dreams are may lead them to perceive a sense of isolation from society with sensations of guilt and shame, for instance.

Social support		Injured Self	
Type of social support	Problematic characteristics	The Injured Self features	Consequences
Social-emotional social support	Illness denial	Worsening of self-fragmentation in those patients who are already adopting biased coping strategies	<ul style="list-style-type: none"> - Low self-efficacy and self-esteem - Negative body image - Difficulties in the integration of the Injured Self into the overall Self
Problem-oriented social support	Taking over	- Fear of not being always self-sufficient, without autonomy in patients with insecure attachment, dependent personality	<ul style="list-style-type: none"> - Accept/reject treatments passively - Perception of hopelessness and absence of coping resources
Instrumental social support	Poor communication with caregivers	- Perception of doing not be worthy of attention - High negative emotions	<ul style="list-style-type: none"> - High distress, anxiety, and depression - Avoidance of patients' needs and expectations - Suppression of negative feelings - Fewer possibilities to elaborate illness experience
Daily social support	Illness-centered view	Seeing oneself only as a patient, for those patients who need to recover hope and intrinsic motivation	<ul style="list-style-type: none"> - Isolation - Sexual disturbances - Lack of future goals and dreams

Table 1. Four main unsupportive social support types that may promote Injured Self features and its emotional and behavioral consequences

Nowadays, studies evidence the efficacy of the psychological intervention (e.g., support-expressive group therapy) in improving emotional well-being in breast cancer patients (Bellver-Pérez et al., 2019). Starting from this theoretical contribution, structured psychological interventions based on positive social support to cope with Injured Self and prevent mental burden may be proposed in the future. For example, developing a psychological intervention that promotes the relevance of assessing the patient's consensus of receiving advice may support their active involvement in the DM processes (Boutin-Foster, 2005). At the same time, improvements in coping strategies related to social support relationships may offer functional benefits in psychological adjustment and well-being (Donovan-Kicken & Caughlin, 2011). It could also be relevant to profile patients regarding personality traits and needs to develop ad-hoc resources for optimizing social support strategies. Available aims could be the promotion of awareness on the functions of social support and the identification of the best support conducts to enact towards the patient (Cherif et al., 2020). Personalized psychological intervention on individuals' characteristics and needs aiming at managing Injured Self's characteristics may take into consideration the primary and fundamental psychological needs associated with social support (Williams, 2009).

In conclusion, unsupportive social support may contribute to individuals' self-fragmentation. This is particularly evident in breast cancer patients, since their "injuries" to the self (Boutin-Foster, 2005). Future experimental research could better explore the relationship between Injured Self features, personal needs, personality characteristics, and social support. For example, a qualitative approach, such as interviews, might investigate how social support can affect women's adaptive coping skills and patient and caregiver communication. In addition, it could be interesting to explore how to manage Injured Self through positive social support by examining the stage of cancer and timing of treatment, cultural background, and the role of personality traits (Shiozaki et al., 2011). This way, interventions have to be targeted at both patients and caregivers to promote more effective support conducts and raise awareness of the opportunities and risks within different types of social support.

1.2.3 Sport and physical exercises: challenges for the promotion of a positive Body Image

Physical activities and sports are often proposed as interventions to promote physical, cognitive, and emotional well-being in breast cancer patients and survivors as well as in a healthy population (Mandolesi, 2018). Possible benefits are referred preventing cognitive deterioration, diabetes, and obesity as well as favoring the cardiovascular and musculoskeletal systems (Mandolesi, 2018; Thivel et al., 2018). On a cognitive level, resistance exercises are protective factors against cognitive decline; in particular, they favor the preservation of executive planning and working memory (Hsieh et al., 2016) in any age group (Benzing et al., 2016). For example, a study by Davis et al. (2011) demonstrated improvements in cognitive performance and exercise dose-response benefits of about three months of regular aerobic exercise on executive functions of weight-bearing and sedentary students using functional magnetic resonance imaging. Similarly, Pontifex and colleagues (2009) evaluating twenty-one students showed a shorter latency during a working memory activity performed immediately and 30 minutes after an acute period of aerobic exercise (Pontifex et al., 2009). Other positive results regarding PE effects on cognitive abilities include duration of attention (Iuliano et al., 2015) and concentration (Gao & Mandryk, 2012). It is relevant to note that any sports has general and specific improvements based on their context. For example, being familiar with the goals and the physical sensations of fatigue, the duration of the training/competition, and efforts guide an individual to an appropriate choice of play (Smits et al., 2014). At the same time, cognitive flexibility is an important asset in sports (Craig, 2013). Therefore, assessing and regulating bodies about the context each time is essential to obtain optimal results.

Regarding the oncological field, a considerable number of studies supports the benefits of PE for cancer survivors, underlining significant health improvements (Spence et al., 2010). Literature reported that cognitive performance could be improved by the duration of moderate to vigorous physical activity (Hartman et al., 2018). Evidence highlighted some benefits of high-intensity interval training for aerobic fitness and cardiovascular risk factors, in particular (Northey et al., 2019). For example, a study by Peterson and colleagues (2018) increased memory performance and executive functions in cancer survivors through a 12-week aerobic exercise intervention. Zimmer et al. (2016) showed improvements in executive functions, especially attention, cognitive flexibility, and planning after exercise. A high degree of interdisciplinary cooperation is needed to integrate medical treatment and sports (Baumann & Bloch, 2013) during different phases: (1) treatment, (2) adjuvant therapy, and (3) exercises supervised by accredited physiologists and/or physiotherapists in order to adapt

PE to patients' characteristics. Another interesting contribution of PE in an oncological field is the possibility to transfer personal skills that are learned during PE to other contexts, which can be different from the ones in which they were originally learned (Camiré et al., 2014), such as from sport to an oncological context. After receiving a cancer diagnosis, working on an individuals' perception of stress management and improving self-efficacy, which are some of the possible skills learned in a PE context, could be strongly helpful (Hardcastle et al., 2015). Transferability an ongoing process whereby an individual continually interacts and interprets the environments to produce skill transfer outcomes (Pierce et al., 2018). It is not an automatic process as well as a unique outcome or phase (Camiré et al., 2012). It manifests in various ways related to the individual's characteristics and motivation (Danish et al., 2004). Skill transferability can be easily performed among contexts similar to each other (Leberman & McDonald, 2016; Sebri et al., 2020^a); moreover, it can be measured using self-report items (e.g., Aryee & Heng, 1990), questionnaires, or interviews (e.g., Lordly, 2008). Specifically, several factors can improve skill transferability (Sackett & Gano-Overway, 2017): (a) value perception of transferable skills; (b) awareness of learned skills and transfer context; (c) confidence in transfer capacity; (d) external support for transfer from significant others; (e) perseverance in case of failure. Skill transfer is influenced by people's expertise by training the learning and transferring abilities (Moore & Müller, 2014). Similarly, skills can be integrated into the own sense of Self by improving internal, rather than external, behavioral regulation (Hodge & Lonsdale, 2011). Two processes can sustain the skills transferability from one context to another: the implicit and explicit processes (Sackett & Gano-Overway, 2017). The first process is related to the ability to transfer acquired skills without intention; the second one involves a leadership figure, such as a professional expert, who intentionally teach skills intending to transfer them in other life domains (Pierce et al., 2018). Additionally, explicit strategies are more useful for transferring skills to other contexts thanks to the role of the environment and a guide (Sackett & Gano-Overway, 2017). This can help individuals be aware of the abilities developed during training. In the same line, oncological treatments, for example, are an occasion for the patient to be engaged in important bonds.

Interestingly, PE may share properties that train the ability make decisions directly in oncology. In any sport, individuals have to alternate focused and divided attention to monitor information related to the current activity (Liao & Masters, 2016). Sophisticated attention management should be maintained in the face of emotional activation, avoiding shame and distractors (Jones, 2016). Similarly, attention and emotional management are important resources for making desirable decisions and being confident in one's own

judgment. Women who have to manage breast cancer could benefit from such attention training by developing notable introspection processes during PE. They must improve their knowledge about their personal characteristics and abilities, resistance to time pressure, and strengths and weaknesses to approximate optimal performance. Promoting reflections on one's own capacity, as well as psychological introspection and metacognition, PE could help patients and survivors to learn how to take into consideration their own identity, habits, and peculiarities, also in the context of healthy decisions. Exercises are not only tools to train physical and cognitive abilities, but also experiences, which may have an important formative value. During PE people make mental representations of problems and solutions to manage an exercise (Clancey, 1997), patients have to decide over therapy options or lifestyle changes. Finally, in the field of health management and within a patient-centered approach, the physician is usually a patient's safety guide during a condition of uncertainty (Rottmann et al., 2010) for a better therapeutic outcome and a shared DM (Renzi et al., 2016^a) as for the coach-athlete relationship related to sports performance. In addition, during the doctor-patient communication, both the patient and the physician become part of a shared experience in which communication is the vehicle for exchanging implicit and explicit information, emotions, and values (Epstein et al., 2005; Roter, 2000; Vogel et al., 2006).

In conclusion, PE and sports can promote an overall sense of identity and self-esteem (Danish et al., 2004). In line with an education "through the physical " and not just "of the physical" (Goudas, 2010), the present Ph.D. project argues for making PE an available tool to prevent and adjust cancer-related issues. Since the association between body and mind during PE, BI could be addressed as a specific point of interest. Promoting BI through training in PE could be indeed useful for health management by transferring abilities learned from a sports context to an oncological one.

1.3 Conclusions

In conclusion, the Self and its characteristics play a relevant role in the overall well-being of breast cancer patients and survivors. Since the significant changes in the body during and after oncological treatments, the bodily self and BI becomes particularly salient. However, BI is not sufficient to embrace all bodily issues related to the breast cancer field. This way, a new and specific self-representation associated with the body and its injuries after cancer is missed, namely Injured Self. The present Ph.D. project aimed to assess the

relevance of the bodily issues first; then, Injured Self, related constructs, and available interventions to promote breast cancer patients and survivors' well-being were proposed.

2. The impact of self-representations on Decision-Making

The first study of the present project focused on the role of self-representations in DM. It is important to demonstrate that the Self is not relevant to well-being in an “abstract” sense, but, on the contrary, focused attention on one’s own-self-representations influence cognitive processes, DM, and behaviors. As previously stated, consistent evidence about the relation between DM and self-focused attention on inner sensation is still lacking. According to the previous studies, high abilities in DM depend on a well-developed procedural knowledge based, not only on an accurate knowledge of information and alternatives. Thereby, decisions rely on knowledge about oneself and the environment at the same time. Personal values and beliefs are essential in the DM process too, primarily when related to life-relevant choices (Gorini et al., 2016). At the same time, several cognitive abilities, ranging from memory to perception, have to be involved.

2.1 *Study 1: The self's choice: Priming attentional focus on bodily self promotes loss frequency bias*

Narrative and bodily self are indeed linked to memories as well as inner sensations. These two parts of the self are not independent but in a continuous relationship with each other and the environment as a hub that processes internal and external information. This is possible thanks to the association between DM, perception, and memory (Sui & Humphreys, 2015). Damasio (2010) proposed a taxonomy based on the narrative part of the self in bodily self-processes through autobiographical memories. Multiple interactions have to be involved, considering interoception (in terms of individuals' awareness of their inner states, such as thirst, heartbeat, and hunger), exteroception (i.e., outwardly-directed five senses), and proprioception (i.e., perception of one’s own position and movement) processes. These processes are helpful in evaluating cognitive-affecting processing and self-related information (Di Lernia, Cipresso, Pedroli & Riva, 2018), which become fundamental over decisions. In other words, the ability to focus attention on oneself and own inner states is not just linked to the possibility of increasing awareness of one’s mental and bodily states. Self-focused attention leads to plan and implement decisions (Bermúdez, 2011). This is consistent with a study by Piff and colleagues (2015) in which people who feel a small self (i.e., a reduced sense of the own self, such as interest and objectives that are assessed as less relevant rather than a greater good) improve ethical DM (e.g., generosity and pro-sociality behaviors). Silvia and Gendolla (2011) explained how interoceptive and exteroceptive self-focus attention promote the own judgment of self-representations. In other words, the

perceptual accuracy hypothesis stated that people with high levels of interoceptive and exteroceptive self-focused attention show better abilities in the judgements of cognitive and somatic aspects of their overall self. Studying decisions, *loss frequency bias* has to be considered. As a definition, *loss frequency bias* is the tendency to prefer for options with a lower frequency of punishment (Beitz et al., 2014). Nowadays, literature shows a debate on the advantageous or disadvantageous role of *loss frequency bias*. It emerged more in children, adolescents, and older adults (Beitz, Salthouse, & Davis, 2014; Cassotti et al., 2014) as well as in pathological conditions such as schizophrenia, where it has been associated with impairments in working memory (Brown et al., 2015). Experimental conditions in which a stimulus is primed might promote *loss frequency bias*. In this case, being focused on the self may be a distraction (Baumeister, 1984), for example leading participants to be less concentrated and, as a consequence, to inhibit intuitive strategies with fewer abilities to consider long-term outcomes in the end. As aforementioned, focused attention on inner processes can also predict loss aversion because the heightened subjective intensity of choice-relevant emotional signals magnifies the weight related to losses (Sokol-Hessner et al., 2015).

Given the usefulness of self-focus attention in daily life decisions, literature presents many possible instruments to improve it. In experimental research, Ainley and colleagues (2013) stated that the mere presence of a mirror as well as looking at a picture of one's face can increase self-focus attention. In this study, they compared two different experimental conditions: in the first one, participants looked at their face – that was the *bodily self-stimulus*; otherwise, participants belonging to the second group looked at self-relevant words – that was the *narrative self-stimulus*. Findings showed the effectiveness of both self-focus conditions. Specifically for this study, the bodily and narrative self-conditions were equally effective in promoting accuracy in a heartbeat awareness task. In line with these results, Northoff (2007) evidenced that the more stimuli are associated with individuals' sense of belongingness, the more they can be correlated to the self. This is relevant in order to highlight the role of memory. Authors claimed that self-related stimuli require stronger involvement of own narrative encoding and retrieval as a result from one's face.

Although the debate is still ongoing, another variable that could impact tasks is sex. Generally, females show higher levels of loss aversion and invest less in risky decisions; on the contrary, males are more vulnerable to risk-taking and less conservative (Charness & Gneezy, 2012). At the same time, females are usually more sensitive to social contexts and

they are more convinced that possible negative selves might develop (Stevenson & Clegg, 2011). However, other studies affirm that there is no difference between males and females in the quality of DM. These studies propose as possible differences as the result of personality types, information access, and experience commonly associated with genders rather than sex (Johnson & Powell, 1994).

One of the most important tools for decision tasks is the Iowa Gambling Task (IGT) by Bechara (1994; 2008). IGT is one of the main tools to evaluate DM processes. In a laboratory context, researchers give 2000 fake dollars to the participant to start with the aim in maximizing profit by repeatedly selecting cards from one of four decks (A, B, C, and D). Participants have 100 trials to play and each deck gives a profit or a loss. Decks A and B yield earnings of \$100, on average, and large punishments, while Decks C and D yield earnings of \$50, on average, and small punishments (Bechara et al., 1997). However, after ten selections from each deck, participants incur a net loss, which is higher in decks A and B. Decks A and B are defined as “disadvantageous” because they are riskier decks; instead decks C and D are considered as “advantageous”. Differences between decks are related not only to long-term outcomes, but also regarding the number of gains. Specifically, gain frequency is high for decks A, low for decks B and D, and null for deck C (Horstmann, Villringer & Neumann, 2012). The frequency and magnitude of gains and losses are not disclosed to participants; the ability to make better decisions is learned through the experience of sampling rewards and punishments across decks (Bellani, Tomelleri & Brambilla, 2009). For example, outcomes of previous choices can adjust future decisions during the task. The computerized version of the task is now more used; no differences have been reported with decks of paper cards (Bowman, Evans, & Turnbull, 2005). Since its creation, IGT is now used as a behavioral instrument to assess risky DM as well as a clinical tool (Chiu, Huang, Duann & Lin, 2018). Several outcomes can be measured within the task, such as total money won, time spent, pressing duration, and the frequency of cards taken by each deck (Bolla, Eldreth, Matochik, & Cadet, 2005). Furthermore, two variables directly associated with the DM process can be measured: the difference between total advantageous cards and total disadvantageous cards $[(C + D) - (A + B)]$, which is considered a global measure of advantageous DM, and the loss frequency bias or preference for decks with a low frequency of punishments (losses) $[(B + D) - (A + C)]$ (Besnard et al., 2015). Over the task, participants learn how to collect money and avoid losses as a functional process of decisions, which is called the *learning effect* (Bechara et al., 1997).

Starting from this theoretical background, it is paramount to understand how stimuli related to narrative and bodily selves can affect cognitive processes, such as DM. Therefore, my first experimental research assessed possible differences induced by narrative and bodily stimuli over a DM task, the IGT specifically. Trying to manipulate self-focused attention aiming at influencing decisions, the fundamental hypotheses for this study were:

(Hp1) in the IGT, participants primed by narrative and bodily stimuli will make more advantageous choices than those in a baseline condition with no self-priming. This is in line with the influence of emotions and autobiographical memories on decisions. In addition, as stated by Ainley and colleagues (2013), observing one's own face as an image enhances individuals' ability to make choices, for example in the field of moral decisions (Ploner & Regner, 2013);

(Hp2) when the bodily or the Narrative Self is primed (experimental conditions), participants will show loss frequency bias in the IGT;

(Hp3) sex differences will impact results in DM;

(Hp4) a growing improvement of total profit and a decrease of the time over the conditions as a learning effect will be shown. Over time, the pressure of touch could also become fainter due to ability in the IGT and/or more confidence thanks to the exercise (Stanton, Lienen & Schultheiss, 2011).

2.1.1 Material and Methods

Participants

Study participation was proposed to people aged older than 18. Researchers promoted mouth-to-mouth communication and posted a brief announcement on online social networks, such as Facebook pages. In addition, participants were to share study invitations following a snowball sampling technique. For example, they provided contacts of researchers (e.g., email addresses). Participants were volunteers and not compensated (no incentive reward was given). At the beginning of the experimental study, they signed a written consent and were informed of being free to withdraw from the study at any time without the need to justify their choice. The majority of the sample was characterized by 30 young adults (25–36 years; 16 females) (Shook et al., 2019) with a graduate degree and white-collar employers. The mean age was 28,83 (SD = 5,65). Only one participant had previous knowledge, albeit only anecdotal, about the IGT (see Table 2).

	Total Sample (N = 30)	
	n	%
Gender		
Male	14	46.66
Female	16	53.33
Age		
Younger adults (25-36 years)	30	100
Older Adults (60+ years)	0	0
Education		
High school diploma or less	7	23.33
Bachelor degree	8	26.66
Graduate degree	15	50
Employment		
Student or unemployed	3	10
Blue-collar	5	16.66
White-collar	18	60
Self-employers	4	13.33

Table 2. Socio-demographic characteristics of the current sample

Procedure

Bodily and narrative stimuli were based on the descriptions provided by Ainley and colleagues (2013) strictly. The authors applied the same methods as Ainley and colleagues to manipulate participants' attention focused on narrative and bodily selves to influence their interoceptive awareness. Once they arrived at the laboratory, participants were welcomed in a quiet room by a researcher. After obtaining informed consent, the study and its phases were explained to participants. Subsequently, the researcher took a digital photograph of the participant's face by smartphone. Participants maintained a neutral expression. This represented the *bodily self-conditioned stimulus*. After this, the researcher asked participants to provide six self-relevant words that referred to their life events. Specifically, participants' first name, city hometown, the name of the school they recently attended, university course, the name of their best friend, and the name of the most important person in their life were asked. These words were the stimulus of the *narrative self-condition*. Then, the digital photograph was mirror-reversed in the center of the screen that was positioned in front of the participants. Similarly, autobiographical words were presented in white font on a black background, arranged in a hexagonal pattern that took up the same area of a computer screen

as the picture. As a baseline condition, a black screen with a small white fixation cross (1 cm_1 cm) in the center of the computer screen was treated.

At the end of this first phase, participants were seated in front of the computer screen. After a brief training trial to understand how to play the IGT (15 seconds), participants were prompted for every three trials to keep their eyes on the computer screen for a minute for each stimulus (baseline, bodily and narrative self). In the beginning, a small white fixation cross was placed on the computer screen for all participants (*baseline condition*). Then, the digital photograph previously taken (*bodily stimulus*) and the autobiographical words collected (*autobiographical stimulus*) were fixed in randomized, counterbalanced order across participants. That is, 15 participants were randomly assigned to the narrative condition after baseline, with the remaining 15 participants completing the bodily condition immediately after the baseline. Finally, the two experimental conditions (bodily and narrative stimuli) were randomly administered to all participants but in a different sequence, while the baseline was always the first condition. Participants were not obliged to fixate on particular aspects of the stimuli; the experimenter advised them just to keep attention to the stimuli as much as possible. After each stimulus fixation, participants completed the IGT on the tablet positioned just below the computer screen. During the task, the stimuli (no stimuli, photographs, or words) were shown on the computer screen, filling an important part of the participant's field of view. When they finished each specific phase - baseline, bodily or narrative conditions and the IGT - a pause of 3 minutes was guaranteed. Participants kept their eyes closed and rested during the pause. Over tasks, the researcher turned off the room's light sat quietly 2 m behind the participant. At the end of the overall experiment, participants were debriefed on the aim of the study and the experimenter answered their possible questions (Figure 1).

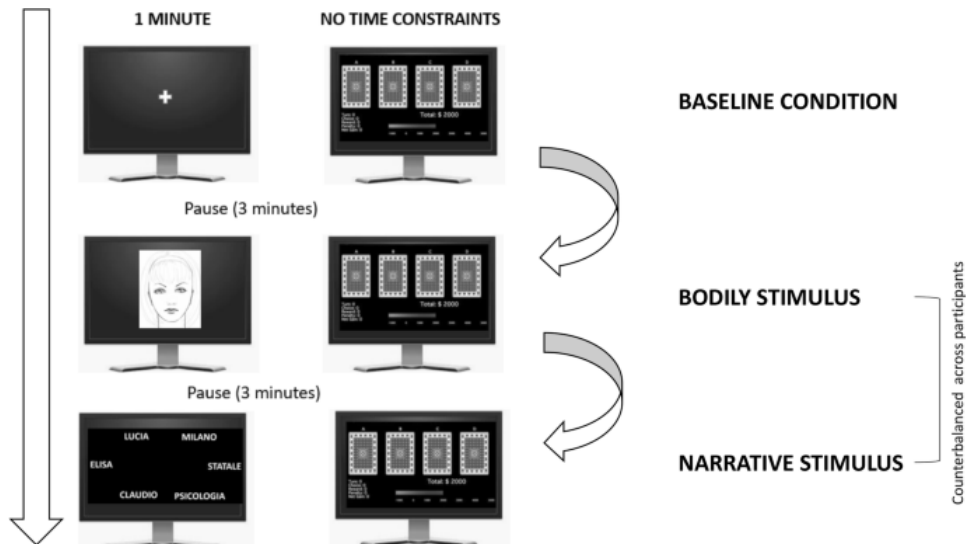


Figure 1. A schematic representation of the experimental procedure

2.1.2 Results

A priori power analysis was run to assess the risk of incurring Type II errors given the expected medium effect size. Analyses were run with GPower (Faul, Erdfelder, Lang, & Buchner, 2007), with power (1- β) set at .80 and an equal to .05, one-tailed. 28 participants were indicated as the total sample size necessary.

Firstly, to obtain the variable Advantageous Choices, we computed the “net score” of advantageous DM [(deck C + deck D) – (deck A + deck B)] (Cassotti et al., 2014; Singh, 2016) (Hp1). Then, we performed repeated measures ANOVA with an experimental condition (baseline, bodily self, and narrative self) as the within-subjects factor and Advantageous Choices as the dependent variable. No significant effect of experimental condition on Advantageous Choices was obtained ($F(2,58) = .289, p = .75, \eta^2 = .01$). Particularly, on average more advantageous choices were made in the bodily self-focus condition (17, $SD = 34.89$) as well as in the narrative self-focus condition (18, $SD = 31.02$) than in the baseline (14.1, $SD = 21.57$).

Secondly, to obtain the variable Loss Frequency, the “net score” of loss frequency bias [(deck B + deck D) – (deck A + deck C)] (Hp2) was computed. Then, repeated measures ANOVA with an experimental condition (baseline, bodily self, and narrative self) as the within-subjects factor and Loss Frequency as the dependent variable were performed. Results showed a significant effect of experimental condition on Loss Frequency, $F(2,58) = 4.019, p = .02, \eta^2 = .122$. In particular, loss frequency bias emerged the bodily-self condition (29.6, $SD = 16.24$), more than in the narrative self-focus condition (20.8,

SD = 23.5) and the baseline (19.4, SD = 16.24). Paired-samples t-test evidenced significant differences both in the bodily-self vs. narrative-self comparison ($t = 2.130, p = .04$) and in the bodily-self condition vs. baseline comparison ($t = -2.520, p = .01$); otherwise, there were not significant differences in the narrative condition vs. baseline comparison ($t = -.401, p = .69$). Moreover, the counterbalance order was included in the analysis (e.g., participants who were exposed to the Bodily Self condition first vs. participants who were exposed to the Narrative Self condition first) in order to check for order effects on this analysis. No significant effect of the stimuli presentation order was found ($F(2, 56) = .131, p = .87, \eta^2 = .005$).

Third, both Advantageous Choices and Loss Frequency Bias scores from the three experimental conditions were analyzed in six independent samples t-tests by sex to assess differences between males and females (see Table 3) (Hp3). No significant differences were evidenced, except for Total Gains in the bodily self-conditions. Particularly, males and females' scores were not significantly different in any other variable of the experimental study (see Table 2). Referring to Total Gains in the bodily-self condition, males gained significantly more than females. ($t = 2.075, p = .047$). Furthermore, two mixed-design ANOVAs were conducted to analyze possible interaction effects between sex and the experimental conditions, with Advantageous Choices and Loss Frequency as dependent variables. Mixed Design ANOVA on Advantageous Choices did not show significant results regarding interaction effects ($F(2,27) = 1.487, p = .244, \eta^2 = .099$). The Mixed Design ANOVA on Loss Frequency did not yield significant results regarding interaction effects too ($F(2,27) = 2.326, p = .117, \eta^2 = .147$).

		BASELINE		BODILY-SELF		NARRATIVE-SELF	
		M	F	M	F	M	F
Advantageous choices	M	12.4	15.6	25.8	9.25	18.8	18.7
	SD	15.7	26	40.4	28.2	38.6	23.8
	M	19.8	19	37.8	22.3	27.4	15
Loss frequency	SD	15.1	17.6	28.5	21.8	25.7	20.4
	M	1564.2	1854.6	2689.2*	1854.6*	2491	1984.6
Total gains	SD	376.8	829.9	1250	949	1313.1	706.5
	M	1527.9	1551.1	1063.8	1330.8	1113.2	1302.4
Response time	SD	406.2	507.8	366.5	654	299.9	526.5
	M	106.1	101.3	115.1	117.6	109.2	115.9
Pressing duration	SD	14.9	23.7	25.9	30.8	25.5	32
	M	147.5	151.3	103.5	123.1	109.2	129.5
Total time	SD	40.3	49.3	36.5	53.2	30.7	49

Table 3. Average and standard deviations of both advantageous choices, loss frequency bias, total gains, response time, pressing duration and total time across baseline, bodily self and narrative self-conditions by sex

Fourth, repeated measures ANOVAs have been conducted to analyze differences in Total Time, Response Time, Pressing Duration and Total Gains by the three conditions (baseline, bodily self and narrative self) as the independent variable (Hp4). No significant effect of experimental condition on Total Gains emerged ($F(2,28) = 2.476, p = .045, \eta^2 = .199$). Particularly, total gains differences were showed in both the bodily self-condition (2244.1, $SD = 1160$) and the narrative self-focus condition (2221, $SD = 1047.4$) than in the baseline (1719.1, $SD = 664.5$). Paired-samples t-test yield that the difference was significant both in the bodily-self vs. baseline comparison ($t = -2.417, p = .022$) and in the narrative-self condition vs. baseline comparison ($t = -2.398, p = .02$), while it was not in the bodily-self condition vs. narrative-self condition ($t = .123, p = .903$).

Finally, there was a significant effect of experimental condition on Response Time, ($F(2,28) = 11.985, p = .00, \eta^2 = .461$). Particularly, response time differences emerged in the bodily-self condition (1206.2, $SD = 547.6$) and in the narrative self-focus condition (1214.1, $SD = 439.1$) than in the baseline (1540.3, $SD = 455.5$). Moreover, paired-samples t-test evidenced that participants took less time to make choices on average in bodily self e narrative self than in baseline ($t = 3.135, p = .00; t = 4.982, p = .00$), while it was not in the bodily-self condition vs. narrative-self condition ($t = -.097, p = .923$). In addition, there was a significant effect of experimental condition on Pressing Duration ($F(2,28) = 5.818, p = .00, \eta^2 = .832$). Differences in Pressing Duration emerged in the bodily-self condition (116.48, $SD = 28.2$) and in the narrative self-focus condition (112.7, $SD = 28.9$) than in the baseline (103.5, $SD = 19.9$) especially. Paired-samples t-test evidenced that participants show less Pressing Duration to make choices on average in the bodily and narrative selves than baseline ($t = -3.454, p = .00; t = -2.048, p = .05$), whereas it was not in the bodily-self condition vs. narrative-self condition ($t = .899, p = .376$). No significant effect of experimental condition on Total Time emerged ($F(2,28) = 11.465, p = .00, \eta^2 = .450$). in particular, total time differences were showed in the bodily-self condition (114, $SD = 45.5$) and in the narrative self-focus condition (120, $SD = 42$) than in the baseline (149.53, $SD = 44.6$). Paired-samples t-test showed that participants took less Total Time to make choices on average in bodily self e narrative self than baseline ($t = 3.894, p = .00; t = 4.567, p = .00$), whereas it was not in the bodily-self condition vs. narrative-self condition ($t = -.770, p = .447$).

2.1.3 Discussion

This first research study assessed the possibility of promoting self-focused attention to influence DM. In line with Werner and colleagues (2009), individuals who show high self-focus attention make better decisions in tasks such as the Iowa Gambling. Authors claimed that could be related to their abilities to be more responsive to internal sensations (e.g., anxiety), which can signal risks or opportunities. Interoception can be manipulated by experimentally priming self-focused attention, as shown in a study by Ainley and colleagues (2013). Participants were more accurate in counting their own heartbeats where they were in front of a picture of themselves (bodily self-focused attention) or personally-relevant words (narrative self-focused attention) than in baseline condition without any kind of stimuli. With the aim to analyze the possible effect of self-focused attention on DM, this study replicated the experimental setting, but with the IGT in the place of interoception task. There were no significant differences between the three conditions regarding advantageous choices. Contrary to Hp1, this seems to argue that self-focused attention may not improve the quality of decisions, as affirmed in the traditional conception of the IGT (i.e., C and D decks are the advantageous ones in terms of long-term outcomes). It argues that the manipulation of self-representations could affect people with high self-focused attention, especially due to their tendency to reflect on their self and sensations. This is in line with studies that showed that higher dispositional self-focused attention influences negative effects (e.g., depression and anxiety) leading to maladaptive processing routines that contribute to stress vulnerability and problem resistance (Pena & Losada, 2017).

In accordance with Hp2, participants preferred decks with low loss frequency in the bodily self-focus condition compared with the others. Two possible interpretations of this result are proposed. It is possible that primed self-focus acted as a distractor for participants. In other words, they were less able to decide in favor of long-term outcomes because of the hindering of the DM process. It is relevant to notice that participants were invited to look at a picture of themselves. As reported in the literature, observing the own face could be an emotionally intense stimulus related to the evaluation of appearance and social judgment (Shin et al., 2017). Moreover, distractions can affect DM due to higher performance anxiety (Hotton et al., 2019). Referring to the actual priming of bodily-self focus, it is known that self-focused attention impacts DM because it allows individuals to be more responsive to internal sensations associated with evaluating alternatives (Werner et al., 2009). This stimulus makes participants more sensitive to internal cues, for example, feelings of anxiety and discomfort related to punishment. Therefore, it is possible that participants were keen to

avoid frequent punishments/losses instead of pursuing long-term outcomes when primed to pay attention to their bodily self-representation in this study. Sokol-Hessner and colleagues (2013) reported that the perception of bodily states and their intensity as choice-relevant emotional signals might increase the relative weight of losses over risky decisions. Additionally, positive state moods are associated with higher reactivity, such as increased loss aversion). Thereby, referring to the frequency losses' role, IGT relies more on affective DM (that are defined as "hot" processes) than calculated decisions (that are "cold" processes) (Bechara, 2008). This is interesting because loss aversion is mainly regarded as a stable trait (Sokol-Hessner & Rutledge, 2019). On the contrary, the present study highlights that loss aversion may be influenced by experimental stimuli and related participants' affective moods. Referring to the *perceptual accuracy hypothesis* (Silvia & Gendolla, 2001), self-focused attention stimulates emotions (e.g., shame), which may directly enhance the tendency to avoid significant losses. Focusing on appearance, self-focused attention increases awareness of internal sensations and, subsequently, leads to body shame and dissatisfaction (Moradi & Huang, 2008) as a result of the self-objectification phenomenon. In line with this, literature demonstrated that people showed more attentional interference in a Stroop task (Quinn, Kallen, Twenge & Fredrickson, 2006) and were made temporarily aware of their appearance to perform worse on various tasks, such as math ones (Fredrickson, Roberts, Noll, Quinn & Twenge, 1998). These interpretations are not mutually exclusive, but both effects concurred in generating loss frequency bias in the bodily self-priming condition.

In contrast with Hp3, no effects of sex were observed. Males just obtained more final gains compared to women, in line with the IGT study by Singh (2016). IGT shows the most prominent sex-differences in lateralization, Since the brain lateralization is defined as an asymmetrical engagement of the two hemispheres (Bolla, Eldreth, Matochik & Cadet, 2004). Neuropsychological studies stated that the right hemisphere is more involved than the left in advantageous choices (Buelow & Suhr, 2009). Generally, males tend to show greater functional right-lateralization of cognitive control, while females show activation in the left hemisphere predominantly (Bolla et al., 2004). Thereby, advantageous IGT decisions and task performance reflect differences in lateralized cognitive control (Singh, 2016). However, it is impossible to completely rule out Type II error, given the relatively high effect sizes of the results.

Finally, response time, total gains, time of completion, and pressing duration were influenced by the main independent variable (Hp4). However, these results show differences

between the two experimental conditions and the baseline. Moreover, they should be probably interpreted as signs of a general learning effect, starting from no significant influences of the two experimental manipulations. Participants became faster due to the repetition of the task and training; however, they did not make choices that were more advantageous in the experimental conditions.

Additionally, the present study did not show a mere *learning effect* (e.g., participants did not perform better in the two experimental conditions because of the mere repetition of the IGT). This evidence that task repetition does not always generate a *learning effect* (Icellioglu, 2015). Similarly, the randomized and counterbalanced stimuli did not generate effects of order (i.e., narrative or bodily condition as first after baseline did not affect participants' performance). In accordance with Wolff and colleagues (2019), self-control aiming at regulating dominant impulses and behavioral tendencies does not always have a role during DM tasks. It argues that people may rely on global and limited resources (such as attention and emotion regulations), which cannot immediately impair their self-control capability.

In conclusion, this study corroborates that self-focused attention and self-representations influence DM, at least loss aversion (Sebri et al., 2021^c). Results may contribute to the understanding of how representations and internal sensations impact selection of alternatives. It could be interesting because within-subjects manipulation of *loss aversion* is scarce in the literature. On the contrary with the idea of *loss aversion* as a stable trait (Sokol-Hessner & Rutledge, 2019), this contribution proposed an alternative interpretation in which loss frequency bias could have been influenced by the emotionally intense stimulus (picture of one's face) and so caused by distraction. At the same time, the absence of interoception measures (as used by Ainley and colleagues, 2013) could be a limitation. Future studies may employ other measurement tools to analyze whether cognitive task effects are related to interoception variations. The small sample size could be another limitation that may underestimate the results. Future research may understand how context variables and individual factors (e.g., age) affect IGT performance when manipulate self-focused. For example, a poor IGT performance could be explained by atypical sensitivities to reward or punishment (e.g., hyposensitivity to punishment, hypersensitivity to reward, or myopia for the future, which is the insensitivity to delayed or infrequent events, whether they be rewards or punishers) (Bechara, Dolan & Hines, 2002). On another side, further studies with more extensive samples might find a significant interaction with sex. Additionally, it is possible that participants cannot be involved in an experimental setting,

since self-focused attention is associated with internal and external stimuli (Tomita, Minamide & Kumano, 2020). This design study could be replicated in contexts different from an experimental laboratory (e.g., an ecological setting) and with various stimuli to evaluate if the bodily stimulus (e.g., seeing one's face) is a distractor effectively. For example, it could be proposed to show unfamiliar faces of others in order to assess whether they are distractors or not, independently of any reference to the self. On the contrary, bodily self-related stimuli may be employed within psychological interventions to promote healthy choices. To assess differences in time development, future studies could replicate this research in a natural environment as well as with a cross-sectional model, for example. Moreover, ANCOVA models could be performed to assess the impact of individual and context differences as covariates. Exploring personality and mood variables that may affect task performance could be interesting too (Shukla, Rasmussen & Nestor, 2019). For instance, additional research could measure how personality mood states and traits and affect IGT performance in individuals with high self-focused attention. This study design could be replicated with different DM tasks or other techniques for priming multiple self-representations, taking into account the possible influence of emotions associated with one's image. The Balloon Analogue Risk Task (BART) is, for example, a computer based-task that provides behavioral measures of risk-taking. It could be applied as a reliable instrument to evaluate decisions in people who are strongly impacted by interoceptive sensations (e.g., individuals with gambling and drug addictions) (Noël et al., 2013). BART could also be applied to explore whether loss aversion' manipulation can be guided by one's attention towards internal sensations, which is not presented in this study.

2.2 Conclusions

The first study highlighted the relevance of self-representations in DM. It shows that enhancing attention to one's self-representations (specifically, bodily self) affects the process and outcome of decisions. While the present study involved a healthy sample in assessing the relevance of self-representations in DM, the following studies will be focused on cancer patients and survivors, focusing on the effort to analyze injured self-representations, BI, and possible tools for the intervention. The aims will be to explore how chronic patients could regain control of themselves and BI to improve QoL and health management.

3. Body Image and the Injured Self

The second and third studies involved in the present thesis focused on bodily issues in breast cancer patients and survivors. Firstly, a review and meta-analysis study assessed the effects of psychological programs on BI and sexual functioning. Then, starting from the results obtained, a tailored intervention to address cancer survivors' BI issues was proposed.

3.1 Study 2: The efficacy of psychological interventions on body image in breast cancer patients and survivors: a systematic-review and meta-analysis

Over the years, several psychological interventions have been proposed to address BI and sexual functioning in breast cancer patients and survivors (Park et al., 2015). Most of them were based on educational, supportive, emotionally expressive, cognitive-behavioral/existential, interpersonal, and psychosocial approaches (Blanco et al., 2014). Their main objectives were to provide problem-solving methods and relaxation to decrease psychological distress and modify the perception of the body. Additionally, literature evidenced the efficacy of novel and mixed approaches that includes psychotherapy-based interventions, physical exercise, art/dance therapy, and cosmetic educational programs to increase self-esteem (Björneklett et al., 2013; Park et al., 2015). Similarly, psychological support programs and PE (aerobic and resistance training especially) enhanced personal strength and QoL (Fong et al., 2012; Benton et al., 2014). Related to the type of psychological sessions, formal one-to-one psychotherapy, couple intervention, and the structured group were the main support formats within clinical settings (Fingeret et al., 2014). Moreover, Cognitive Behavioral Therapy (CBT) was particularly promising as a goal-oriented and time-limited psychotherapeutic approach (Fingeret et al., 2014).

Despite literature suggesting that breast cancer patients and survivors perceive psychological interventions as feasible, acceptable, and effective to address BI issues (McLean et al., 2011), there is a general lack of methodological rigor across studies in order to evaluate studies' long-term impact (Lewis-Smith et al., 2018). Most psychological interventions do not adopt an exclusive focus on BI, which tends to be only a small component within more extensive interventions. Similarly, there is no clear and unified information about the dimension of such positive effects. For these reasons, this review and meta-analysis study assessed the effectiveness of psychological interventions in BI and sexuality in breast cancer patients and survivors. In particular, it evaluated which typology

of psychological intervention is the most effective in promoting BI in breast cancer patients and survivors. Starting from the existing literature, two main hypotheses were presented:

(Hp1) psychological interventions would promote benefits on BI in breast cancer patients and survivors,

(Hp2) psychological intervention positively impact on sexual functioning related to BI in cancer patients and survivors.

3.1.1 Material and Methods

The present meta-analysis has been registered with the International Prospective Register for Systematic Reviews with ID number CRD42020203021 (available from https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020203021).

The literature search for relevant contributions was carried out in March 2020 through an electronic computer-based search. The databases involved were as follows: Scopus, PsycINFO, and ProQUEST. Moreover, the PICOS model was used to develop search strategies for this meta-analysis and eligibility criteria. It includes the patient or problem (P), the intervention or exposure (I), the comparison intervention or exposure (C), the clinical outcome of interest (O) (Eriksen & Frandsen, 2018), and (S) study type. In accordance with this model, records were searched using “psychological intervention” OR “psychological therapy” OR “psychological support” OR “psychotherapy” AND “body esteem” OR “bodily self” OR “body image” OR “body consciousness” AND “breast cancer” as key terms in the title or the abstract of the manuscripts. Only articles available in English were included. *A priori* was placed by excluding “gray literature” (e.g., conference abstracts, other non-peer-reviewed sources, and doctoral dissertations) in the attempt to improve review manageability (Beatty et al., 2018). Inclusive criteria were: (1) studies that evaluated the efficacy of psychological interventions for BI on breast cancer patients or survivors in comparison with a control group, (2) studies that involved a consistent measure of BI with any dimension of BI (e.g., subjective evaluation and/or perceptual), (3) between-group research studies or between-group outcome data of mixed-method design studies (in case of different times analyzed in the study, only the last outcome point available was considered), and (4) studies written in English. Previous literature showed no evidence of a systematic bias from English language restriction in meta-analyses (e.g., Morrison et al., 2012; McKenzie et al., 2019; see Table 4).

Selection criteria		Keywords	Inclusion criteria
Participants	#1	"breast cancer" (title and abstract)	We included studies with breast cancer patients or survivors
Interventions	#2	"psychological intervention" (title and abstract) OR "psychological therapy" (title and abstract) OR "psychological support" (title and abstract) OR "psychotherapy" (title and abstract)	We included studies that examined the efficacy of psychological interventions for body image (BI) on cancer patients or survivors compared with a control group. We included only intervention that was conducted by trained psychologists or studies in which the psychological intervention is used alone, and not administered in combination with other educational techniques (which makes it difficult to understand the effectiveness of the psychological interventions)
The comparison intervention or exposure	#3		We included studies in which participants in the control group participated in an active or non-active intervention
Outcome	#4	"body esteem" (title and abstract) OR "bodily self" (title and abstract) OR "body image" (title and abstract) OR "body consciousness" (title and abstract)	We included studies that assess a measure of BI that was consistent with any dimension of BI (e.g., subjective evaluation and/or perceptual). We included between-group outcome data of mixed-method designs studies or between-groups research studies. If different times were analyzed in the study, we considered only the last outcome point available
Study type	#5	No restriction	No restriction
Search combination		#1 AND #2 AND #3 AND #4	
Database search			
Language			We included studies written in English
Electronic databases		Scopus, PsycINFO, and ProQUEST	

Table 4. The search strategy

The effect sizes (Hedges' g) were reported or computed based on the information provided in the article. As exclusion criteria, articles that did not provide appropriate statistics to compute effect sizes were not included. Of note, considering the interest in only exploring the efficacy of psychological interventions for BI in breast cancer patients and survivors, studies that did not use psychological interventions were excluded too. Similarly, studies that explicitly stated that trained psychologists did not conduct the intervention or in which the psychological intervention is not used alone but was administered in combination with other educational techniques (which makes it difficult to understand the effectiveness of the psychological interventions) were not included. No other limitations were placed regarding the statistical presentation of results, the age of participants, study type, or time of publications.

Coding of Studies and Data Extraction

Two researchers independently coded the studies during the first screening stage. After deleting duplicates, the titles and abstracts of 180 articles (20% of 903 articles potentially relevant for inclusion) were screened based on the inclusion criteria independently. Irrelevant studies for this meta-analysis were excluded. Inter-rater agreement coefficient (Cohen's k ; McHugh, 2012) was equal to 0.91. Referring back to the original article, discussions with the third author were helpful in resolving discrepancies between the raters and reach a consensus. Then, researchers screened 20% of 32 full-text articles assessed

for eligibility (six articles) to assess their relevance. Inter-rater agreement coefficient (Cohen's k) was equal to 1.00. For each of the selected studies, two researchers extracted in a blinded manner (1) the type of psychological interventions, (2) some of the basic information (e.g., name of authors, publication year), (3) the format of the intervention (individuals, groups, couples), (4) the type of control group (no intervention vs. alternative intervention), (5) the instruments involved and the variables explored and (6) the sample size and characteristics [i.e., participants (patients or survivors); mean age of participants]. Inter-rater reliability analysis revealed that a perfect agreement between researchers was reached.

Assessment of Study Quality

Two authors assessed the quality related to studies included independently; then, discrepancies were resolved through discussions with another author. As a result, eight criteria defined by Cuijpers and colleagues (2010) and already used in other meta-analyses for assessing study quality (David et al., 2018; Hoppen & Morina, 2020) were involved. Moreover, three additional items were added to further explore the quality of the studies included in this meta-analysis (see Table 5).

In Cuijpers et al. (2010, p. 212, 213)	In this meta-analysis
(1) "Participants met diagnostic criteria for a depressive disorder (as assessed with a personal diagnostic interview, such as CIDI, SCID, or SADS, and using a diagnostic system such as DSM or Research Diagnostic Criteria)"	(1) Breast cancer patients or breast cancer survivors
(2) "The study referred to the use of a treatment manual (either a published manual, or a manual specifically designed for the study)"	(2) Detailed description of the psychological approach, timing, procedure, and sessions
(3) "The therapists who conducted the therapy were trained for the specific therapy, either specifically for that study or as a general training"	(3) The psychologists who conducted the psychological treatment were trained for the specific psychological intervention
(4) "Treatment integrity was checked during the study (by supervision of the therapists during treatment or by recording of treatment sessions or by systematic screening of protocol adherence by a standardized measurement instrument)"	(4) "Treatment integrity was checked during the study (by supervision of the psychologists during treatment or by recording of treatment sessions or by systematic screening of protocol adherence by a standardized measurement instrument)"
(5) "Data were analyzed with intention-to-treat analyses, in which all persons who were randomized to the treatment and control conditions initially were included in the analyses"	(5) Same
(6) "The study had a minimal level of statistical power to find significant effects of the treatment, and included ≥ 50 persons in the comparison between treatment and control groups [this allows the study to find standardized effect sizes of $d = 0.80$ and larger, assuming a statistical power of 0.80 and $\alpha = 0.05$; calculations in Stata (Stata Corp., USA)]"	(6) Not included
(7) "The study reported that randomization was conducted by an independent (third) party (this variable was positive if an independent person did the randomization, when a computer program was used to assign patients and survivors to conditions, or when sealed envelopes were used)"	(7) Same
(8) "Assessors of outcome were blinded and did not know to which condition the respondents were assigned to (this was only coded when the effect sizes were based on interviewer-based depression ratings; when only self-reports were used, it was assumed that this criterion was met)"	(8) Same
	Additional items to further explore the quality of studies
	(9) The control groups do not receive an intervention*
	(10) The absence of differential attritions between intervention and control groups (e.g., a great number of participants dropped out of the research study)*
	(11) The absence of reporting bias in the results*

*Items included in this meta-analysis to further explore the quality of studies.

Table 5. Criteria of the assessment of study quality.

Quality Appraisal of the Studies

Three researchers conducted assessments of the methodological quality of each study independently using the Cochrane risk of bias tool, version 2 (RoB 2; Higgins et al., 2011). The RoB 2 is based on some domains about the studies' quality appraisal and their biases (Sterne et al., 2019). The results of the risk of bias were differentiated as "low risk," "some concerns," and "high risk" for each study; each domain and its related specific risks were evaluated. If the risk assessment of all the domains resulted in low, the study's overall risk is also evaluated as low (Higgins et al., 2011). Finally, discussions between researchers resolved discrepancies in the quality of the studies.

3.1.2 Results

Data Analysis

Data analyses were conducted via the software R (the `rma.mv` function of the `metaphor` package) (Viechtbauer & Viechtbauer, 2015) and the SPSS Statistical Software 20.0. Six major sets of analyses were included:

- firstly, an outlier analysis was conducted on the effect sizes included in this meta-analysis. An outlying effect was present when standardized z values exceeded $+3.29$ (Tabachnick & Fidell, 2013);
- Hedges' g was computed for each comparison between the experimental and control groups considering means and standard deviations. Hedges' g was interpreted as small (≤ 0.20), medium ($=0.50$), or large (≥ 0.80) (Cohen, 1988; Chalmers et al., 2014). Positive values indicate that the outcome is higher in breast cancer patients or survivors who received psychological interventions compared to the control group (that is based on people who did not receive a psychological intervention);
- meta-analyses were run to assess the efficacy of psychological interventions on Body Image (Outcome 1) and Sexual Functioning Related to Body Image (Outcome 2) in breast cancer patients and survivors. As known in the traditional meta-analysis, the independence between the included effect sizes is an important assumption to take into consideration (Rosenthal & Rubin, 1986; Assink & Wibbelink, 2016) for avoidance of "inflated" estimates and overconfidence in the results (Van den Noortgate et al., 2013; Assink & Wibbelink, 2016). Since this important precondition is violated in this meta-analysis, a three-level analysis was used (Assink & Wibbelink, 2016; Assink et al., 2018; van der Put et al., 2018; van der Put et al., 2020);

- three levels of the model were included in the analysis to deal with the dependency of effect sizes (Van den Noortgate et al., 2013; Cheung, 2014); particularly:

- a) Level 1 variance: regarding the sampling variance of the individual effect sizes;
- b) Level 2 variance: it refers to the variance between effect sizes from the same study;
- c) Level 3 variance: considering the differences between studies.

(Level 2 and Level 3 variances are included as random terms in the model);

- publication bias was explored by inspecting the funnel plot graphs' asymmetry (Sterne & Egger, 2001) conducted with the trim-and-fill method and .rma function. The funnel plot should assume a symmetric funnel shape, ff publication bias is absent. The presence of small effects underrepresented and significant effects missing (a great number of “missing” effect sizes suggested a bias to a greater extent; Assink et al., 2018) were tested by observing the white dots in the funnel plot (Higgins & Thompson, 2002);

- lastly, heterogeneity across studies was assessed by the Q statistic (Hedges & Olkin, 1985). The extent of such heterogeneity across studies was assessed using the I2 index (Higgins & Thompson, 2002). I2 indexes of 25, 50, and 75% indicate low, moderate, and high heterogeneity respectively (Higgins et al., 2003). The distribution of the total variance over the three levels (Level 1, Level 2, and Level 3; Cheung, 2014, formula 14, p. 2015) was examined too. Furthermore, two separate one-tailed log-likelihood-ratio-tests were performed to determine whether the variance in Level 2 and Level 3 were significant. Moreover, the outcome of the entire model was compared to that outcome of a model excluding one of the variance parameters. The restricted maximum likelihood estimation method was used to estimate the model parameters. Lastly, a prediction interval analysis was computed to explore an approximate 95% range of underlying effects (e.g., IntHout et al., 2016).

Study Selection

The present meta-analysis was conducted following the guidelines and checklist of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Liberati et al., 2009; Moher et al., 2009; Figure 2). Participants, Interventions, Control group intervention, and Outcome measures included in this meta-analysis were summarized in Table 6. 921 potentially relevant articles were found after the initial search

process returned. After removing duplicates, 903 studies remained. Two researchers reviewed and screened studies by reading the title and abstract. Based on the inclusion criteria, 32 were full-text screened. This selection procedure yielded a subset of seven usable empirical studies (Table 7). Selected studies included a total sample size of 366 participants and 17 individual effect sizes were published between 2008 and 2014. The authors carefully analyzed each variable assessed in these studies to be classified in the Body Image outcome (Outcome 1). Moreover, since the strict interconnection between BI issues and sexual functioning in breast cancer patients and survivors, this meta-analysis also explored the effect of psychological interventions on Sexual Functioning Related to Body Image in breast cancer patients and survivors (Outcome 2).

Participants	Breast cancer patients or survivors
Interventions	Psychological Interventions (Art therapy, psychosexual intervention, mindfulness-based stress reduction treatment, or metacognition group therapy, sexual life reframing program focused on the physical, psychological, and relational aspects of sexual health elements, psychosocial intervention program, mindfulness and dance/movement activities, web-based psychological intervention)
The comparison intervention or exposure	Non-active intervention (no intervention) vs. active intervention (usual care or expressive writing)
Outcome	Body Image (Outcome 1) or Sexual Functioning related to Body Image (Outcome 2)
Study type	Randomized and non-randomized control trials

Table 6. Description of the studies included in the meta-analysis following the PICOS model, The PICOS measure.

Study	Population	Psychological intervention type	Control group	Intervention format	N (N experimental group; N control group)	M age
Svensk et al. (2009)	Patients	Art therapy (1 h/a week per 5 weeks, for a total of five sessions)	No intervention	Individual	41 (20;21)	59.5
Kalaitzi et al. (2007)	Patients	Psychosexual intervention (one session/2 weeks for 10 weeks, for a total of five sessions)	No intervention	Couple	40 (20;20)	51.8
Rahmani et al. (2014)	Patients	Mindfulness-based stress reduction treatment or metacognition group therapy (2 h/a week for 8 weeks, for a total of eight sessions)	No intervention	Groups	24 (12;12)	43.25;44.92
Jun et al. (2011)	Survivors	Sexual life reframing program focused on the physical, psychological, and relational aspects of sexual health elements (2 h/a week per 6 weeks, for a total of six sessions)	Usual care	Groups	45 (22;23)	45.7
Sebastián et al. (2008)	Patients	Psychosocial intervention program (2 h/a week per 14 weeks, for a total of 14 sessions)	No intervention	Groups	175 (102;73)	48
Crane-Okada et al. (2012)	Patients	Cognitive: mindfulness and dance/movement activities (2 h/a week per 12 weeks, for a total of 12 sessions)	No intervention	Groups	41 (25;16)	65.6
Sherman et al. (2018)	Patients	Web-based psychological intervention (a single session)	Expressive writing	Groups	274 (132;142)	57.5

Table 7. Detailed description of the studies included in the meta-analysis.

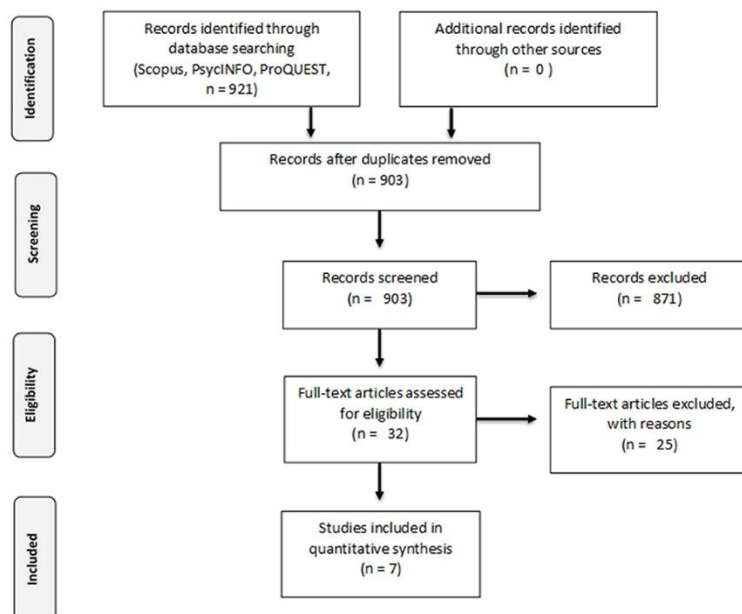


Figure 2. PRISMA flow diagram

BI (Outcome 1) includes six studies and nine dependent effect sizes on personal satisfaction related to BI, BI when naked or dressed, and BI appreciation. Sexual functioning (Outcome 2) involves four studies and eight dependent effect sizes related to sexual functioning, sexual desire frequency, feeling attractive, sexual interest, and sexual satisfaction. Details of each study included in the meta-analysis and descriptions of the effect sizes are presented in Table 8.

Study	Dependent variable	Measure	Outcome	<i>g</i>	95%CI	Variance	<i>z</i>
Svensk et al. (2009)	Body image	QLQ-BR23	1	0.36	-0.26; 0.98	0.1	-0.418
Svensk et al. (2009)	Sexual functioning	QLQ-BR23	2	0.23	-0.36; 0.82	0.09	-0.120
Kalaitzi et al. (2007)	Body image satisfaction when naked	<i>Ad hoc</i> questionnaire	1	1.41	0.73; 2.09	0.12	1.827
Kalaitzi et al. (2007)	Body image satisfaction when dressed	<i>Ad hoc</i> questionnaire	1	0.89	0.24; 1.54	0.11	0.715
Kalaitzi et al. (2007)	Feeling attractive	<i>Ad hoc</i> questionnaire	2	1.51	0.83; 2.19	0.12	1.797
Kalaitzi et al. (2007)	Sexual desire frequency	<i>Ad hoc</i> questionnaire	2	0.12	-0.50; 0.74	0.1	-0.285
Rahmani et al. (2014)	Body image (body cognition vs control)	QLQ-BR23	1	0.66	-0.12; 1.44	0.16	0.223
Rahmani et al. (2014)	Body image (mindfulness vs control)	QLQ-BR23	1	0.72	-0.09; 1.53	0.17	0.351
Rahmani et al. (2014)	Sexual functioning (body cognition vs control)	QLQ-BR23	2	-0.84	-1.65; -0.03	0.17	-1.722
Rahmani et al. (2014)	Sexual functioning (mindfulness vs control)	QLQ-BR23	2	0.30	-0.48; 1.08	0.16	-0.015
Jun et al. (2011)	Body image	CARES	1	-0.11	-0.70; 0.48	0.09	-1.423
Jun et al. (2011)	Sexual interest	CARES	2	0.20	-0.39; 0.79	0.09	-0.165
Jun et al. (2011)	Sexual dysfunction	CARES	2	0.13	-0.46; 0.72	0.09	-0.270
Jun et al. (2011)	Sexual satisfaction	CARES	2	0.83	0.24; 1.42	0.09	0.779
Sebastián et al. (2008)	Body image	BIS	1	0.77	0.49; 1.05	0.02	0.459
Sherman et al. (2018)	Body image distress	BID	1	0.07	-0.13; 0.27	0.01	-1.038
Sherman et al. (2018)	Body appreciation	BCSs	1	0.23	0.03; 0.43	0.01	-0.696

Measures: QLQ-BR23, Breast Cancer-Specific Quality of Life Questionnaire (Sprangers et al., 1996; EORTC, 2010); CARES, Cancer Rehabilitation Evaluation System questionnaire (Ganz et al., 1992); BIS, Body Image Scale (Hopwood et al., 2001); BID, Body Image Distress (Galiano-Castillo et al., 2014; Paterson et al., 2015); BCS, body appreciation scale (Avalos et al., 2005).

Outcome: 1 = body image; 2 = sexual functioning.

Table 8. Effect sizes of the studies included in the meta-analysis

Assessment of Study Quality

An adequate quality (5 or more points out of 10 points) were revealed in the assessment of the most of the studies. Table 9 reported the details of the assessment of study quality included in this meta-analysis.

Study	Breast cancer patients or breast cancer survivors	Detailed description of the psychological intervention	Training conducted by a trained psychologist	Supervision during treatment or protocol screening for adherence	Intention to treat analysis	Randomization by a third party	Blind conditions	Control group without treatment	Absence of differential attritions between groups	Absence of reporting bias	Total
Svensk et al. (2009)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	8/10
Kalaitzi et al. (2007)	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	8/10
Rahmani et al. (2014)	Yes	Yes	N/A	No	Yes	No	Yes	Yes	Yes	Yes	7/10
Jun et al. (2011)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes*	Yes	Yes	9/10
Sebastián et al. (2008)	Yes	Yes	N/A	No	Yes	No	Yes	Yes	No	Yes	6/10
Crane-Okada et al. (2012)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	8/10
Sherman et al. (2018)	Yes	Yes	N/A	No	No	Yes	Yes	No	No	Yes	5/10

N/A, not available.
*unspecified "usual care."

Table 9. Assessment of the quality of the studies

Risk of Bias

The Cochrane risk of bias tool, version 2 (RoB 2; Higgins et al., 2011) was used to assess the quality appraisal of the selected studies. Researchers reached a consensus on the quality appraisal evaluation of the seven selected studies. Only one (Sebastián et al., 2008) of the included studies had a high risk of bias in sequence generation (see Table 10). Even if they did not explain how participants were allocated, the randomization methods of the other studies were precise. Only Sherman and colleagues (2018) specified the blinding of participants and personnel. Sebastián and colleagues (2008) claimed the blinding of outcome data, while in the other studies it is unclear. Three of seven studies (Sebastián et al., 2008; Crane-Okada et al., 2012; Sherman et al., 2018) reported attrition bias due to a drop-out rate. No selective reporting bias was detected in included studies. Finally, three of seven studies (Kalaitzi et al., 2007; Svensk et al., 2009; Rahmani et al., 2014) stated biases in their experimental studies. Finally, other studies are unclear or the risk of bias was assessed as low.

	Random sequence generation	Allocation concealment	Blinding of participants and personnel	Blinding of outcome data	Incomplete outcome data	Selective reporting	Other bias
Svensk et al. (2009)	+	?	-	?	+	+	-
Kalaitzi et al. (2007)	+	?	-	?	+	+	-
Rahmani et al. (2014)	+	?	-	?	+	+	-
Jun et al. (2011)	+	?	-	?	+	+	?
Sebastián et al. (2008)	-	-	-	-	-	+	+
Crane-Okada et al. (2012)	+	?	-	?	-	+	?
Sherman et al. (2018)	+	?	+	?	-	+	?

*+, low risk of bias; "?", unclear risk of bias; "-", High-risk of bias.

Table 10. Risk of bias assessment.

The outlier analysis on all the dependent effect sizes included in this meta-analysis highlighted that standardized z values did not exceeded ± 3.29 . Thereby, all the effect sizes were included in the analyses.

Outcome 1: Body Image

The first meta-analysis explored the efficacy of the psychological intervention on breast cancer patients and survivors' BI (Table 11). The analysis included six studies and nine non-independent effect sizes (Figure 3). The random effect three-level analysis showed a medium, statistically significant effect of psychological interventions on breast cancer patients and survivors' BI [$g = 0.50$; 95% CI (0.08; 0.93); $p < 0.05$]. No visual asymmetry was shown in the funnel plot with the trim and fill function, which suggests a low probability of publication bias (Figure 4). The heterogeneity was significant [$Q(8) = 33.75$, $p < 0.001$, $I^2 = 80.89$]. 19.11% of the total variance can be attributed to the sampling variance, 1.01% can be related to studies variance (the differences between effect sizes within studies), and 79.88% can be attributed to between-studies variance (differences between studies). Log-likelihood tests revealed a non-statistically significant variance within-study ($p = 0.89$), and between-study ($p = 0.07$). The prediction interval is between -0.49 to 1.50 .

Domain	# Studies/# ES	Mean g (SE)	95% CI	p	% Var. at level 1	Level 2 variance	% Var. at level 2	Level 3 variance	% Var. at level 3
Body image	6/9	0.50 (0.18)	(0.08;0.93)	0.03	19.11	0.002	1.01	0.149	79.88
Sexual functioning related to body image	4/8	0.33 (0.22)	-0.20;0.85	0.19	27.37	0.286	72.63	0.000	0.00

#Studies/#ES, Number of studies/ number of effect sizes; % Var., percentage of variance explained; Level 2 variance, variance between effect sizes from the same study; Level 3 variance, variance between studies.

Table 11. Results for the overall mean effect sizes of the two outcomes (body image and sexual functioning).

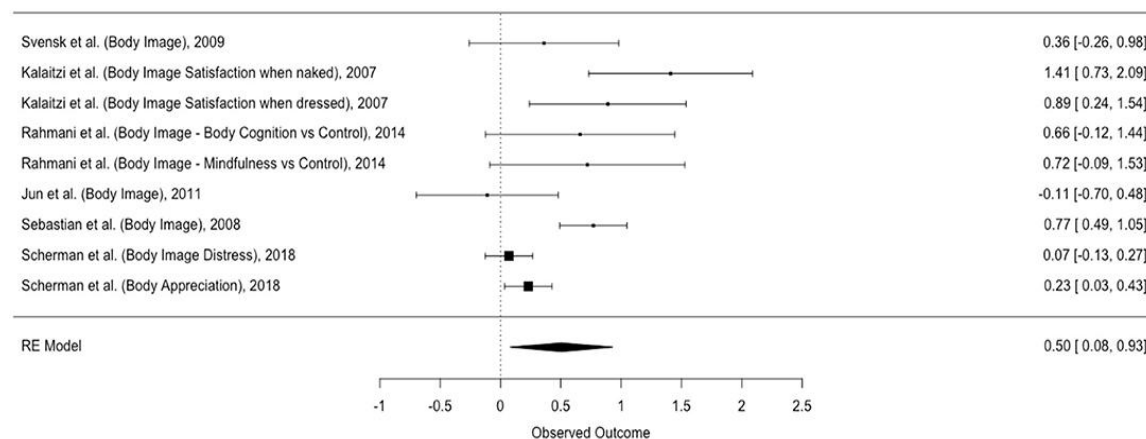


Figure 3. Forest plot of effect sizes of Body Image

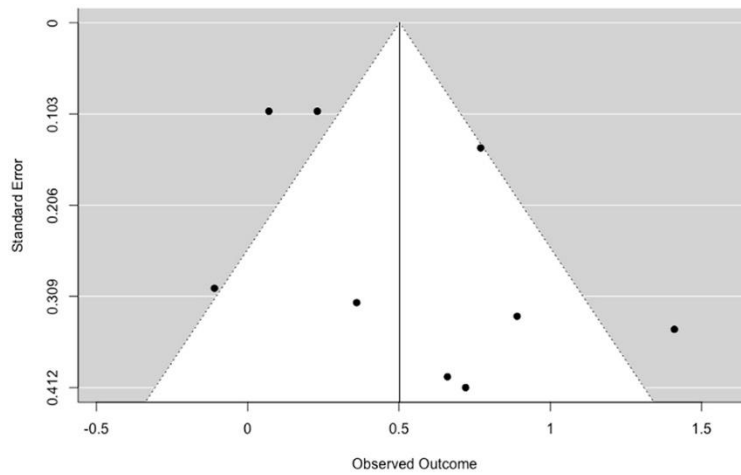


Figure 4. Funnel plot of publication bias in BI

Outcome 2: Sexual Functioning Related to Body Image

The second meta-analysis explored the efficacy of the psychological intervention on breast cancer patients and survivors' Sexual Functioning Related to BI. The database composed four studies and eight dependent effect sizes (Figure 5). The three-level meta-analysis showed a non-statistically significant effect size $\{g = 0.33 [95\% \text{ CI } (-0.20; 0.85); p = 0.19]\}$, which suggests that psychological interventions do not impact on breast cancer patients and survivors' Sexual Functioning Related to Body Image. Interestingly, one study highlighted a negative effect size on sexual functioning ($g = -0.84$) (Rahmani et al., 2014). The funnel plot with the trim and fill method (Figure 6) reveals only one missing effect size on the (bottom) right side of the graph, suggesting a low probability of publication bias. The heterogeneity was significant [$Q(7) = 23.60, p < 0.01, I^2 = 72.63$]. 27.37% of the total variance can be attributed to the sampling variance, 72.63% can be attributed to within studies variance, and 0% can be attributed to between studies variance. Log-likelihood tests revealed a statistically significant variance within-study ($p = 0.02$). No-statistically significant variance between-study ($p = 1.00$) was highlighted. The prediction interval ranged between a largely negative and large positive effect size (-1.04 to 1.69).

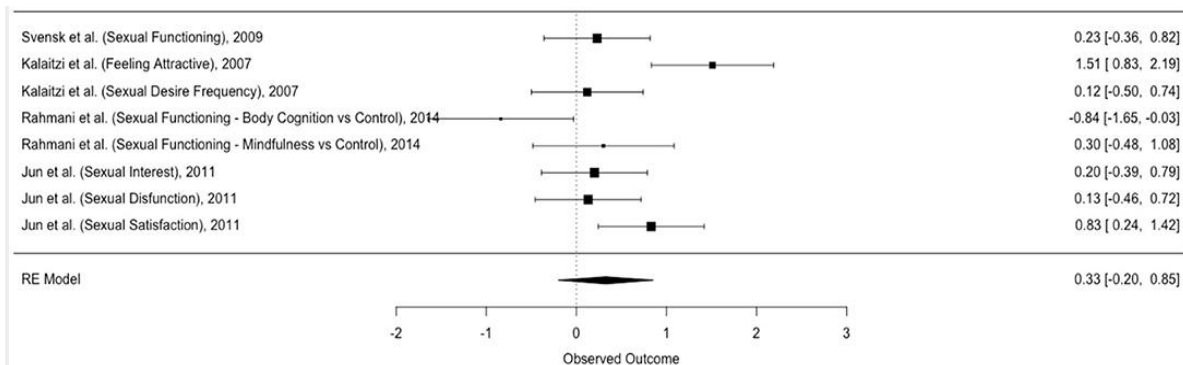


Figure 5. Forest plot of effect sizes of Sexual Functioning Related to Body Image.

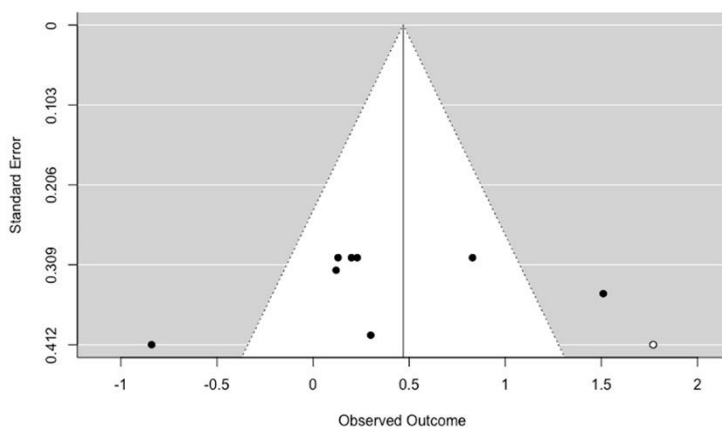


Figure 6. Funnel plot of publication bias in Sexual Functioning related to Body Image

3.1.3 Discussion

This meta-analysis reviewed the literature before March 2020 about the efficacy of psychological interventions for BI and sexual functioning related to BI in breast cancer patients and survivors. Firstly, considering all the consequences of BI and Injured Self issues, identifying psychological interventions which impact patients' and survivors' BI is important to sustain the adjustment to breast cancer. Accordingly, findings suggested that different psychological interventions are effective for breast cancer patients and survivors' BI with a medium effect size. Interestingly, improvements are not modality-specific; cognitive, sexual, social interventions, mindfulness, art therapy, and web-based treatments were involved. Positive outcomes on BI do not depend on specific characteristics of psychological interventions, but on meeting patients and survivors' needs and preferences, as affirmed by Möller et al. (2019) and in line with the complexity of BI definition as a multidimensional construct. Therefore, personalized and collaborative psychological interventions (e.g., Smith & George, 2012; Aschieri et al., 2015; Durosini et al., 2017) are needed to deal with BI issues by considering any individual breast cancer patient or survivor's characteristics and experiences. In addition, except for the study by Sherman et

al. (2018), in which the authors used a single session in the web-based psychological treatment, psychological interventions are extended and consistent over time (from 5 to 14 weeks for each intervention). Moreover, in the selected studies, professionals who deliver psychological interventions are psychologists. They draw on their training to propose mixed methods to engage many aspects of BI and related psychological, emotional, and social changes aiming at enabling breast cancer patients and survivors to address various aspects of BI without self-fragmentation.

Second, despite the strong association between BI and sexual functioning in breast cancer patients and survivors (Woertman & Van den Brink, 2012), sexual functioning does not show improvement among the reviewed contributions. One possible explanation might be related to the typology of psychological interventions that include sexual functioning. In these studies, sexual functions are not presented as the main objective of interest. For example, the study by Rahmani and colleagues (2014) and the art therapy program by Svensk and colleagues (2009) in the cognitive-based intervention field do not specifically focus on sexual issues. It is possible that these interventions were not effective due to a lack of a specific focus on sexuality. In addition, Perdue and colleagues (2018) suggested that BI is extensively entwined with social ideals in a specific place and time. This way, comparing the actual and ideal appearance can increase the self-objectification, which is strongly linked to disease in sexual functioning (Bishop, 2015). In breast cancer patients and survivors, this could be particularly evident because tumor experience affects cognitions and perceptions about BI with direct influences on, for example, the perception of being attractive and sexual desire (Benoit, 2020). Moreover, relevant changes in the body can be both visible (e.g., scarring and hair loss) and not apparent (e.g., interoception or the inner perception of the body). Therefore, sexual functioning has to be assessed as one of the main aspects of interest related to BI, especially in breast cancer patients and survivors.

In conclusion, this study explored the efficacy of psychological interventions by involving both individual and relational aspects of BI. Positive outcomes on BI were presented, involving both individual and group psychological interventions conducted by trained professionals. As a limitation, strict criteria for data selection and cultural differences have been applied. Additionally, gray literature and doctoral dissertation were excluded as well as keywords related to specific types of psychological interventions were not used. Literature search might be insufficient to provide a comprehensive and complete picture of the evidence by excluding some studies that were not identified as fulfilling the selection criteria adequately. Only three databases were used for the study research without relevant

medical databases related to breast cancer issues. A cautious evaluation is suggested regarding the funnel plot and the trim-and-fill method. This is about their low sensitivity to detect publication bias when the number of studies is small, as in this meta-analysis. Lastly, another study limitation is the high statistical variance across study designs, because of different levels of clinical and methodological diversity (e.g., the inclusion of a non-randomized trial). Future research may improve measurements, feature more psychological characteristics, and change the inclusion criteria of study selection. Additionally, exploring the effectiveness of psychological interventions moderated by the type of psychological intervention and the typology of participants in breast cancer patients and survivors may be interestingly. Third, qualitative studies could be reviewed to explore BI dimensions and implement personalized psychological interventions centered on the lived illness to assess the individual perceptions of patients and survivors. Finally, psychological interventions have to assess BI and related constructs in terms of BI appreciation as well as sexual functioning as recommendations for clinical practice. Clinical implications could be the foundation of intervention able to individualize aids in meeting breast cancer patients and survivors' needs, given more space to sexual functioning. The low number of available studies focused on BI issues shows that it has not been explored enough in the current literature. This way, the need to promote psychological interventions in this field is mandatory.

3.2 Study 3: How to heal the Injured Self: a physical and psychological intervention

As previously demonstrated in the review and meta-analysis study (Sebri et al., 2021^b), novel and mixed approaches are efficacy in promoting well-being in breast cancer patients and survivors (Björneklett et al., 2013). A possible intervention can include both psychological sessions and physical activities, for example. On one side, psychological intervention (e.g., cognitive, social, and sexual programs) effectively decrease emotional distress and negative behaviors, which are relevant to sustain the illness adjustment and avoid self-fragmentation (Jabłoński et al., 2019). Specifically, studies highlighted that psychological interventions decrease distress by providing problem-solving methods and relaxation (Blanco et al., 2014). This can be helpful thanks to favorable modification in the perception of one's own body (Blanco et al., 2014). Similarly, physical activities are safe and accessible activities to decrease self-distortions (Yang et al., 2017) with long-lasting effects on cognition, emotions, and behaviors (Danish et al., 2004; Morel et al., 2015). Literature showed that combining aerobic and resistance fitness, which increases muscle strength and

functional ability to perform tasks, might improve perceptions of health and appropriate BI (Speck et al., 2010; Woertman & Van den Brink, 2012). A recent study Stan and colleagues (2012) showed significant improvements in QoL, mood, and BI after 12 weeks of group Pilates programs. In general, the internal focus and awareness of the body and its inner sensations may be particularly beneficial to empower breast cancer survivors who feel more in command over their body by reducing perceived constraints, such as shame, self-doubt, and negative BI. It is important to note that when developing an exercise program for cancer survivors, individual differences must be considered and adjusted about individual fitness level, health status, treatment protocols, side effects, and surgeries (Schmitz et al., 2010). Potential risks related to side effects of cancer treatment (e.g., fractures due to hormonal therapies) should be considered when developing an exercise program (Kirkham et al., 2016). Interventions should suit the individual's physical ability to gain the most benefits and avoid injuries (Kirkham et al., 2016).

Since the outbreak of COVID-19, psychological issues in terms of worry, anxiety, and depression have particularly increased (Sebri et al., 2021^a). Internet-based interventions have been implemented to deal with psychological and physical issues in cancer patients especially (Weiner et al., 2020). The need to improve patients' QoL through exercise, which is related to survival and healing, increased, especially during lockdown. Online interventions were not only used to monitor exercise training at home (Grazioli et al., 2020), but offered the opportunity to provide tailored psychosocial cancer care. Moreover, patients can complete online training sessions at their convenience, with the added benefit of reviewing sessions of delivered information as often as needed (Esplen & Trachtenberg, 2020). Online interventions are gaining popularity as a cost-effective way to address these persistent challenges (Esplen & Trachtenberg, 2020). Current studies showed the effectiveness of online interventions on BI by enhancing QoL and decreasing fatigue (Weiner et al., 2020). More specifically, on a psychological level, Esplen and colleagues (2018) showed the effectiveness of 8-week online text-based group intervention developed by a therapist-led in-person and evaluated in a randomized controlled trial to restore BI in terms of self-schemas and emotional reactions after cancer. This program significantly improved BI and QoL thanks to: group therapy techniques to address emotional reactions, such as grief and loss; guided imagery exercises to address self-schema and altered and emerging identity; and psychoeducational materials to stimulate group discussions on the sociocultural influences that are impeding adjustment. At the same time, Sherman et al. (2018) recently conducted a randomized controlled trial based on a writing web-based psychological intervention (My Changed Body) to alleviate BI distress in breast cancer

survivors. My Changed Body intervention was brief and conducted as a single-session, self-compassionate online writing activity. Campo et al. (2017) conducted a feasibility pilot study of a mindful self-compassion videoconference intervention designed for young adult cancer survivors. The intervention was group-based and consisted of 90-minute videoconference weekly sessions over 8 weeks, with audio-supplemented home practice. Finally, an Italian study by Grazioli and colleagues (2020) revealed the positive effects of home-based combined training regimen on BI. Two breast cancer survivors were required to participate in 2 h/week supervised and home-based combined training for sixteen weeks. Women reported improvements in the emotional function of QoL and fatigue perception in breast cancer women undergoing therapy. Patients attended all training sessions with no adverse events, showing the sustainability of this training as an alternative and affordable method capable of improving patients' well-being. To sum up, online interventions increased BI's perception in breast cancer patients and survivors, which is a crucial endpoint in QoL evaluation.

It is important to notice that women's psychological experience of BI is also integrated within a broader socio-cultural context. Along with understanding women's broad experience of changed womanhood after cancer, it is vital to understand how this experience plays out within a particular cultural environment and group-belongingness (Hungry et al., 2017). A growing body of literature evidences the efficacy of psychological interventions in groups for breast cancer patients and survivors to improve personal well-being and a deeper understanding of their inner psychological world, thanks to positive social support. Paulo and colleagues (2019) evidenced that group physical activities increase positive perceptions and satisfaction with BI by improving self-esteem, the perception of feeling better, motivation, and social relationships in sharing experiences, fears, and challenges. At the same time, Mehnert and colleagues (2011) reported the effectiveness of a 10-week physical exercise intervention in increasing individual BI, overall well-being, and physical fitness. Authors indicated that group intervention led to more benefits than individual ones thanks to different training elements combined and high patients' participation. This way, adding group belongingness to remotely delivered physical activity interventions may enhance their effectiveness thanks to giving and receiving feedback and sharing ideas with other survivors (Lloyd et al., 2020). Group interventions are useful thanks to others' point of view by sharing experiences, intimacy, and recognition by others. Authors stated that a safe context with members who lived similar life experiences could be helpful to explore illness experiences and formalize goals, create a sense of accountability, facilitate an understanding of their achievements, and support behavior change techniques (Michie et al., 2011; Speck et al.,

2010). More specifically, groups facilitate knowledge and strategic skills acquisition. At the same time, it encourages critical reflection about the Self and possible changes in the way of being with and looking at others promoting a mutual understanding that internal growth processes. While a self-perspective highlights subjective mental images in a specific moment (Markus, 1977), the others' perspective evaluation sustains the retrieval process of autobiographical memories that come out with objective mental images of the Self (Ochsner et al. 2005). Since the relevance of external judgments from individual experiences and behaviors (Her & Seo, 2018), evaluating the Self from another's perspective suppressed the self-referential processing promoting a more objective view (Shiota et al., 2017). Additionally, the presence of an expert group moderator can be important too (Rabin et al., 2016). Previous interventions based on online forums through study websites (Rabin et al., 2016) or Facebook (Valle et al., 2013) reported a low participants' engagement, perhaps due to lack of moderation or moderation by a researcher (Valle et al., 2013). A moderator could further enhance intervention effectiveness by increasing the likelihood that participants will be engaged in promoting of their behavioral changes (Lloyd et al., 2020).

Based on these considerations, the present study evaluated the effectiveness of the Injured Self Program. Physical activity and psychological support interventions were combined to improve BI and psychological well-being by alleviating mood disturbances, such as anxiety and depression. It was assumed that:

- (Hp1) the intervention group would show significant changes in all components of well-being (e.g., physical and emotional) as opposed to the control group;
- (Hp2) the program would lead to a better BI in comparison to the control group;
- (Hp3) the intervention group would show a significant promotion of positive emotions compared to the control group.

3.2.1 Material and Method

The study was approved in agreement with the Declaration of Helsinki. Informed consent was obtained from all subjects prior to enrollment. Participants were required to be over 18 years of age and previously diagnosed with breast cancer. They were volunteers recruited online through email and online platforms (e.g., Facebook). Exclusion criteria were as follows: absence of more than one psychological intervention session; not wanting to continue participating in the program; development of metastasis elsewhere in the body during the research. The sample size needed was determined using G*Power 3 (Faul et al. 2007). A total of 17 participants were estimated to be included in the sample to detect an effect size of Cohen's $d = 0.30$ on the primary outcome, an alpha error of .05, and statistical

power of .80. Study's goal was to investigate a new intervention for the Injured Self in a preferably homogenous sample. Participants were randomized either to the body image therapy condition (intervention group following the Injured Self program; $n = 26$) or to the control condition (control group without intervention, CG; $n = 25$). In order to exclude possible complications related to sports, participants filled out a questionnaire based on a medical examination, including an anamnesis carried out by the trainer in gymnastics. In addition, participants were required to perform a battery of psychological tests. The project was based on 6 weeks of a home-based intervention, monitored through video call, twice a week, and was conducted from February to April 2021.

Measures

To quantify the changes in various aspects of the Injured Self and related constructs to determine outcome, the following self-report measures should have taken twenty minutes. These questionnaires are widely used in body image research in oncology and were administered at pre- and post-test: Body Image Scale (BIS), the Italian version of the Objectified Body Consciousness Scale (I-OBCS), Patient Health Questionnaire (PHQ), State-Trait Anxiety Inventory (STAI), and The Functional Assessment of Cancer Therapy-Breast, (FACT-B), Version 4.

The Body Image Scale (BIS) (Hopwood et al., 2001) is a 10-item questionnaire to assess body image distress regarding physical appearance and the feelings related to changes caused by disease and treatments. Specifically, behavioral (e.g., avoiding people due to their appearance and finding it hard to look at oneself naked), affective (e.g., feeling attractive and feminine), and cognitive (e.g., being satisfied with scar or appearance) items have been assessed. Participants rated on a 5-point Likert scale (from 1 to 5) the extent to which they agreed with statements, such as "Have you been feeling self-conscious about your appearance?" as follows: "never", "little", "moderately", "greatly", and "I do not know" (Grazioli et al., 2020). All the ten items' score were summed up to produce an overall summary score for each patient. Higher summed scores show acute BI distress (Cheli et al., 2016). The BIS showed high internal reliability (Cronbach's $\alpha = 0.94$), unidimensional, and construct validity (Annunziata et al., 2018; Hopwood et al., 2001). It has been widely applied in oncological contexts thanks to its good clinical validity and sensitivity to change (Przedziecki et al., 2013). The Italian version was translated through a forward-backward procedure (Didier et al., 2009), according to the recommendations for translating questionnaires of the QoL Group of the EORTC.

The Italian version of the Objectified Body Consciousness Scale (I-OBCS) (Dakanalis et al., 2017) is a 24-items questionnaire of the original English version by McKinley and Hyde (1996). Participants completed statements on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). Specifically, I-OBCS measures body surveillance (e.g., “I often worry about whether the clothes I am wearing make me look good”), appearance control beliefs (e.g., “I think a person can look pretty much how they want to if they are willing to work at it”), and body shame (e.g., “I feel ashamed of myself when I haven’t made the effort to look my best”) (Boursier et al., 2020). In addition, good construct validity, high internal consistency, and test–retest reliability were evidenced (Dakanalis et al., 2017).

Patient Health Questionnaire – 9 (PHQ – 9) (Kroenke, 2001) is a reliable 9-item self-report questionnaire that measures clinical depression severity in adults. On a 4-point Likert scale (0-3 points), PHQ-9 scores each of the 9 DSM-IV criteria from “not at all” to “nearly every day” (Mazzotti et al., 2003). In addition, it is a valuable research and clinical tool thanks to its brevity (Kroenke et al., 2001). A cut-off points of ≥ 10 was applied as recommended for the screening of depression (Kroenke et al., 2001) with good internal consistency (Grassi et al., 2017). The questionnaire was validated in an Italian version (Rizzo et al., 2000).

State-Trait Anxiety Inventory (STAI-Y) (Spielberg, 1983^b) is a modified version of STAI-X and has been developed to assess state (STAI-Y-1) and trait (STAI-Y-2) anxiety employing these two parallel versions. It is a standard measure in international research on anxiety (Abdel-Khalek, 1989). STAI-Y-1 consists of 20 statements to assess a temporary emotional state that requires respondents to mainly consider the current feelings “right now, at this moment”. STAI-Y-2 is a 20-item questionnaire that evaluates a relatively stable response to stressful situations that requires respondents to consider the overall feelings of anxiety that they experience “generally”, “all the time” (Han et al., 2020). The two versions can be used independently from the other one (Santangelo et al., 2016). All items are scored on 4-point Likert scale (“not at all”, “somewhat”, “moderately” and “very much so” for the STAI-Y-1 and “almost never”, “sometimes”, “often”, “almost always” for STAI-Y-2). 10 STAI-Y-1 and 9 STAI-Y-2 items have to be reversed. The sum of all items accumulated the total score of STAI-Y and higher scores indicate more severe anxiety (ranging from 20 to 80) (Santangelo et al., 2016). This revised version distinguishes between symptoms of

anxiety and depression better than the original form (Crawford et al., 2011) and improves the psychometric properties showing good internal consistency, test-retest reliability, and construct validity also in a sample of healthy subjects (Potvin et al., 2011; Spielberg, 1983^a; 2013). Pedrabissi and Santinello (1989) validated the questionnaire in an Italian version.

The Functional Assessment of Cancer Therapy-Breast (FACT-B), Version 4 (Cella et al., 1993), is a 36-item self-administered scale that assesses both general QoL referring to cancer (FACT General – FACT-G, 27 items) and additional 9-items more specific to breast cancer. Participants indicate their agreement with the statement during the last seven days using a 5-point Likert scale ranging from “0” (not at all) to “4” (very much). The questionnaire has domains that assess four general domains related to physical well-being (PWB), social well-being (SWB), emotional well-being (EWB), functional well-being (FWB), and the relationship with the physicians. In addition, the fifth subscale is specific for breast cancer scores about the patients’ perception of body image, sexual satisfaction, and attractiveness (Bichoo et al., 2021). Higher scores indicate better QoL in all the domains (Deepa et al., 2020).

The Injured Self program

From February to April 2021, using an online platform, the patients performed the Injured Self program composed of two sessions per week for a total of 13 sessions in 6 weeks of both psychological group sessions conducted by clinical psychologists and physical exercises with an expert trainer. The psychological intervention was inspired by previous psychological interventions (Lewer, 2017; Lewis-Smith, 2018). It comprised four bi-weekly sessions, each lasting for approximately 90 minutes. The Injured Self group therapy was conducted online by two female clinical psychologists who received special training in conducting the group sessions, including intensive study and detailed discussion of the Injured Self construct. The program was structured to identify and cope with dysfunctional Injured Self thoughts of each participant using cognitive and relational techniques, such as positive self-instructions. It laid out in the following modules: 1) self-monitoring of the current Injured Self (i.e., beliefs, emotions, and behavioral consequences); 2) concerning the causes, prevalence and effects of the Injured Self in the past; 3) relaxation training and identification and correction of cognitive body image errors; and 4) relapse-prevention strategies. In addition, the contents and meanings of sessions were shared into the online moderated group discussion with an emphasis on homework tasks and relaxation-based

practices. The latter has allowed enhanced recognition of negative emotions concerning Injured Self percepts and befriending of a good-enough self (see Table 12).

In Session 1, after a brief group “ice-breaker” in which clients introduced themselves and their reasons for attending the program, the definition and related components (cognitive, affective, and behaviors) of the Injured Self were introduced to the patients. Based on this, participants created an individual table in which they wrote what are the beliefs, emotions, and behaviors of the Injured Self. They started to be aware of the development and maintenance of the Injured Self. Then, they shared results of their BI assessments and set specific, identified dysfunctional “appearance assumptions” beliefs, and individualized goals for change. Finally, the “Injured Self Diary” was proposed. Participants learn to monitor ongoing BI experiences by attending to and recording the precipitants of distress and its effects on their thoughts, emotions, and behaviors.

Session 2 focused on historical events, including cultural and social experiences, which predisposed one to the Injured Self. Participants created a timeline to indicate significant BI events related to their Injured Self (in particular, their narrative representations). Participants learn how these vulnerabilities are activated and unfold in day-to-day thoughts, emotions, and behaviors and how they may become self-perpetuating.

Session 3 began the process of teaching effective coping in order to reduce body avoidance and body-checking behavior. All members participated in “*Body and Mind Relaxation*” technique, which integrated muscle relaxation, diaphragmatic breathing, mental imagery, and positive self-talk to promote skills for managing dysphoric BI emotions. First, group members were instructed to practice relaxation using the instructions read by the psychologist and gradually imagine and perceive different parts of their body and related inner sensations (working on their bodily self). These skills are generally applied in desensitization exercises to foster BI comfort and control concerning distress-provoking stimuli. Secondly, each participant drew on a paper the shape and color of body parts. This aimed to identify negative evaluations of body parts to achieve habituation and developed a realistic image of one’s body in a “*Private Body Talk*” (body-related thought processes). Finally, they discuss in-group by focusing on body areas perceived as positive, with the aim to shift the attention away from a deficit-oriented BI.

In session 4, participants summarized the contents. They discussed specific behavioral strategies for altering Injured Self and dysfunction behaviors. Self-consciousness and the reinforcement of a positive BI were sustained. These self-tailored strategies typically involve graduated exposure and response prevention interventions that clients develop within the group. Moreover, they set goals for accomplishing participants outside of the

group. Strategies to promote proactive and positive interpersonal relationships with others (i.e., a good marriage or friendship) and the body were proposed. Participants were engaged in prescribed exercises for “BI affirmation” and “BI enhancement”. This step emphasized developing rewarding body-related activities by creating and increasing experiences of mastery and pleasure. Finally, participants reviewed the results of their re-administered BI assessments, received feedback about attained changes, and then set goals for further needed changes. Reviewing relapse-prevention strategies helped them identify and prepare for future situations that might induce negative BI experiences.

	Themes	Contents	Examples of questions
Session 1:	Introduction to the group and rules	Exploration of individual expectations	How did you feel about taking part to this project?
Setting the scene	A brief group “ice-breaker” in which patients introduce themselves and their reasons for attending the program	Therapy outline explained	What are your BI evaluations?
Motivation, setting goals for change	Theoretical background on self-representations and Body Image by the psychologist The BI assessment : participants a Table in which addressing their maladaptive cognitive, emotional, and behavioral elements associated with BI; the results were shared with each other into the group Participants used these profiles to set specific, individualized goals for change BI Diary : participants were invited to monitor their emotions, cognitions, and behaviors related to BI. This is line with the cognitive-behavioral issues of BI in terms of “Activators” (precipitating events and situations), “Beliefs” (assumptions, thoughts, and interpretations), and ‘Consequences’ (resulting emotions and behaviors)	Group motivational therapy	What might be the benefits of attending this project? What are your beliefs, emotions, and behaviors related to your BI?
Session 2:	Questions about the individual experience with the previous gymnastic sessions	Exploring the impact that an event on Body Image	What are the main events linked to your body image experiences that you have had over the years?
Definition and development of Body Image and Injured Self	The construction of a BI timeline : participants signed on the timeline their main historical events related to BI. Then, they reflected on what predisposed one to a negative BI by sharing the biographical events in the group. Then, they were asked to associate a word and a picture with those events. The aim was to learn what are the more relevant events of one’s biography and the related emotions	Understanding of coping strategies and available safety behaviors	How do you react to these difficult experiences?
Distorted thinking and core beliefs on the Injured Self	The psychologist helps participants to relieve coping behaviors (e.g., avoidance, checking) which actually serve to worsen body image distress in the longer-term. Furthermore, specific behavioral strategies for altering avoidant Body Image behaviors and appearance-preoccupied rituals that might reinforce a negative body image were provided. These self-tailored strategies typically involve graduated exposure and response prevention interventions that patients develop within the group and set objectives for accomplishing them outside of the group. Finally, the psychologist enhances a positive Body Image by instructing the patients to engage in activities across different categories (health and fitness, appearance, social relationships), which foster pleasure and skills to promote a proactive relationship with one’s body	Emphasis on thought recognition and possible positive consequences on everyday life	How can you foster your safety behaviors?

Session 3:	Questions about the individual experience with the previous gymnastic sessions	Self-monitoring and listening of inner sensations are introduced	To what extent are you in contact with your thoughts and feelings?
Discovering your mental reflection Body awareness on the Injured Self and self-defeating behaviors	The “ Body and Mind Relaxation ”: participants were instructed by the psychologist to practice involving muscle relaxation, diaphragmatic breathing, mental imagery, and positive self-talk to promote the positive bodily sensations and feelings. Then, group members drew on paper their own physical shape and colored body areas differently. The group discussion aimed at fostering BI comfort and control in relation to distress-provoking stimuli		What happens to make you think or feel a certain way? What does emotional discomfort lead you to do?
Body awareness and the pressures from the world around us	The “ Stop, look, and listen ” technique: to identify inner sensations and cognitive distortions, a “Private Body Talk” (body-related thought processes) training was proposed. Patients were instructed to stay in contact with their inner sensations daily, incorporate cognitive restructuring exercises to modify cognitive distortions and discover the emotional and behavioral positive consequences of changes. Patients identified dysfunctional BI-related schema (e.g., cognitive errors), replaced a faulty self-talk with a new positive one, looked at their activating events and body sensations that lead to BI related emotional reactions, and become aware of the influences of these assumptions in everyday life		What do you believe about yourself? How vulnerable do you feel given existing societal pressures?
Session 4:	Questions about the individual experience with the previous gymnastic sessions	Review of all previous sessions, the individual progress and future goal setting	What have you learned about your BI?
Review and future goals for preserving a positive body image and facing with the Injured Self	Participants reviewed the individual and group results , received feedback about attained changes by the psychologist. They shared and reflected on their vulnerabilities and learned how to stop their negative attitudes. In addition, participants reviewed their Body Image Diary and the relapse-prevention strategies to cope with future situations that might induce negative BI experiences and set goals for further needed changes		How can you manage BI distress in the future?

Table 12. Description of the psychological intervention

Physical intervention

The online physical intervention, mainly based on the study of Grazioli and colleagues (2020), was composed of nine lessons one or two times a week divided into three groups. Each session lasts approximately 45 minutes and was led by a qualified instructor trained specifically in providing postural exercises. Participants took part in the training through an online platform and the instructor monitored the patients’ workload and status during each training session. They were structured into 10 minutes of warm-up focused on neck, shoulder, ankles, and trunk mobilization, 25 minutes of postural and resistance exercises involving all parts of the body both on the ground and standing, and 10 minutes of stretching and cool-down focused on shoulder and trunk flexibility and the breath management (Scarpa et al., 2011). The three modules of lessons were:

Module I (1-3 sessions): participants stayed on the ground all time. Over the strength part, several instruments (e.g., chair, pillow, and towel) were used to improve and stretch the

dorsal and abdominals. In this first module, participants were particularly focused on the perception of different body parts in terms of contact with the ground and body tension.

Module II (4-6 sessions): this second module consisted of standing exercises to improve orthostatic equilibrium and the coordination of upper and lower limbs. Notably, participants strengthened and stretched leg muscles and enhanced trunk flexibility.

Module III (7-9 sessions): the last three sessions were aimed at improving proprioceptive stimulations. Staying on the ground, participants stretched both the pelvis and adductors of the legs. Finally, some exercises were added to increase joint flexibility, ankles, and knees.

3.2.2 Results

In order to explore socio-demographic variables (i.e., age, type of job, marital status) of participants, a descriptive analysis (frequencies and/or mean and standard deviation scores) was performed. Fifty-one females fulfilled the inclusion criteria and agreed to participate. The full sample had an average age 51.55 years (range 33 – 68). The majority of the sample attended high school (34.4%), were office workers (17.9%), were married (52.9%) and had one or more children (62.7%). In addition, most participants usually do physical activities (64.7%) and are not involved in psychotherapy's sessions (76.5%).

A repeated measure analysis of Variance (ANOVA) was also computed to assess possible differences in well-being, depression, anxiety, and BI's perceptions between groups pre and post-intervention. Post hoc tests were corrected using the Bonferroni method for multiple comparisons. Data analyses were performed using the statistical software package SPSS (Version 26.0). ANOVA was conducted with two conditions (experimental and control groups) as the between-subjects' factors and the battery of questionnaires as the dependent variable. There were significant effects of experimental conditions on physical well-being. Significant results emerged for physical well-being, $F(1,55) = 5.233$, $p = .027$, $\eta_p^2 = .100$, meaning that the online intervention increased breast cancer survivors' well-being significantly in the experimental group ($M = 24$; $DS = 2.755$) compared with the control ($M = 23.347$; $DS = 4.839$). Otherwise, no significant results emerged for the other variables (anxiety, depression, and BI) (see Table 13).

	Experimental group		Control group	
	M	SD	M	SD
PWB	24	2.77	23.34	4.83
F(1,55) = 5.233, p = .02, $\eta_p^2 = .10$				
SWB	14.11	6.77	15.83	5.63
F(1,55) = .714, p = .40, $\eta_p^2 = .01$				
EWB	18.11	3.95	18.29	3.62
F(1,55) = .78, p = .38, $\eta_p^2 = .01$				
FWB	14.15	5.53	14.95	6.14
F(1,55) = .74, p = .39, $\eta_p^2 = .01$				
BCS	23.65	5.87	25	4.89
F(1,55) = 2.7, p = .10, $\eta_p^2 = .05$				
I-OBCS - Surveillance				
F(1,55) = 1.87, p = .17, $\eta_p^2 = .03$	23.02	5.17	23.59	5.46
I-OBCS – Body Shame	26.25	8.30	25.30	8.91
F(1,55) = .02, p = .33, $\eta_p^2 = .01$				
I-OBCS – Control Belief	36.16	36.08	6.52	6.13
F(1,55) = .30, p = .58, $\eta_p^2 = .00$				
STAI-Stato	43.65	4.31	42.96	3.08
F(1,55) = 1.89, p = .17, $\eta_p^2 = .03$				
BIS	22.23	7.85	20.68	7.68
F(1,55) = .93, p = .33, $\eta_p^2 = .01$				

Table 13. Results from ANOVA

3.2.3 Discussion

This pilot study preliminarily assessed a mixed intervention coupling psychological support and postural exercise sessions through online sessions to promote well-being and BI in breast cancer survivors. Findings suggested a positive effect of mixed-method programs on physical well-being in breast cancer survivors. However, no significant findings emerged about BI, anxiety, and depression. First of all, physical exercises based on progressive

muscular relaxation greatly impact pain reduction in women after breast cancer surgery, in line with the literature (Odynets et al., 2020). Similarly, these findings present improvements on a physical well-being level, supporting the helpful programs in which the body is involved as a central aspect of the intervention. At the same time, the group-belonging perception and affiliative bonds could increase well-being (Rice et al., 2016). The authors also demonstrated that online programs of intervention could enhance social connectedness. Literature showed that people can offer peer support to others in an online intervention too (Hsiung, 2007). Moreover, the social interaction between people who have had a similar experience (e.g., breast cancer) may reduce feelings of separateness and isolation (Gilart & Shahar, 2009). On the contrary, other variables, such as BI, anxiety, and depression, did not improve positively. Following studies that highlight the positive promotion of emotions and BI after exercise interventions (Mifsud et al., 2021; Salam et al., 2022), some hypotheses have been presented as follows. Firstly, the ongoing COVID-19 health emergency could have played a negative role in promoting of positive emotions. Particularly, lockdown measures have disengaged cancer patients from formal health care settings, leading to significant negative sentiments, with fear being the predominant emotion (Moraliyage et al., 2021). Online interventions do not even strengthen positive emotions. Mullarkey and colleagues (2022) evidenced that no-therapist and single-session interventions can promote perceived control over emotions, such as anxiety. Regarding BI issues, the COVID-19 emergency and the related lockdown led to a significant increase in weight concerns, disordered eating, and negative emotions compared to pre-COVID (Zhou et al., 2021). As study limitations, the relatively small and self-selected sample size may have strongly impacted on the result. Future studies should take into account motivation to participate in psychological interventions as it could influence adherence and outcomes (Durosini et al., 2021). Additionally, further studies are needed to investigate the effectiveness of this type of mixed intervention in a heterogeneous population, not only in a breast cancer survivor sample. This could be interesting to explore possible differences in emotions, physical well-being, and BI among populations.

Starting from the results obtained, it is paramount that mixed-method interventions can promote well-being in breast cancer survivors. However, how to address BI issues is still unclear.

3.3 Conclusions

In conclusion, the review and meta-analysis study and the mixed-method intervention proposed demonstrated the effectiveness of programs able to promote breast cancer patients and survivors' well-being. Specifically, meta-analysis evidenced the possibility of addressing BI in breast cancer patients and survivors through several interventions. However, BI is still missing in covering all breast cancer-related issues. Therefore, the second study proposed a specific intervention to promote a positive Injured Self, as a new self-representation after cancer. Despite the encouraging results in reference to well-being, emotions and BI did not show significance. A possible explanation could be related to the ongoing health emergency, for example; people and, in particular, oncological women experienced distress and anxiety daily. In order to further address BI issues and the Injured Self, other constructs are needed. Therefore, since a strong association between BI and Body Compassion (BC) in the literature, the following studies will explore the impact of BC on a breast cancer survivor population.

4. Exploring a new construct: body compassion in breast cancer survivors

Starting from the non-significant results obtained in reference to emotions and BI in the previous study, another relevant construct was involved to deeply explore the illness-related experiences of breast cancer survivors. This Ph.D. project deeply explored BC as another significant construct because strongly associated with BI and the Injured Self. Both quantitative and qualitative methods were applied. Firstly, a quantitative and pilot study explored BC in breast cancer survivors providing findings about the relevance of kindness and positive thoughts towards their body. Starting from these findings, a tailored psychological intervention based on the promotion of BC for breast cancer survivors was conducted. A qualitative study highlighted positive changes in body perception and related emotions and thoughts after psychological intervention in a group.

4.1 Study 4: Relating to a new body: understanding the influence of body compassion and metacognition on body image in breast cancer survivors

In general, the literature showed the positive impact of self-compassion on BI. As a definition, compassion is a sensitivity to suffering in self and others with a commitment to try to alleviate and prevent it (Gilbert & Choden, 2013). Closely related to mindfulness (Cebolla et al., 2017), it is characterized by six attributes as follows: “Sensitivity” (i.e., the ability in perceiving others’ emotions), “Sympathy” (i.e., showing concerns for the other person's suffering), ”Empathy” (that is the capacity to feel other people's emotions), “Motivation” (in terms of act or response toward the suffering that others express), and ”Distress tolerance” (when managing difficult situation without overwhelmed feeling and with a non-judgment attitude (Gilbert, 2009). When the attitudes of kindness and attention are towards the body, it could be defined as BC. BC is conceptualized as a new multidimensional construct that specifically describes the facets of the relationships between individuals and their bodies (Altman et al., 2017). It refers to one’s dispositional attitude towards the physical self and involves cognitions, emotions, and behaviors (Altman et al., 2020). Particularly, BC is strictly linked to the relationship with the body and the related BI (Altman, 2017). Matos and colleagues (2002) stated that negative emotions related to BI and body dissatisfaction are inversely associated. More specifically, BC incorporates Cash’s (2000) concept of BI involving attitudinal and evaluative dispositions toward physical self on a cognitive and behavioral level.

Metacognition is defined as the cognitive processes involved in thinking about what individuals think (Muntsant et al., 2021). It is characterized by high levels of voluntary

control and awareness, which lead to understand the results of activities. In addition, metacognition is helpful to plan and make decisions, which is relevant also in the promotion of BI and positive emotions (Babaei et al., 2015; Golmohammadian et al., 2018).

In general, BC and metacognition have a strong influence on bodily issue. In particular, literature shows a protective role of BC on BI issues in eating disorders. A study by Oliveira and colleagues (2018) showed that BC was negatively correlated with shame experiences and disorders eating. At the same time, Golmohammadian and colleagues (2018) demonstrated a significance relationship between BI concern and metacognition beliefs. This contribution supports the idea of promoting BC and metacognition in prevention and treatment programs for BI issues. Nonetheless, there is a lack of understanding regarding breast cancer survivors, who have to deal with a new and renovated BI. Therefore, the following study aimed to assess the association between BC, metacognition, emotional issues (anxiety and depression), and BI in breast cancer survivors. Specifically, four hypotheses have been formulated, as follows: (Hp1) BC, metacognition, and emotional issues may be strongly linked to BI as an outcome. Additionally, we hypothesized that (Hp2) BC, anxiety and depression, and metacognition may affect BI significantly. In particular:

(Hp2.1) A higher level of BC may predict a more positive BI;

(Hp2.2) A higher level of metacognition may predict higher BI distress.

4.1.1 Material and Method

Participants

The study sample consisted of 18 years old and older women with a diagnosis of breast cancer in the past and had finished the primary treatment in the previous five years. Exclusion criteria were as follows: individuals with a history of serious mental illness or cognitive impairments, women who did not complete the total questionnaire, and inability to read and speak Italian. Eighty-seven breast cancer survivors accepted to participate voluntarily (no reward was given). The current study was approved following the ethical standards of the institutional and national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Participants came from Italy, mainly from the Northern regions (72.5%). Their age ranged from 33 to 69 (Mean = 52.48; SD =6.99). Most of the sample had received an academic education (specifically: 48.2% primary/middle school; 8% high school; 39.1% bachelor/master's degree; 4.6% post Ph.D.). Moreover, they were married (52.5%),

employed (82.8% were white-collar, in particular), and not involved in psychological support sessions with a psychologist (77%) (see Table 14).

	n	%
Educational level		
Primary/middle school	42	48.2
High school	7	8
Bachelor	34	39.1
Master's Degree/Ph.D.	4	4.6
Employment		
Unemployed	14	14.9
Blue-collar	2	2.3
White-collar	71	82.8
Place of residence		
North of Italy	63	72.5
South of Italy	12	13.7
Island of Italy	12	13.8

Table 14. Sociodemographic characteristics of participants

Procedures

An anonymous online survey, which should have taken twenty minutes, was sent to participants. The online survey ran from 1st November to 31st December 2021. Participants were recruited online through email and online platforms (e.g., Facebook). A link that reported a brief study presentation and the request to participate anonymously was sent. Specifically, when participants clicked on the link, the first page opened and included a cover letter to explain the goals and procedure of the research and an informed consent statement. Then, participants were asked to provide sociodemographic data (such as age, education, current residential location, and job) and a battery of self-report and standardized questionnaires. Specifically, behavioral (e.g., avoiding people due to their appearance and finding it hard to look at oneself naked), affective (e.g., feeling attractive and feminine), and cognitive (e.g., being satisfied with scar or appearance) items have been assessed.

Questionnaires

The following standardized self-report questionnaires were provided:

Body Image Scale (BIS) (Hopwood et al., 2001): for the questionnaire description, see page 54. In this study, Cronbach's alpha is excellent ($\alpha = .874$).

The Metacognitions Questionnaire (MCQ-30) (Wells & Cartwright-Hatton, 2004; Quattropani et al., 2014): it is a reliable, brief, and valid self-report questionnaire (Spada et al., 2008), which evaluates a range of metacognitive beliefs and processes related to vulnerability and maintenance of emotional disorders (Cartwright-Hatton & Wells, 1996; Wells & Cartwright-Hatton, 2004). MCQ-30 is based on 30 items on a 4-point Likert scale, ranging from 1 (do not agree) to 4 (completely agree). As in the original version (Cartwright-Hatton and Wells, 1996), the items are divided into five subscales: cognitive confidence, which measures confidence in attention and memory (Cognitive Confidence, CC); cognitive self-consciousness, which measures the tendency to monitor one's own thoughts and focus attention inward (Cognitive Self-Consciousness, CSC); positive beliefs about worry, which measures the extent to which a person thinks that perseverative thinking is useful (POSitive Beliefs about worry, POS); negative beliefs about worry concerning uncontrollability and danger, which assess the extent to which a person thinks that perseverative thinking is uncontrollable and dangerous (NEGative beliefs about uncontrollability and danger, NEG); beliefs about the need to control thoughts, which assesses the extent to which a person believes that certain types of thoughts need to be suppressed (Need to Control thoughts, NC). A high score on each factor is considered dysfunctional. In this study, a validated Italian version of the MCQ-30 assesses metacognitive beliefs (Quattropani et al., 2014). As in the original version, the Italian version of MCQ-30 indicated direct correlations between metacognitive factors (except for CSC) and state and trait anxiety, obsessive-compulsive symptoms, and pathological worry. In addition, reliability of all five factors in the present clinical group was excellent, with Cronbach's α ranging between .677 and .880 for the different scales.

Hospital and Anxiety Depression Scale (HADS) (Zigmond & Snaith, 1983): is a self-report measure based on 14 items on a 4-points Likert scale. It evaluates emotional distress and, specifically, anxiety (7 items) and depression (7 items) in patients without psychiatric symptoms. The sum of the anxiety and depression subscale is the total score (0-42)

(Zigmond & Snaith, 1983). The higher the final score is, the higher anxiety and depression are. Specifically, clinically significant scores higher than 10 points (LoMartire et al., 2020). HADS is widely applied in a different population, both healthy and patients with chronic diseases (Lynch et al., 2011; Woolrich et al., 2006) and shows good reliability (Bjelland et al., 2002; Norton et al., 2013). In this study, Cronbach's alpha is sufficient ($\alpha = .74$).

Body Compassion Scale (BCS) (Altman et al., 2020): it is a self-report measure that evaluates an attitude of compassion specifically towards one's body. Participants rate how often they believe or behave in the stated manner on each of the 23 items using a 5-point scale, ranging from 1 ("Almost never") to 5 ("Almost always"). The items are related to three subscales: Defusion (e.g., "When I notice aspects of my body that I do not like, I get down on myself"- reverse item); Common humanity (e.g., "When I feel out of shape, I try to remind myself that most people feel this way at some point"); and Acceptance (e.g., "I am accepting of my looks just the way they are"). The BCS demonstrated good internal consistency. In this study, Cronbach's alpha is excellent, with Cronbach's ranging between .888 and .913 for the different scales.

Data Analysis

A descriptive analysis (frequencies and/or mean and standard deviation scores) explored the socio-demographics of breast cancer survivors. Then, a correlation analysis was executed to identify which variables were linked to BI to verify our Hp1. Finally, multiple regression analyses examined the predictive value of BC scale (BCS), anxiety and depression (HADS), and metacognition (MCQ-30) on the BI scale (BIS), which acts as the outcome variable. The multiple regression analysis also showed the impact of BCS and MCQ-30 subscales on BI respectively. Data analyses were performed using the statistical software package SPSS (Version 27.0).

Moreover, a power analysis was conducted to ensure statistically and meaningful significant results (Cohen, 1988). Analyses were run with the software G*Power (Faul et al., 2007), with power (1 - b) set at 0.95, a medium effect size (one-tailed test), and a 5% level of significance. Data reported a total sample size of 74 participants needed to detect a large effect size. The sample estimates were very close to our hypothetical suggestions, ensuring that there were adequate levels of power for the detection of effect. A p-value of <0.05 was considered statistically significant.

4.1.2 Results

Correlations examined the relationships between the control variables (BCS, MCQ-30, and HADS) and the outcome (BIS). The three constructs (BC, anxiety and depression, and metacognition) were found to be significantly associated with BI distress (see Table 15). Consistently scientific literature on BI (Nejati et al., 2017), the following significant associations were evidenced: the MCQ-30 questionnaire ($r = .460, p < .01$) and its subscales POS ($r = .280, p < .01$), NEG ($r = .448, p < .01$), and CC ($r = .247, p < .05$) were positively associated with BI distress, while BCS ($r = -.452, p < .01$) and its subscales Defusion ($r = -.509, p < .01$) and Acceptance ($r = -.522, p < .01$) were negatively associated with BI distress. Regarding HADS, anxiety ($r = .477, p < .01$) and depression scores ($r = .428, p < .01$) showed positive associations with BI distress.

		Correlations												
		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Pearson Correlation	1	,636**	,477**	-,472**	-,241*	-,467**	-,537**	,414**	,633**	,147	,383**	,323**	,611**
	Sig. (bilateral)		,000	,000	,000	,026	,000	,000	,000	,000	,175	,000	,002	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
2	Pearson Correlation	,636**	1	,428**	-,480**	-,186	-,442**	-,500**	,155	,480**	,126	,310**	,150	,406**
	Sig. (bilateral)	,000		,000	,000	,086	,000	,000	,153	,000	,244	,003	,166	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
3	Pearson Correlation	,477**	,428**	1	-,509**	-,020	-,522**	-,452**	,280**	,448**	,247*	,198	,195	,460**
	Sig. (bilateral)	,000	,000		,000	,857	,000	,000	,009	,000	,021	,066	,071	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
4	Pearson Correlation	-,472**	-,480**	-,509**	1	,125	,489**	,761**	-,331**	-,437**	-,087	-,302**	-,105	-,413**
	Sig. (bilateral)	,000	,000	,000		,251	,000	,000	,002	,000	,424	,004	,333	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
5	Pearson Correlation	-,241*	-,186	-,020	,125	1	,231*	,679**	,036	-,125	-,018	,116	,051	-,003
	Sig. (bilateral)	,026	,086	,857	,251		,033	,000	,745	,250	,869	,286	,640	,981
	N	86	86	86	86	86	86	86	86	86	86	86	86	86
6	Pearson Correlation	-,467**	-,442**	-,522**	,489**	,231*	1	,709**	-,160	-,354**	-,204	-,161	-,096	-,337**
	Sig. (bilateral)	,000	,000	,000	,000	,033		,000	,138	,001	,058	,136	,377	,001
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
7	Person Correlation	-,537**	-,500**	-,452**	,761**	,679**	,709**	1	-,211	-,415**	-,122	-,151	-,062	-,332**
	Sig. (bilateral)	,000	,000	,000	,000	,000	,000		,051	,000	,264	,165	,569	,002
	N	86	86	86	86	86	86	86	86	86	86	86	86	86
8	Pearson Correlation	,414**	,155	,280**	-,331**	,036	-,160	-,211	1	,356**	,103	,218*	,318**	,614**

	Sig. (bilateral)	,000	,153	,009	,002	,745	,138	,051		,001	,342	,042	,003	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
9	Pearson Correlation	,633**	,480**	,448**	-,437**	-,125	-,354**	-,415**	,356**	1	,129	,614**	,288**	,786**
	Sig. (bilateral)	,000	,000	,000	,000	,250	,001	,000	,001		,235	,000	,007	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
10	Pearson Correlation	,147	,126	,247*	-,087	-,018	-,204	-,122	,103	,129	1	,221*	-,133	,521**
	Sig. (bilateral)	,175	,244	,021	,424	,869	,058	,264	,342	,235		,040	,219	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
11	Pearson Correlation	,383**	,310**	,198	-,302**	,116	-,161	-,151	,218*	,614**	,221*	1	,179	,712**
	Sig. (bilateral)	,000	,003	,066	,004	,286	,136	,165	,042	,000	,040		,097	,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
12	Pearson Correlation	,323**	,150	,195	-,105	,051	-,096	-,062	,318**	,288**	-,133	,179	1	,433**
	Sig. (bilateral)	,002	,166	,071	,333	,640	,377	,569	,003	,007	,219	,097		,000
	N	87	87	87	87	86	87	86	87	87	87	87	87	87
13	Pearson Correlation	,611**	,406**	,460**	-,413**	-,003	-,337**	-,332**	,614**	,786**	,521**	,712**	,433**	1
	Sig. (bilateral)	,000	,000	,000	,000	,981	,001	,002	,000	,000	,000	,000	,000	
	N	87	87	87	87	86	87	86	87	87	87	87	87	87

Table 15. Correlations among variables involved in the study

Note. 1. HADS_anxiety; 2. HADS_depression; 3. BI_TOT; 4. BCS_Defusion; 5. BCS_Common Humanity; 6. BCS_Acceptance; 7. BCS_TOT; 8. MCQ-30_POS; 9. MCQ-30_NEG; 10. MCQ-30_CC; 11. MCQ-30_NC; 12. MCQ-30_CSC; 13. MCQ-30_TOT

** $p < .001$

Multiple regression analysis was run using BCS, HADS, and MCQ-30 (predictor variables) and BI (outcome variable) (Table 16). The regression model was significant, $F(4, 81) = 10.197, p < .001$, and explained 33% of the variance of the body image score. In particular, BCS ($\beta = -.224, B = -.103, t = -2.211, p < .05$) showed a statistical negative effect, whereas metacognition ($\beta = .262, B = .169, t = 2.295, p < .05$) showed a statistical positive effect. Furthermore, there was no evidence of multicollinearity (BCS: Tolerance = .672, VIF = 1.488; MCQ-30: Tolerance: .632; VIF: 1.583). However, anxiety and depression did not show significant results.

Moreover, multiple regression analysis was run with BC subscales (predictors) and BI distress (outcome) (Table 17). All the BC subscales significantly contributed to explain the variance of BI distress in breast cancer survivors ($F(3, 82) = 16.13, p < .001$, explaining 37% of the variance), except for the Common Humanity subscale. Specifically, the Defusion ($\beta = -.329, B = -.260, t = -3.275, p < .05$) and Acceptance ($\beta = -.391, B = -.515, t = -3.812, p < .001$) subscales showed a statistical negative prediction on the BI distress scores. There was no evidence of multicollinearity for each of the predictors (Defusion: Tolerance = .758, VIF = 1.319; Common Humanity: Tolerance = .947, VIF = 1.058; Acceptance: Tolerance = .729, VIF = 1.372).

Finally, multiple regression analysis was run with MCQ-30 subscales as predictors and BI distress as outcome (Table 18). As result, only NEG and CC subscales contributed to explain the variance of the BI distress ($F(5, 86) = 6.17, p < .001$, explaining 27% of the variance). In particular, NEG ($\beta = .456, B = .763, t = -3.275, p < .001$) and CC subscales ($\beta = .228, B = .358, t = -3.812, p < .05$) showed a statistical negative prediction on the BI distress scores. Finally, there was no evidence of multicollinearity for both predictors (NEG: Tolerance = .557, VIF = 1.769; CC: Tolerance: .908; VIF = 1.102).

Dependent Variable BI	Predictor	B	β	<i>t</i>	<i>R</i> ²	<i>F</i>	Tolerance	VIF
					.33	10.197		
	BCS	-,103	-,244	-2,211*			.672	1.488
	Anxiety	,241	,094	,658			.406	2.466
	Depression	,307	,140	1,147			.548	1.826
	MCQ-30	,169	,262	2,295*			.632	1.583

Table 16. Multiple regression analysis between BCS, HADS, and MCQ-30 and BI

Note. 1 = Body Compassion Scale (BCS); 2 = Metacognition Questionnaire (MCQ-30); 3 = Anxiety and Depression Scale (HADS).

*** $p < .001$; ** $p < .01$; * $p < .05$

Dependent Variable BI	Predictor	B	β	<i>t</i>	<i>R</i> ²	<i>F</i>	Tolerance	VIF
					.37	16.13***		
	BCS_CH ¹	.088	.112	1.240			.947	1.056
	BCS_Def ²	.260	-.329	-3.275*			.758	1.319
	BCS_Acc ³	-.515	-.391	-3.812***			.729	1.372

Table 17. Multiple regression analysis between BCS subscales and BI

Note. 1 = Common Humanity (BCS_CH); 2 = Defusion (BCS_Def); 3 = Acceptance (BCS_Acc)

*** $p < .001$; ** $p < .01$; * $p < .05$

Dependent Variable BI	Predictor	B	β	<i>t</i>	<i>R</i> ²	<i>F</i>	Tolerance	VIF
					.27	6.17***		
	POS	.216	.100	1.240			.812	1.231
	NEG	.763	.465	-3.275*			.557	1.796
	CC	.358	.228	-3.812***			.908	1.101
	NC	-.412	-.176				.601	1.663
	CSC	.253	.091				.828	1.208

Table 18. Multiple regression analysis between MCQ-30 subscales and BI

Note. 1 = Positive beliefs about worry (POS); 2 = Negative beliefs about uncontrollability and danger (NEG); 3 = Cognitive confidence (CC); 4 = Need to control thoughts (NC); 5 = Cognitive self-consciousness (CSC)

*** $p < .001$; ** $p < .01$; * $p < .05$

4.1.3 Discussion

This study aimed to explore the impact of BC on BI in breast cancer survivors. Literature showed that several interventions can promote BI in different fields of interest over years. For example, studies demonstrated the relevance of BC on BI in women with eating disorders (de Carvalho Barreto et al., 2020). The present study aimed to provide

evidence on the association between some variables (BC, anxiety and depression, and the metacognition process) with BI in breast cancer survivors particularly.

In line with Hp.1, correlation analyses evidenced associations between BC, metacognition, emotional issues (anxiety and distress), and BI. In general, metacognition is positively related to BI distress. Golmohammadian and colleagues (2018) evidenced that the POS, NEG, and CC subscales of MCQ-30 showed significant correlations with BI distress. Following the Self-Regulatory Executive function (Wells et al., 1996), people with body dysmorphic disorder are more engaged in metacognitive processing due to challenging concerns with their aesthetic appearance (Donyavi et al., 2015). For example, in a study by Cooper and colleagues (2007), patients showed attempts to control, appraise, correct, and regulate their thinking regarding their BI and illness-related concerns. Furthermore, breast cancer survivors reported associations between BC and BI in this exploratory study. In line with this, Breines and colleagues (2014) evidenced that self-compassion may be similarly compared to self-esteem in the context of BI. Neff (2003) evidenced that BC supports the perception of imperfections as a part of the human being, avoiding negative judgments about one's appearance. Altman and colleagues (2020) also stated that BC is positively linked to BI flexibility. In addition, Przewdziecki and colleagues (2012) emphasized that self-compassion impacts a lower BI disturbance in breast cancer patients. In particular, body-related Defusion and Acceptance abilities have relevant implications for improving a positive BI clinically (Oliveira et al., 2018). Additionally, about emotional issues, continuous dissatisfaction from BI is likely to lead to higher levels of emotional issues, such as anxiety and distress (Zhang et al., 2021). Davis and colleagues (2020) stated that a good perception of bodies and their outward appearances is associated with positive emotional states in breast cancer survivors. For example, BI concerns due to mastectomies are strongly associated with poorer mental health (Figueiredo et al., 2004).

In line with Hp2.1, the regression model results in a well-fitting model by including the variables mentioned above and explaining the 33% variation of BI scores (Ferguson, 2009). Results evidence that BC predicts a higher effect on a positive BI (Halliwell, 2015). One probable explanation is that BC may be a protective factor able to promote positive embodiment and protection against self-criticism and body shame (Burychka et al., 2021; de Carvalho Barreto et al., 2020). In particular, Defusion and Acceptance subscales play a relevant role in predicting BI. As a definition, Defusion is the ability to experience one's body as an observer, rather than as the body itself. High Defusion is linked to decreased

attachment to BI evaluations, which can be helpful to decrease distress and emotional discomfort (Mandavia et al., 2015). At the same time, self-acceptance can be essential to predict BI (Tiggemann, 2019). Several studies evidenced that psychological interventions focused on self-acceptance (e.g., acceptance-based exposure therapy) can reduce dysfunctional BI issues successfully. This result is in line with some studies that showed the efficacy of self-acceptance in increasing BI flexibility and satisfaction (Givchki et al., 2018; Selby et al., 2011).

Although metacognition did not reach the recommended minimum effect size, it resulted in statistically significant in the regression model (Ferguson, 2009). Specifically, higher levels of metacognition predict a negative BI (Hp2.2). Self-reflection and metacognitive processes may recall memories, which leads to negative self-judgment, in line with the literature (Cooper et al., 2007). As a consequence, self-images related to the perception of being worthless and inferior compared to others may improve to emotional distress. Regarding metacognition' subscales, results evidenced the association between NEG and CC with BI distress. Starting from the literature, promoting universal beauty features can enhance negative beliefs about one's BI, as suggested by Alsaïdan and colleagues (2020). Propagating videos, photos, and comments about an ideal body can easily trigger and increase the belief that the body is deviated from average; in particular, it could happen if it is a body after oncological treatments. In this study, having persistent and negative thinking about uncontrollability could be helpful to promote the need of control, for example regarding negative beliefs on BI. Cartwright-Hatton and Wells (1997) stated that the compelling negative beliefs may lead individuals to attempt to avoid an activity, such as worries about BI. Finally, as literature showed that a high level of CC could predict eating disorders, a good confidence with cognitive process can influence distress in terms of worry and rumination about BI (Laghi et al., 2018).

In conclusion, the present study evidenced the need to develop interventions to promote BC to predict a positive BI. At the same time, the strong associations observed between metacognitive processing and BI empathize the relevance of managing breast cancer survivors' thoughts and perception of their own bodies. Similarly, emotional issues (such as anxiety and depression) have to be considered. Starting from these results, further research is required to shed sufficient light on this topic. Limitations of the present study could be related to the lack of generalization of these results to other cancer populations. Oncological intervention and treatments on specific body parts (e.g., breast(s)) are indeed strictly connected to femininity and body satisfaction. Future studies might consider

whether there are differences on BI about to each specific type of cancer and, in addition, the women's characteristics in terms of BC and metacognition, for example. Finally, longitudinal studies may be needed to support these findings further.

4.2 Study 5: The Body as an ally: A Qualitative Study on Breast Cancer Survivors' Body Representations

Starting from the relevance of BC and motivation to participate in psychological intervention, as demonstrated in the previous studies, new research was conducted involving BC. Nowadays, studies evidenced that psychological interventions on self-compassion can be helpful for breast cancer survivors (Kirby, 2017; Neff & Germer, 2013; Reddy et al., 2013), supporting the growing interest in self-compassion interventions for breast cancer survivors over the years (González-Hernández et al., 2021). However, the specific changes in bodily representations in breast cancer survivors are still unclear. On this basis, a new psychological intervention focused on BC for breast cancer survivors was conducted to explore their changes in body perception. According to the self-compassion theory, the contents of the psychological programs were based on the promotion of resources by treating oneself and others with kindness and support. The overall aim was the promotion of emotion regulation and abilities to sustain and enrich individuals' valued life goals (Gilbert, 2009). Moreover, a specific relevance was on the body and its issues after cancer, learning self-compassion strategies to tolerate distress (Kirby, 2017). A qualitative lexicometry analysis and a thematic analysis were carried out to assess changes in body perception on both a cognitive and emotional level.

4.2.1 Material and Methods

Participants

Twenty women voluntarily agree to participate in this study. They were involved in a psychological intervention focused on BI after cancer, applying a self-compassion approach. A total of eighteen women responded to open questions (age range: 38-69; $M_{age} = 50.6$; $SD_{age} = 8.97$) both at the beginning and at the end of the psychological intervention. The majority of participants had obtained a bachelor's degree (50%), lived in the North of Italy (83.2%), and worked as white-collar employers (83.2%). Additionally, more than half of them are not currently involved in individual psychological therapy (55.6%), had one or more sons (55.6%) and a partner (72.3%) (see Table 19).

	n	%
Educational level		
Primary/middle school	2	11.1
High school	5	27.8
Bachelor	9	50
Master's Degree/Ph.D.	2	11.1
Employment		
Unemployed	2	11.2
Blue-collar	1	5.6
White-collar	15	83.2
Place of residence		
North of Italy	16	88.8
South of Italy	0	0
Center of Italy	1	5.6
Island of Italy	1	5.6

Table 19. Sociodemographic characteristics of participants

Psychological intervention

Women participated in a one-month psychological intervention for a total of four sessions. An expert psycho-oncologist with extensive professional experience in BI issues conducted the psychological session. Each session lasted two-hours weekly and all breast cancer survivors participated in each session of the program. Contents of the program were based on previous studies focused on BI issues (Lewer et al., 2017; Lewis-Smith et al., 2019; Morgan et al., 2014) and, in particular, on the steps presented in the BI workbook by Cash (1997; 2008). The main goal was to promote positive bodily representations by increasing cognition, emotions, and behaviors. Moreover, the previous psychological program related to the Injured Self was a point of reference for the contents. In addition, starting from psychological theories and validated group interventions on self-compassion among different populations (Allen et al., 2021), a BC approach was integrated. Specifically, it was focused on: (1) the relationship with the body before and after diagnosis and oncological treatments, (2) barriers and facilitators in the body relationship, (3) participants' BI and the related emotions, and (4) how to manage bodily issues in the future (see more details in Table 20). Furthermore, all breast cancer survivors shared their illness experiences in the online group in order to explore personal bodily representations and related emotions and thoughts. In addition, the program included discussion, in-group activities, and take-home tasks.

	Themes	Contents	Examples of questions
Session 1: Setting the scene	Introduction to the group and rules	Exploration of individual expectations	How did you feel about taking part in this project?
Motivation, setting goals for change	<p>A brief group “ice-breaker” in which women introduce themselves and their reasons for attending the program</p> <p>Theoretical background on Body Image and Self-Compassion by the psychologist</p> <p>The Body Compassion assessment: participants filled a table focused to have a clear understanding of the maladaptive thoughts, emotions, and behaviors associated with BI and BC before and after diagnosis and oncological treatments. Results were shared with each other into the group</p> <p>Participants defined specific goals</p>	<p>A Body Compassion assessment</p> <p>Group motivational therapy</p>	<p>What are your BC evaluations?</p> <p>What might be the benefits of attending to this project?</p>
Session 2: BC and daily behaviors	<p>Sharing of BC behaviors: each participant wrote about barriers and facilitators in order to implement BC behaviors every day. Then the group discussed about the main related emotions and how practice self-compassion in a traumatic situation, such a breast cancer</p> <p>The psychologist helps participants to relieve coping behaviors to improve BC towards the body in the longer-term. Finally, the psychologist instructed the patients to stay engaged in healthy activities (e.g., fitness and medications).</p>	<p>Exploring the impact of traumatic events on BI on BC</p> <p>Understanding coping strategies and available safety behaviors</p> <p>Emphasis on thought’s recognition and possible positive consequences on everyday life</p>	<p>What are the main events linked to your BC experiences that you have had over the years?</p> <p>How can you foster your safety behaviors?</p>
Session 3: Promoting emotional awareness related to BC	Group members draw on paper their shape and label each of their body’ parts with an emotion. Then, the group discussion aimed at fostering their control on Body Image in relation to distress-provoking stimuli. In addition, the psychologist proposed various ways in which self-compassion may assist participants in overcoming negative emotions. Participants were encouraged to treat themselves with self-compassion when they dealt with their bodily issues	Self-monitoring of BC towards the body was introduced	<p>To what extent are you in contact with your thoughts and feelings?</p> <p>What happens to make you think or feel a certain way?</p>
Session 4: Reviewing future goals to preserve a positive BI and support self-compassion attitudes	Participants reviewed the individual and group results and received feedback about attained changes by the conductor. They reflected on what vulnerabilities were activated and unfolded in day-to-day thoughts, emotions, and behaviors and how they learned to stop this self-perpetuating. Finally, they set goals for further needed changes.	Review of the individual progresses and future goal setting	<p>What have you learned about your BC?</p> <p>How can you manage BI distress in the future?</p>

Table 20. Contents of the psychological intervention on BI

Procedure

Breast cancer survivors were invited participate in the program via a mailing list. At the same time, the project was posted on social networks. This way, recruitment was based on a self-selection method. After the acceptance to participate, women received an email with the information sheet and informed consent form. Inclusion criteria were: (1) 18 and

older years old (2) having received a diagnosis of breast cancer in the past years, (3) absence of ongoing oncological treatments, and (4) understanding and speaking of the Italian language. Moreover, physical or psychological impairments that prohibited participation, such as inability to understand the study or to sign the informed consent, were considered exclusion criteria. Participants were invited to respond to three open questions. Each participant completed all the answers individually two times (before and after the psychological intervention). Specifically, they were asked to describe: 1) their representation of their body, 2) the experience related to their body after cancer, and 3) their thoughts about it. The qualitative study was based on prompts designed to elicit the free expression of patients' thoughts and emotions about their bodies without word limits or time restrictions. Basic biographical data (e.g., age and type of tumor) were also collected.

Data Analysis

All the textual answers were collected through the Qualtrics platform. The analytical process followed two main phases. First of all, the analysis was aimed to identify the more frequent words that the breast cancer survivors used to speak about their own body before and after the intervention. A lexicometry analysis with the software T-LAB Plus 2021 was performed (Lancia, 2012). This software represents a set of linguistic and statistical tools that allows the automatic analysis of patterns of words and themes related to the explored topic. The mixed-method ability of T_LAB Plus 2021 allows the user to perform a set of statistical and linguistic analyses of textual data (Mazzoni et al., 2018). More specifically, the corpus under analysis was made by all the words spontaneously used by participants to describe their body representation and related emotions and thoughts. Moreover, the tool Word Association analysis allows identifying the words that were more frequently used in association with (i.e., in the same sentence with) the word "body". In the present study, this analysis allows detecting of the words used most recurrently in association (i.e., in the same paragraph) with the key-term "body", before and after the psychological intervention. The words spontaneously used by the participants and that frequently co-occurred with the key word "body" were analyzed. This analysis leads to a deeper understanding of participants' aspects and changes over time. In addition, a Word Association Analysis considered the word "body" in the analysis to pick out differences and similarities, which contribute to defining the meaning of this term.

In the second phase of analysis, a qualitative thematic analysis with a bottom-up approach was performed (Braun & Clarke, 2006), allowing the analysis of the women' experience and feelings related to their body perception. Adopting an inductive approach,

subthemes were identified through a "bottom-up" process, starting from the participants' texts (Clarke & Braun, 2014). As in the previous qualitative study, the analytical process followed the main phases of qualitative thematic analysis (Braun & Clarke, 2006).

4.2.2 Results

The length of the answers was heterogeneous, ranging from a few-word statement to a paragraph of 124 words. Results evidenced changes in women's descriptions of their body after the four group sessions, suggesting increasing attention, appreciation, and care towards their body.

Before the intervention, women associated with "body" terms related to the self-assessment of their *symptoms* (such as, "seek", "observe"), and with aspects related to their *negative feelings* about it (such as, "uneasy"). For example: "I do not like my body and I do not want to observe myself in the mirror" or "I have a feeling of rejection, and whatever it is that makes me uncomfortable and uneasy with myself". After the intervention, participants tended to associate the keyword "body" with terms of "care" and "cure", such as: "I am trying to take care of my body now". The association between the term "body" with words related to "positive", "pleasure" and "relationships" suggested the tendency of women to stay in contact with their new body perception, "looking" after a long time with the signs of oncological treatments. Furthermore, only after they participation in the psychological group, breast cancer survivors linked the word "relax" with the word "body", as reported: "I feel my body relaxed and stable, well rooted on the ground and in its support surface. I feel my body as an empty and inert container" (Table 21, Figure 7 and 8).

Lemmas (before the intervention)	Coeff.	EC(B)	EC(AB)	X²	p
seek	0.67	5	5	2.73	0.10
see	0.67	5	5	2.73	0.10
feel	0.61	6	5	0.51	0.48
unease	0.60	4	4	1.98	0.16
energy	0.60	4	4	1.98	0.16
pleasure	0.60	4	4	1.98	0.16
to be able to	0.60	4	4	1.98	0.16
accept	0.52	3	3	1.36	0.24
look	0.45	4	3	0.01	0.93
physique	0.43	2	2	0.84	0.36

Note. The first ten lemmas with the higher coefficients were reported in the table.

Coeff. = value of the coefficient; EC(B) = total amount of elementary context that contains every associated lemma (B); EC(AB) = total amount of elementary context where lemmas "A" and "B" are associated (co-occurrences)

Lemmas (after the intervention)	Coeff.	EC(B)	EC(AB)	X ²	p
feel	0.75	5	5	5.00	0.03
care	0.67	4	4	3.64	0.06
positive	0.67	4	4	3.64	0.06
cure	0.60	5	4	1.25	0.26
relationship	0.60	5	4	1.25	0.26
look	0.58	3	3	2.50	0.11
time	0.58	3	3	2.50	0.11
pleasure	0.50	4	3	0.51	0.48
ache	0.33	4	2	0.23	0.63
relax	0.19	3	1	1.11	0.29

Note. The first ten lemmas with the higher coefficients were reported in the table.

Coeff. = value of the coefficient; EC(B) = total amount of elementary context that contains every associated lemma (B); EC(AB) = total amount of elementary context where lemmas “A” and “B” are associated (co-occurrences)

Note. The first ten lemmas with the higher coefficients were reported in the table.

Coeff. = value of the coefficient; EC(B) = total amount of elementary context that contains every associated lemma (B); EC(AB) = total amount of elementary context where lemmas “A” and “B” are associated (co-occurrences)

Table 21. Word association analysis before and after the psychological intervention



Figure 7. Graphical representation of the Word Association Analysis (before the psychological intervention)

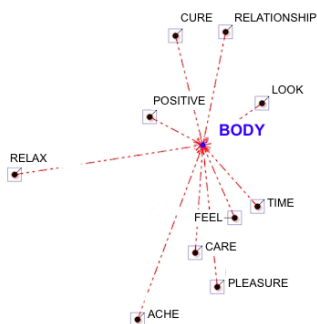


Figure 8. Graphical representation of the Word Association Analysis (after the psychological intervention)

Then, a thematic analysis was conducted on the three main themes related to women's body perception before and after the psychological intervention were presented (Table 22).

The first area explored is related to the women's **relationship with their bodies**. Before the psychological intervention, women described their relationship with their bodies differently, such as "I have a difficult relationship with my body due to the non-acceptance of their physical appearance" (ID4). Specifically, three women reported the *un-acceptance of their body* due to the physical changes after the oncological diagnosis and treatments due to the signs of surgery and oncological treatments. Scarring and weight gain led women to see their bodies like a stranger, developing the desire to return to their bodies before treatments: "I do not have a good relationship with my body. I do not like myself anymore. I would like to lose weight and be toned again. I want to return to my body before cancer (ID6)". Additionally, a woman reported that "the scar is ugly [...]. The aesthetic treatment I did after the surgery did not yield the expected results. The relationship with my body is bad" (ID9). Accordingly, they stated an overall discomfort in the relationship towards their body due to their aesthetic appearance and/or the physical sensations perceived. For example: "I don't like my body. I need to tone my muscles; I have been out of training for many years" (ID2). In line with this, the "signs of cancer" lead women to take *distance from their body*, avoiding looking and touching it and observing their necked self-image in the mirror: "I do not like my body and I try to look at myself in the mirror as little as possible. When I look at myself in the mirror, it is as if I saw the body of another woman. In particular, I avoid touching and looking at my breasts as little as possible (ID1)". The changed body may represent for participants a clear reminder of their oncological diagnosis, in terms of the *body as a cancer-related reminder*, as reported: "The sight of my naked body disturbs me: this happens not so much for the brutality of the image, but because I am forced to rethink the lived experience" (ID12). Furthermore, some women highlighted that while they tend to love their body, they harbor the fear that it may somehow hurt and betray them again: "I love my body, I talk to him often and ask him to support me not to fight me that we are one. I know I have a strong connection with him, I hope he listens to me (ID10)". The expression "*insecure attachment*" was employed to describe this kind of relationship. The psychologists Bowlby (1944) and Ainsworth (1979) used the word "attachment" to refer to the quality of mother-child attachment relationship that people can form in their life. Generally, this relationship can be grouped as either secure or insecure. In an insecure relationship, which is a type of the mother-and-child bond, the infant is insecure in the

presence of the caregiver. The child resists staying in contact with it and is wary of the stranger. In this study, the expression “insecure attachment” was used to highlight this ambiguous relationship between cancer survivors and their bodies after the diagnosis. Despite this, two women described a collaborative relationship with their bodies after the cancer diagnosis: “My body, when dressed, is like before illness. So, I don’t have a bad relationship with it. I just see myself a little fat after the surgeries, also because I had sharply increased the amount of food at meals. I wanted to fight against cancer. I also fought in this way. So, I would like to recover in better physical shape if I can. But without worries” (ID11) and “My body is not perfect, but it’s still better than it could be after cancer. I am not still in peace with the idea that it is changed, and I will not have a baby in the future, that I will no longer feel sexual pleasure as before illness, and that I feel physical pain that should not be felt at my age. Nevertheless, I accept it, in exchange for health stability that allows me to survive (ID13).

After the psychological intervention, participants reported different descriptions of the relationship with their body, compared to the beginning of the intervention. Even if some women maintain a difficult relationship with their body (*un-acceptance of their body*) due to the psychological impact of the evident signs of the therapies (e.g., “The relationship with my body is very difficult. I cannot accept the changes that the disease and its treatments caused to my appearance” (ID4) and “The first thought is that I don't like my body...I would like to be like before illness” (ID4)), the majority of the sample highlighted positive changes in this relationship after the psychological intervention. For example, they evidenced the tendency to have a *collaborative relationship with their bodies*, despite the signs of the diagnosis: “I have a good relationship with my body, over time I have learned to respect its new rhythms (ID12)” and “I accept my body, I would like to improve some things, but overall, I accept myself. (ID7)”. This is in line with a psychological intervention program. Women were invited to create a new relationship with their body supporting new meaning about their physical changes to improve their care and integrate a body perception. For example: “I have a collaborative relationship with my body, I try to take care of it as much as possible. Sometimes I listen too much to its signals and this in some cases is not good, but I am aware of it and I am working to try to find a balance” (ID10). In line with this, improvements in the *confidence with the body* emerged, recognizing their capacity to overcome the sign of the diagnosis. In some cases, women recognize that their body “deserves more attention and positive stimulation from me...in all its parts...especially the parts that I consciously ignore because I feel that they are foreign parts that inhabit me, such

as prosthesis. I have to reconcile myself with all the aches and pains (ID13)”. Interestingly, after the psychological intervention, participants who described the tendency to avoid watching and touching her body, expressed the desire to *stay in contact with it* (“I have decided with confidence that I will have to look in the mirror when I am naked. Despite the fear of seeing the ugly scar, I want to take courage and look at myself every day... but it is not easy (ID8)”).

The second area explored by participants is the **emotions related to their bodies**. Participants reported a *sense of alienation* towards their bodies at the beginning of the psychological intervention. In other words, they experienced a sense of being in a body that does not belong to them and is not under their control. The actual body is often compared with the body before the surgery and oncological treatments, with difficulties in the psychological acceptance of bodily changes, as follows: “Sometimes I feel a sense of alienation: this is my body right now...but I no longer recognize it as mine, it does not represent myself...it is as if I were looking at my body from the outside. Sometimes, I feel frustrated because I have no control over my body: no matter how hard I try, I could not come back to my previous weight; as much as I try, my mental brilliance and memory are not those of the past; No matter how hard I try, the physical energies and abilities are not comparable to those before breast cancer (ID13)”. In accordance with this, *body signals are perceived as unclear*. In fact, women reported difficulties in recognizing and understanding bodily signals, as follows: “The signals of the body are a burden for me! Maybe they try to give me some information about myself...but I do not receive these signals, I am not able to understand and interpret them!” (ID14). At the same time, the body is sometimes a clear reminder of cancer, leading to the promotion of the *FCR* (“I am sometimes scared...not every day... I am afraid when I am forced to think about what I have experienced. Right now, I feel like my body’s held up” (ID11). Accordingly, *negative emotions* of rejection, discomfort, and contempt towards their body emerged: “I have a feeling of rejection towards my body...I feel myself uncomfortable” (ID1). Similarly, another participant reported: “I feel a feeling of contempt toward my body...when I am naked, I avoid looking in the mirror as much as possible” (ID4). In other cases, breast cancer survivors experienced *ambivalent emotions* related to their body, ranging from positive thoughts concerning their physical appearance to negative emotions related to physical changes and side effects of oncological treatments. They may have positive feelings about it, appreciating some parts of their body; however, the body can be a source of negative feelings and evaluations, as follows: “Several times I feel good inside my body, I look beautiful and this makes me feel good...other times I see myself bigger and this makes me feel awkward” (ID3) and “Searching for a balance

with my body. My body responds well to therapies, which is a (great) gift that makes me. On the other hand, I must accept and counteract all the side effects of oncological treatments, both on a physical and psychological level” (ID13). On the contrary, some participants can emphasize positive feelings about their body, appreciating the progress made by their body over time, and experiencing a *sense of gratitude* towards it: “Sometimes, I appreciate my body because “it could be much worse”...instead it allows me to be still alive and live an almost normal life: I can do everything, with very few limitations and especially without help” (ID13), “My body has changed and has many scars. I look at them every day and I am sorry that my body has had to undergo amputations...but I know that there are just bodily changes that I have to accept...however, it is strange, sometimes I do not recognize myself!” (ID10), and “I feel a sense of gratitude because, despite the oncological therapies, it has been able to recover from the illness and allowed me to have a child” (ID12).

After the psychological intervention, participants’ emotions towards their bodies slightly changed. Although a woman still reported a *sense of alienation* (“I have no emotions...I am detached from my body...the mind wanders off on its own without relating to the body...” (ID14), the majority of the sample perceived many emotions after the intervention. Specifically, some women maintain *negative emotions* towards their bodies, even if they differ from those perceived at the beginning of the intervention. They indeed reported emotions such as anger, despair, discomfort, or sadness due to the signs of the oncological therapy, which are still visible on their bodies: “Speaking on my body, I feel almost exclusively negative emotions, such as, anger, discomfort, and sadness” (ID4) and “I feel discomfort for the physical pain. The ongoing hormonal treatment damages my poor bones every day!” (ID9). Moreover, one participant recognized a sense of guilt towards her body for neglecting it for a long time: “I realize that I have neglected it because of the illness for a long time” (ID15). This is a new emotion that was not reported before intervention. At the same time, some breast cancer survivors reported *ambiguous emotions*, like “love and hate”, for their bodies. Interestingly, after the psychological intervention, the emotional swing is connected to the process of integrating a new body perception, as follows: “Sometimes I like my body a lot, sometimes I just don’t: I find myself swollen, fat, and I think that I could attract more positive attention with a more beautiful body” (ID3) and “I feel an alternation of joy and inconstancy...I would care more about a healthy diet, but my head does not give weight to this point!!” (ID5). On the contrary, some participants emphasize a strong *sense of gratitude* for their bodies because they can bear the weight of the oncological treatments: “In this moment of personal reflection, I feel as if I were grateful

to him for having supported surgical operations, for having resumed, after the time of convalescence, to move, to act, to support me in daily activities. Despite the wounds - which are quite extensive - my body did not stop: it adhered not only to the demands of daily life but also to the desire for movement, following my cultural and social interests. So, I'm very grateful to him!" (ID11) and "I feel a sense of gratitude because my body has been able to endure all the oncological interventions and treatments...I can count on him every day" (ID12)". In line with this, the relevance of the total body as a new awareness is reported: "I am grateful to my body for not betraying me, despite the wounds - they are many - inflicted...but I am also aware that I neglected it, as if it were forced to follow me. I didn't have much respect for my body over illness: I asked him a lot. For example, I treated only the face: I always attributed a greater value to the face. The face is the expression of the inner world; therefore, it has always been more important for me. Now I think that the whole body has equal dignity (ID11)". Interestingly, the perception of unclear bodily signals and *FCR* disappeared after the psychological intervention.

Finally, the third area was related to **thoughts about the body**. Before intervention, participants reported high levels of *cognitive burden* due to physical and mental fatigue (e.g., "I don't feel my body at the top. I have physical energy but then I feel out of training. I am very tired!" (ID3)) as well as a sense of body rejection (e.g., "The first thought that comes to my mind is indifference and rejection towards my body. When I have to think of my body, I perceive a mental fatigue" (ID1) and "Obviously I would have preferred not to have to run into this disease, I look ugly, and I have to deal with age but also with the consequences of cancer..." (ID8)). They also reported a strong *sense of impotence*: "The first thought is that I would like to go be like before the disease experience...but I know that this is not possible...so I feel helpless" (ID4) and "I would like to help both my body and me to feel good, calm, full of energy...I would like to have a healthy diet...but my tiredness is too high...the, anxiety affect my body negatively" (ID14). On the contrary, other main thoughts were focused on *taking care and time* for their body daily, speaking about the meditation practice as a way to listen body sensations (e.g., "I often dedicate myself to meditation and relaxation, it helps me to know myself and my body" (ID6)). This is in line with the program's aim of learning how to respect the body (e.g., "I know I should respect my body more, without stressing it every day" (ID12)). Interestingly, the ability to stay in contact with the body and its related sensations may sometimes become an issue to solve. In particular, a breast cancer survivor stated: "I shouldn't listen to my body too much! I tend to stress about

it! Sometimes my body tends to make a distance from me; sometimes I am too focused on any physical changes and inner sensations. This stresses me a lot!” (ID10).

After the psychological intervention, some participants reported the familiar sensations of fatigue and tiredness related to a *cognitive burden* (e.g., “I feel my body tired because of my everyday issues” (ID7)) and a *sense of impotence* as before the intervention. On the contrary, others highlighted their desire *to take care and time* for their body thanks to relaxation practices and positive thoughts of caring and love towards it, as follows: “I have the desire of a relaxing massage to fight physical tensions and relax the mind” (ID9), “My body is beautiful, strong and, at the same time, delicate. I have to take care of it every day (ID12)”, and “Going forward: I have so much to do and want to do it. Looking forward and leaving behind everything that makes me too heavy. I want to be more serene and happy” (ID13). Interestingly, they were stronger awareness about the importance of caring their bodies to sustain physical and psychological well-being: “Now I know that relaxation and serenity help me keep my negative thoughts under control” (ID5), “I know that I have to take better care of it by physical training regularly, drinking more water, and relaxing more from working tensions” (ID13) and “The relationship with my body is, at this time, overall positive. I do not feel any particular tension. However, I do not abandon the awareness of improving my physical appearance. Now I want to dedicate myself caring for my body” (ID11). Lastly, participants reported a new point of view regarding their bodies. Interestingly, it was defined as a *helper*: “My body is a friend, not an enemy! It suffered with me, it felt pain, but it never gave up. We will never give up. We will never give up. I will love him more than I have in recent years (ID8)”, aiming at making a new positive relationship (“I want to thank by body for its efforts over cancer illness, trying to do not stressing it anymore” (ID15), “I think it is important to have a positive relationship with my body. It allows me to live on this earth! I should listen to it and take care of it as much as possible” (ID10)), and “Compassion. I suffer with my body and we react together: mind and flesh. We react to therapies, side effects, mood swings, fatigue and everyday stresses that arise from work, home and family care. After all, yes, I perceive him as my ally, that despite everything still gives me satisfaction and leads me to look” (ID13).

	Before the psychological intervention	<i>n</i>	After the psychological intervention	<i>n</i>
Relationship with the body	1.1 <i>un-acceptance</i> : incapacity to accept the body changed after cancer	7	1.1 <i>un-acceptance</i> : incapacity to accept the body changed after cancer	3
	1.2 <i>distance from the body</i> : avoid looking and touching their bodies	1	1.2 <i>staying in contact with the body</i>	3
	1.3 <i>body as a cancer-related reminder</i>	1	1.3 <i>having confidence with the body</i>	3
	1.4 <i>body collaboration</i> : be aware of its efforts	2	1.4 <i>body collaboration</i> : the body role and relevance to sustain the overall well-being	7
	1.5 an "insecure attachment"	1	/	0
Emotions	2.1 <i>sense of alienation</i> : perception of a body that is not under control	1	2.1 <i>sense of alienation</i> : absence of the bodily sensations	1
	2.2 <i>unclear body signals</i> : the body gives information that are difficult to be understood	1	/	0
	2.3 <i>fear of cancer recurrence</i> : sensations are linked to the fear of a new cancer diagnosis	1	/	0
	2.4 <i>negative emotions</i> : rejection, discomfort, and contempt towards their body	5	2.4 <i>negative emotions</i> : anger, discomfort, sadness, and guilt	3
	2.5 <i>ambivalent emotions</i> : presence of both positive and negative feelings towards the body	4	2.5 <i>ambivalent emotions</i> : presence of both positive and negative feelings towards the body	4
	2.6 <i>sense of gratitude</i> : gratitude for the efforts endured by the body	3	2.6 <i>sense of gratitude</i> : gratitude for bearing oncological treatment; awareness related to the relevance of the total body	4
Thoughts	3.1 <i>cognitive burden</i> : fatigue related to the perception of a tired body and body rejection	4	3.1 <i>cognitive burden</i> : fatigue related to the perception of a tired body and body rejection	3
	3.2 <i>sense of impotence</i> : impossibility to do something to come back to their bodies before breast cancer	2	3.2 <i>sense of impotence</i> : impossibility to do something to come back to their bodies before breast cancer	1
	3.3 <i>take care and time</i> : listening to inner sensations and relaxation practice.	4	3.3 <i>take care and time</i> : be involved in relaxation practice; more awareness about the importance of the body to promote the overall well-being	6
	/	0	3.4 <i>the body as a helper</i> : body is now perceived as an ally	4

Table 22. Main themes and sub-themes emerged in the thematic analysis

4.2.3 Discussion

The process of change in the relationship, emotions, and thoughts that occurred in a group of breast cancer survivors over an intervention based on self-compassion towards their body was explored. The lexicometry analysis of the participants' answers suggested a general increase in the use of words communicating attention, appreciation, and care toward the body. This tendency was further confirmed in the analysis of the answers through qualitative thematic analysis.

Firstly, results emphasize an increasingly positive relationship with the body, in terms of body acceptance and less distance, more confidence, and collaboration, in line with emotional improvements obtained at the end of intervention and the current studies that evidence the positive impact of psychological intervention focused on self-care and kindness on BI in breast cancer survivors (Lewis-Smith et al., 2018). In particular, Lewis-Smith and colleagues showed that this kind of intervention can promote body appreciation and acceptance, reducing weight, and shape concerns. Moreover, improvements in self-esteem, which is strongly associated with BI issues in a breast cancer population, play a relevant role too (Fobair et al., 2006). Despite some participants' reporting negative aspects of their relationship and emotions regarding the body with the body, even after the intervention, a reduction in the frequency and intensity of the reported negative emotions was found. The past cancer experience could have seriously impacted on these dimensions (Boquiren et al., 2013; Jabłoński et al., 2019) in a way that this brief psychological intervention cannot completely heal. However, it was possible to observe an increased consciousness about the importance of a good relationship with their body to promote general well-being, an increased agency, and a less sense of impotence. Mifsud and colleagues (2021) evidenced that a brief self-compassion intervention aiming at addressing BI issues can promote breast cancer survivors' well-being, promoting individuals' awareness about their experiences and related responses in a broader context. Lastly, an interesting result is the new body perception, which is strictly related to the aim of the intervention. At the beginning of the program, women stated that they wouldn't touch and look at their bodies in the mirror. On the contrary, the desire to have a contact with bodily parts, even changed due to oncological surgeries and treatments (e.g., breast), emerged after the psychological sessions. Participants also considered healthy activities (e.g. sport and relaxation) as helpful in order to promote well-being and improve their abilities to manage their emotions. In line with it, literature suggested that sport and PE represent an important aspect after cancer, helping women to improve cognitive abilities and QoL (Sebri et al., 2019; Durosini et al., 2021).

Regarding limitations, one of them is the study design, which did not include a control group nor a quantitative evaluation of the intervention efficacy with validated and standardized measures. Results shed light on the process of body perception change during the intervention, rather than statistically demonstrating the intervention's efficacy in comparison with alternative approaches. Second, another limitation is participants' selection. It is possible that women who decided to participate in the intervention already had specific attention and interest in their bodies and their changes. This is in line with the involvement of almost half of the sample in individual psychological sessions. For this reason, some caution should be used in generalizing the results to the entire population of breast cancer survivors.

Despite these limits, some important theoretical, methodological, and practical implications can be proposed. First of all, this is the first online study focused on self-compassion towards the body that investigates the specific changes in body perception of breast cancer survivors after an intervention. Starting from this evidence, this online intervention demonstrated the possibility of overcoming space and physical barriers. Second, this study adopts two complementary approaches to text analysis: the lexicometry approach was used to identify, with a quantitative tool, the specific words that constituted the body representation (Lancia, 2012), while the thematic analysis (Braun & Clarke, 2006) deeply described the breast cancer survivors' relationship with their body and their related cognitions and emotions. These two approaches to text analysis have been rarely applied in the same study (for rare exceptions see: Cortini & Tria, 2014; Mazzoni & Cicognani, 2014); however, as this study demonstrated, they can be usefully integrated to obtain a more detailed and consistent picture of the texts' meaning. Third, the relevance of group psychological sessions to improving patients' confidence in their bodies was evidenced. More specifically, it is needed to implement psychological interventions focused on cancer survivors' needs, describing specific changes that helped the participants to rethink their body and promote their well-being. Future studies could further evaluate the psychological intervention's efficacy with validated measures. In addition, the inclusion of a control group may demonstrate the efficacy of this specific intervention compared to alternative approaches. Moreover, exploring the changes in bodily perceptions in patients with other kinds of chronic diseases could be interesting.

In conclusion, this study describes the relationship with the body, emotions, and thoughts of a group of breast cancer survivors participating in an online and group psychological intervention. It highlights the relevance of psychological programs to improve

the quality of such relationships, meeting the participants' need to rebuild contact, confidence, and collaboration with their bodied. At an emotional level, reducing the intensity of negative emotions related to the illness experience and improving the sense of gratitude towards their body is fundamental. Finally, the reduction of a sense of impotence and an empowered sense of vitality, perceiving the body as a helper that can sustain women in their daily life activities, can be the main aim to reach in other psychological interventions for breast cancer survivors.

4.3 Conclusions

In conclusion, BC can be considered another relevant construct related to Injured Self. Interestingly, the present studies evidenced that attitudes of self-compassion towards one's body and its related meanings could become a point to address psychological interventions for breast cancer survivors. Specifically, the psychological program demonstrated that training BC in breast cancer survivors can change their body perceptions, from a representation strongly associated with oncological signs and issues to the perceiving a body as an ally, able to handle everyday life activities. Considering the results obtained, future directions are given. Specifically, the fifth chapter will present a study protocol with the possible involvement of technology in order to manage bodily issues and, in particular, inner sensations in breast cancer survivors.

5. New directions and a study protocol

Technology, eHealth, and Virtual Reality (VR) have strong involvement across different contexts over the years (Castelnuovo et al., 2015; Gorini et al., 2016). Health care management is applying technological devices even more frequently to address several phases of the care path, from diagnosis to the choice of better treatments. This is in line with the promotion of personalized interventions in cancer patients (Gorini et al., 2018).

Particularly, in the eHealth field, mobile technology (mHealth) can empower patients in disease management and in the achievement of experiential growth and positive experiences. Oncological diseases, as chronic conditions, challenge the health care systems worldwide (Gorini et al., 2018). The need to manage and contain cancer from diagnosis to death requires continuous attention and availability from the health provider. Similarly, patients have to adhere to long-term therapy and change their everyday lifestyles. Moreover, other figures, such as patients' caregivers, organizations, and institutions, are involved due to the extensive demands of care (Castelnuovo et al., 2015; Gorini et al., 2016). On one hand, health technologies can empower and facilitate the administration of drugs; at the same time, they offer opportunities for maintaining patients' active engagement in the care process and promoting patients' psychological skills (e.g., health literacy, the engagement in health behaviors, and emotion regulation). On a psychological level, technology can promote some variables, such as the cognitive representation of the disease and the management of emotional issues (Beiwinkel et al., 2017), in line with the development of a P5 mHealth approach. Specifically, the P5 refers to the Predictive, Personalized, Preventive, Participatory, and Psycho-cognitive aspects. These features have a unique and significant role in how individuals experience emotional events, make decisions about their health, and cope with illness (Pravettoni & Gorini, 2011). Some of the aims should be sharing more useful and non-redundant information (Pravettoni et al., 2016) and personalizing communications to each patient and his or her individual characteristics. In order to do this, a good patient–doctor communication is fundamental. Technologies should not be used as a substitute for this relationship; however, they can promote it by including Instant Messaging functions and social networking features, for example. These goals are recommended to make patients active managers of their health, following a patient-centered medicine (Triberti et al., 2019^b).

Avatars, as digital figures representing human users within digital environments, can be another interesting instrument in assessing and promoting breast cancer patients' well-being. They can adopt several aesthetical features, ranging from static images to dynamic, often humanoid, characters (Triberti et al., 2019^a). According to *projective identity theory*, avatars created or customized by users maintain aspects of their identity and self-perception (Gee, 2003). They could represent the users' personality traits and physical and cognitive development over time, or be similar to users in terms of physical appearance (Wrzesien et al., 2015). Moreover, they are modified by users depending on the characteristics of the Virtual World they have to enter. In self-representation, studies showed that participants who created ideal-self avatars were more likely to visualize their own ideal body. In contrast, participants who created actual-self avatars showed higher perceived health risks for their bodies. These results show interesting implications of avatar customization for health care (Kim & Sundar, 2012). Avatars that are linked to the cancer experience are generally associated with negative judgments and unpleasant emotions. However, literature reported that breast cancer survivors do not experience more difficulties exploring their self-representations than others. One possible explanation could be that they are involved in intrapersonal process already while fighting cancer (Marzorati et al., 2017).

VR is another available technology that could be applied to address BI issues. VR is an advanced form of human-computer interface (Arane et al., 2017; Ventura et al., 2018). Literature demonstrated that individuals might recognize any object as a part of their own body during a VR experience. In this case, real body parts and external objects in the form of dummy body parts are associated with multisensory (visuo-tactile) integration processing. Bodily illusions are indeed generated by inducing a visuo-tactile conflict where individuals experience illusionary ownership over a fake body (De Jong et al., 2017). For example, in the rubber hand illusion, spatial and temporal congruities between tactile signals on the real hand and visual signals on the dummy hand induce illusory feelings and individuals experience more ownership after it (Kanayama et al., 2021). This way, users are immersed in a computer-generated environment and interact with it naturally (Riva, Baños, Botella et al., 2016), thanks to the promotion of the feeling of presence (Kilteni, Groten, & Slater, 2012). Interestingly, the literature showed that exposure therapy for specific diseases (e.g., anxiety, panic attack, eating, and sexual disturbances) can be more efficient if delivered in different VR environments that simulate natural situations (Ferrer-Garcia et al., 2017). In addition, it is recommended the application of multiple contexts during exposure treatments to reduce the likelihood of renewal (Shiban et al., 2013). As VR places the exposure in the

context of virtual environments that simulate realistic situations, it may represent a useful way of overcoming these drawbacks. Besides it is easy to disseminate, in an interview by Carl and colleagues (2019), people reported that they would prefer to receive VR exposure therapy compared to traditional ones.

The involvement of VR also in the field of breast cancer could be considered for future studies in promoting positive inner sensations and self-representation in breast cancer patients and survivors. Particularly, VR could be used to address Bodily Self-Consciousness (BSC), which refers to the experience of one's Self as located within an owned body (self-identification) and as occupying a specific location in space (self-location). Specifically, BSC can be altered through multisensory stimulation, as in the Full Body Illusion (FBI), aiming to improve the self-awareness of the current self-image. The possibility to experience continuity between the virtual and the real body in real-life physical and emotional sensations might be very useful to experience self-coherence in a time-and-space continuum. Similarly, the use of the first-person perspective in VR can promote the personal sense of location, agency (i.e., the sense of global motor control, for example, the subjective and conscious experience of intention, action, and control selection), and ownership in order to enhance BSC in breast cancer patients with relevant consequences in terms of emotions, self-esteem, and behaviors (e.g., social relationships and adherence to treatments).

5.1 Virtual reality: a tool of assessment and intervention for Body Image in Breast Cancer Survivors

As known, the experience of the body is the result of a complex interplay of various perceptual streams (e.g., touch, visions, and interoception), which can be synthesized by the term “embodiment” (Ventura et al., 2018). As previously stated, embodiment involves the sense of self of location, the sense of agency, and the sense of body ownership (i.e., the self-attribution of the virtual body, for example the conviction that the avatar is my own body) (Kilteni Groten, & Slater, 2012). Specifically, about bodily issues, VR allows addressing the embodied self (Slater et al., 2019) by dealing with the self-image in space and the autobiographical and episodic memories related to the specific disease.

Given the possibility of altering the body's perception in an experimental setting (Ventura et al., 2018), VR has already been applied in the field of breast cancer as an effective means of distraction for alleviating pain and anxiety firstly (Chirico et al., 2020; Mohammad & Ahmad, 2019). It also has been used to manipulate body perception (for a

Review see Matamala-Gomez et al., 201) and to successfully modify BI (Irvine et al., 2020). However, no studies assess the efficacy of the VR' application to manage BI in breast cancer survivors. A proposal for future studies is indeed based on the involvement of VR as a tool to manage interoception and BI distortions after the illness. In particular, it might promote BSC (Nagamine et al., 2016) that can be altered through multisensory stimulation to improve self-awareness of the current self-image. In other words, a VR intervention may argue to promote BI by managing illness self-schemas (*cognitive dimension*), increasing awareness of inner sensations and attenuating disrupted self-regulation emotions with biofeedback or specific relaxing narratives (*emotional dimension*), and enhancing social relationships and adherence to treatments (*behavioral dimension*).

In order to apply VR as a tool to promote BI in breast cancer survivors, two main goals may be focused:

1. *VR as an instrument of assessment*: since VR is an embodied technology that decreases the distance between self and reality (Riva et al., 2016^a), it could measure the differences between the real body and the body in the immersive reality by assessing the individuals' self-location and sense of agency. On a hypothetical level, breast cancer survivors with low bodily acceptance may show difficulties in the embodiment of the virtual body. It could be useful to implement tailored psychological interventions on patients' characteristics and needs.

2. *VR as an instrument of intervention*: since VR can simulate our internal reality, it could improve changes in the way in which the body is perceived and emotionally react to life events, giving the possibility of managing renovate and appropriate bodily perceptions damaged from breast cancer experience (Riva et al., 2016^a). More specifically, VR could be involved in psychological interventions to improve patients' cognition, emotions, and behaviors. In particular, when immersed in a virtual body different from the illness self-schema (e.g., lack of illness reminders, such as scars), the perception of one's own body as ill could be reduced thanks to the high level of emotional engagement and sense of presence (Riva et al., 2016^b). This could reduce the perception of being only "patients", supporting a more positive overall self with consequences on the QoL. Moreover, VR could enhance positive emotions as an instrument to relax (with biofeedback or specific relaxing narratives, such as the body scan). As a clinical implication, it could be particularly beneficial to alter the perception of time during chemotherapy treatment and a form of distraction and management for acute and chronic cancer pain and anxiety (Ng et al., 2018). In accordance with this, relaxation could help breast cancer survivors to be aware of one's inner sensations

and disrupt self-regulation emotions (Patibanda et al., 2017). Finally, the occasion of presenting realistic controlled stimuli and, simultaneously, monitoring the responses generated by the user may offer information about patients' understanding and control of bodily signals (Riva et al., 2012). Improvements in the perception of personal efficacy and self-reflectiveness (Hasna et al., 2020) could show benefits related to social relationships as well as adherence to treatments by removing the idea of accepting treatments in a passive and lacking manner, which would be evident when they struggle or refrain from actively taking decisions (Martos-Méndez, 2015) (Table 23).

	Virtual Reality intervention	Consequences
Cognition	Experience of a body without illness reminders	Refute the illness self- schema
Emotions	Biofeedback and relaxing narratives	Improvements in interoception and management of disrupted self-regulation emotions
Behaviors	Realistic stimuli whose generated responses can be monitored by the users	Improvements in social-relationships and adherence to treatments

Table 23. VR's effects on cognition, emotions, and behaviors and related consequences in breast cancer survivors

In conclusion, VR could be an interesting assessment and intervention tool to deal with bodily self-issues in breast cancer patients. Particularly, it may improve bodily self-consciousness with long-lasting outcomes on cognition, emotion, and behaviors. Firstly, as an instrument of assessment, VR might measure the distance between the own body and an ideal one in a virtual environment; secondly, as instrument of interventions, this embodied technology can simulate survivors' internal reality to alter the experience of the body and space aiming at managing the illness-schema (cognition), attenuating emotional arousal through relaxation (emotions), and increasing social-relationships and adherence to treatments thank to the promotion of self-efficacy and reflectiveness as well as a realistic perception and control of inner sensations. Additionally, it could be interesting to better explore the effects of VR on bodily self-consciousness by implementing intervention with breast cancer patients. Future investigations could take consider the role of the stage of cancer and personality traits. For instance, personality traits may impact bodily self-consciousness and the stage of cancer may affect the possibility to intervene on bodily self-issues. This to address bodily issues by tailoring a personalized intervention to individuals' characteristics and needs.

5.2 A study protocol: Virtual reality to manage illness-related sensations in breast cancer survivors

Addressing interoception is fundamental in order to explore individuals' inner sensations. At the physiological level, interoception refers to the sense of conditions originating from internal visceral organs (e.g., stomach and lungs) that signal bodily state (Cameron, 2002). On another side, at the psychological level, interoception is the ability to be consciously aware of inner sensations, which is strongly relevant in regulating emotional well-being (Füstös et al., 2013). Individuals with high interoception consciously perceive their heartbeats, for instance. Indeed, interoception encompasses abilities of awareness and skills of accuracy, which represents the extent to which individuals can detect internal bodily sensations (Garfinkel et al., 2015), which can be measured by assessing individuals' ability to describe affective experiences (Subic-Wrana et al., 2012). Following the *constructed theory of emotions*, being aware of oneself inner sensations is important to regulate internal body state and maintain physical and emotional well-being by reducing somatic symptoms (Herbert et al., 2012) to promote subjective feelings (Damasio, 2010; Fustos et al., 2013) and the representation of an agentive self, in terms of continuous and invariant over time (Craig, 2010).

Over the years, literature has explored the relationship between body and interoception. William James (1884) was one of the main authors to state that the experience of emotion is the perception of bodily responses. Subsequently, the somatic markers hypothesis (Damasio, 1999) suggested that the foundation of our individuals' feelings is in the neural representation of the body's physiological condition. It evokes feeling states and forms the basis for the Self that influences individuals' cognition and behaviors (Craig et al., 2009; Damasio, 1999). The somatic markers hypothesis summarized that self-awareness is continually generated in a series of pulses of bodily signals that give rise to a continuous "stream of consciousness". The interaction between interoceptive and exteroceptive awareness of the body is very relevant and predicts the bodily experience in terms of self-awareness (Babo-rebelo et al., 2016) and body ownership (Tsakiris et al., 2011).

Interoception in breast cancer survivors

In breast cancer survivors, the body perception and its inner sensations are a relevant source of emotions, worry, and FCR. It can become a permanent issue in the lives of breast cancer patients who, even if cancer has been treated successfully (Soriano et al., 2019), take under control available bodily signals continually. The way in which emotions are actively

experienced (interoceptive and exteroceptive) and expressed is associated with improvements in regulation strategies and illness symptoms, such as nausea, fatigue, pain, distress, and mortality (Czamanski-Cohen et al., 2017). Survivors' sensitivity to bodily signals hampers their abilities in DM and emotion regulation (Breuninger et al., 2017), with implications for well-being and social functioning (Mazzocco et al., 2019). Specifically, breast cancer survivors' ability to detect subtle bodily changes sustains an emotional reaction aiming at changing bodily sensations in detailed thoughts (Lane et al., 2015) and improving the assessment of the events (Mazzocco et al., 2019). In this regard, checking behaviors could theoretically attenuate the distress connected to FCR. However, considering that checking behaviors may become excessive and compulsive, they must be an explicit target to reduce FCR (Humphris & Ozakinci, 2008). In general, unpleasant bodily sensations are signals of a disturbance in the body that requests an adaptive response by the organisms to recover the overall balance (Damasio & Carvahlo, 2013). Additionally, recent studies evidenced that the levels of interoceptive accuracy are inversely associated with self-objectification (Ainley & Tsakiris, 2013) and BI satisfaction (Emanuelson et al., 2015). In this line, the lower awareness and accuracy interoceptive level is associated with higher body image concerns on a cognitive level (e.g., body shape, appearance, and the overall mental representation of the body) (Badoud & Tsakiris, 2017) and affective (e.g., FCR) especially.

Virtual reality and bodily self

In reference to bodily illusion, VR techniques illustrated the virtual reality full-body illusion (VRFBI) as the experience of ownership that can even be induced over an entire fake body (Slater et al. 2008). Thanks to the embodiment, users can experience, at the same time, the virtual body as their own, to the point that they “attach” to it the sensations coming from the physical body (Ventura et al., 2018). This can enhance the relationship with the sense of self through the experience of time and space continuity between virtual bodily experiences and real-life sensations to alter BCS, aiming at improving awareness of the current self-image and inner sensations (Matsangidou et al., 2017). It was found that when individuals experienced ownership over a virtual body, they showed physiological responses when the virtual body was being threatened (Petkova et al., 2011). The experience of ownership relies on a combination of both visual and tactile information. VR may indeed work on the embodied self dealing with the self-image in the space and the related autobiographical and episodic memories. Specifically, the manipulation of interoception in a VR condition extends from the basic levels of multisensory integration to the individuals' conscious attitudes about the body (Badoud & Tsakiris, 2017), which can be distinguished

between the “self-specific” (i.e., the recognition of a specific visual object as part of one’s own body) and the “generic” mental representations of the structured body. Thus, VR can promote BCS as well as one’s awareness of internal body sensations, known as Private Body Consciousness (PBC) (e.g., how well one is aware of internal bodily sensations) (Bekker, et al., 2008).

Anyway, current studies showed that interoception issues in breast cancer survivors are not strongly addressed. To the best of our knowledge, there is a lack of interest in the management of inner sensations, that are relevant to promote body image well-being in breast cancer survivors. VR might be an interesting tool to face some of breast cancer’s bodily perceptions and emotions. In particular, VR may be an instrument of intervention to manipulate sensations connected to bodily parts affected by breast cancer experience to promote interoceptive sensations and their re-appraisal and the overall relationship with the body. Specifically:

(Hp1) virtual experience may alter bodily awareness: breast cancer survivors may decrease negative sensations linked to specific parts of the body;

(Hp2) manipulation of interoception may promote self-coherence and psychological well-being by diminishing both the negative evaluation of the bodily self on a cognitive level and FCR.

5.2.1 Material and Methods

Participants

Participants will be volunteers, over 18 years of age who have previously completed successful treatment for breast cancer. Exclusion criteria will be the development of metastasis elsewhere in the body. Participants will be randomized either to the VR condition (intervention group) or the control condition (without intervention on the body but only VR relaxation), following a mixed design. The sample size needed will be determined using G*Power 3 (Faul et al. 2007). A total of >40 participants (tentative sample) is estimated to be involved.

VR system

The VR setup will consist of a headset covering the participants’ eyes. It will create immersion by displaying images placed very close to the users’ eyes, which are viewed through high-powered lenses (Turnbull & Phillips, 2017). In this study, participants will see their virtual bodies inside a virtual environment.

Scenario

A set of 3D computer-generated women's bodies will be created. A virtual environment will be developed with a neutral room and a usual size virtual body dimension of the avatar. Virtual bodies will be created without their heads to avoid the fact that facial feature can draw attention away from the body (Moussally et al., 2017). Virtual bodies will dress in dark shorts and a black top. Participant will be asked to sit on a chair and to have her forearms resting on a small table in front of them. When wearing the headset, participant will see a virtual body substituting their image, with the virtual arms and hands on the small table and resting on a virtual table collocated like the real one and, therefore, in the corresponding position and orientation. Participants will see their virtual body by looking directly at it as if looking at their own real body. At the same time, to induce ownership over the virtual body, a synchronous visuo-tactile stimulation will be applied by using the method described by Slater and colleagues (2008). Particularly, this will be achieved by visuo-tactile synchronicity, introducing more tactile movements especially (e.g., “caress your leg or arm”) (Ventura et al., 2018).

Procedure

Upon arrival in our laboratory, participants will be greeted, asked to sign a written consent form, and briefed on the experimental process. Moreover, they will be informed about the principles of immersive VR and how the session would be organized. Then, they will be divided into two groups randomly: 1) participants who will be immersed in VR and will experience the interoception-focused training; 2) participants who will be immersed in VR and will not experience the interoception-focused training but other (e.g., only a relaxing narrative). Before entering the VR simulation, a battery of questionnaires and the Implicit Association Test (IAT) will be administered. Subsequently, participants will be positioned in a specific way as their avatars: they will be sitting down on a chair and must put their open hands with their palms on a table; legs will have to be not cross-legged, and the back will have to stand straight. At the beginning, the experimenter will start with a warm-up task in which participants will stay in the virtual environment without other stimuli (2 minutes). Then the experimental group will be immersed in VR by receiving a visual and auditory stimulation on different parts of their virtual body (breast, fingers, and feet) subsequently and randomly.

Specifically, the VR training focused on interoception will be structured as such: on their (virtual) breast, patients will see a light (that will slowly change from strong red to

white). Meanwhile, participants will listen to the voice of the researcher who describes the ongoing process of “guiding” the light/color changes and explaining the alleviation of an itching sensation slowly on the same part of the body. This is expected to promote the process of embodiment in the VR and support participants in the perception of a decrease of inner sensations. The treatment will be proposed for a total of 5 minutes, considering that 90 seconds is a time interval sufficient to induce the body illusion (Serino et al., 2018). Then, the training process will also be reproduced for the fingers (5 minutes) and feet (5 minutes) in the same way. 2 minutes of pause will be applied between each stimulation. During these pauses, participants will stay in the VR world, without other stimuli. On the contrary, participants in the control group will be immersed in VR simultaneously and in the same position but will listen to a relaxing narrative. At the end, participants will be debriefed and take a battery of questionnaires and the Implicit Association Test (IAT). Finally, some self-report questionnaires (STAI-Y1, Self-Assessment Manikin, and checking behaviors) will be administered some days after (follow-up) (see Figure 1).

Measures

Pre-VR:

Implicit Association test (IAT) (Greenwald, McGhee, & Schwartz, 1998): literature shows that concepts associated with memory are categorized rapidly and accurately when they share a typical response. IAT uses a reaction time methodology to measure strengths of association among participants’ cognitive representations of target concepts and attributes. In this study, IAT will be proposed to infer unconscious attitudes and stereotypes regarding the relationship between interoception and thoughts towards two categories (body/mind and good/bad). Specifically, after the explicit measures, a series of words referring to inner sensations (e.g., itching, discomfort, pain, shiver, warm) and thoughts (memory, remembrance, fear, hope) will be presented one at a time in the center of the screen randomly. Using keyboard keys on the left (e) or right (i), participants’ task will sort the example into one of the two corresponding categories as quickly and accurately as possible. After a false classification, an error message occurred immediately, which required a correction before the onset of the subsequent trial. The task relies on the assumption that the prime automatically activates an evaluation, and that if primes and target words are strongly associated in the participant’s mind, the participant will react more quickly (Fazio & Olson, 2003). Therefore, the response time to the task was assumed to be the shortest when the participant strongly associated the prime with the presented target (Kregting et al., 2020).

Note: we expect that breast cancer survivors would be faster in responding to target words when they pertain to the body (breast) and are associated with a “bad” experience; this could be explored with a preliminary experiment on the specific IAT alone, involving breast cancer survivors vs. healthy controls.

Multidimensional Assessment of Interoceptive Awareness (MAIA) (Mehling et al., 2012): MAIA questionnaire measures eight dimensions of interoceptive awareness (noticing, not distracting, not worrying, attention regulation, emotional awareness, self-regulation, body listening, and trusting). 32 items are answered on a 6-point Likert scale ranging from 0 = Never to 5 = Always. The MAIA has been found to have high internal consistency (.66 to .82), and high unstandardized alphas ($> .70$; Mehling et al., 2012). Although the scoring guide for the MAIA does not include calculating a total score, a principal component analysis (PCA) supported the calculation of a total score (ranging from 0 to 160) to test this variable as a potential mediator and moderator.

Fear of Progression Questionnaire (FoP-Q-12) (Mehnert et al., 2006): FoP-Q-12 is a short form of the original 43-item Fear of Progression Questionnaire (Thewes et al., 2012). The items are scored on a five-point Likert scale, ranging from 1 (“never”) to 5 (“very often”). The resulting sum score of the FoP-Q-12 ranges from 12 to 60. A score of 34 or above indicates a dysfunctional level of FoP (Hinz et al., 2015).

State-Trait Anxiety Inventory (STAI-Y) (Spielberg, 1983^b): for the questionnaire description, see page 55.

Self-Assessment Manikin (SAM) (Bradley & Lang 1994): The SAM is a nine-point picture-oriented questionnaire developed to measure three features of an emotional response that have been identified as central to emotion in research conducted by Lang and colleagues (1993). This questionnaire is a non-verbal self-report measure of affective state using cartoon-like manikins. In particular, there are single-item scales that assess the valence/pleasure of the response (from positive to negative), perceived arousal (from high to low levels), and perceptions of dominance/control (from low to high levels) (Bynion & Feldner, 2017). Participants will be asked to use the two sets of SAM (valence and arousal) rating scales to assess current affective states (daytime) and recall of affective state at bedtime the previous night (night-time).

Checking Behaviors: ad hoc questionnaire to measure the frequency and warning attitudes towards own inner bodily sensations. Participants will respond on 10 points Likert scale to some questions, such as:

- In the last seven days, how often do you need to take control of nodules in the breast?
- In the last seven days, do you feel anxiety in these moments?
- In the last seven days, how many times have you spoken with your family member about this aspect?

Post-VR

Implicit Association Test (IAT) (Greenwald, McGhee, & Schwartz, 1998): for the tool description, see page 103.

Presence Questionnaire (PQ) (Witmer & Singer, 1998): PQ is a classic questionnaire to measure presence in a virtual environment. PQ is a 32-item instrument across 6 subscales: involvement/control, naturalness, auditory stimulation, haptic response, resolution, and interface quality on a 7-point (1-7) Likert scale. PQ measures the degree to which a virtual environment interface affects the participant's perception and their ability to interact with the virtual environment. Internal consistency reliability measures (Cronbach's Alpha) for PQ yielded reliability of 0.81.

Measures regarding Expectations and Satisfaction about the Treatment: ad hoc questionnaire to measure the expectation about the satisfaction of the treatment. Participants will respond on 10 points Likert scale to some questions, such as:

- Do you think this type of intervention is appropriate for your cancer-related physical disturbances?
- How much can this intervention help you?
- Would you suggest to other patients in your condition to try this intervention?
- Do you see any issue with this intervention?

Follow-up:

State-Trait Anxiety Inventory (STAI-Y) (Spielberg, 1983^b): for the questionnaire description, see page 55.

Self-Assessment Manikin (SAM) (Bradley & Lang 1994): for the questionnaire description, see page 105.

Checking behaviors: for this questionnaire description, see page 105.

5.2.2 Expected results

Since the theoretical background and related hypothesis, some expected results were presented as follows. Firstly, the strength of associations between “bad” and “body/breast” words could be reduced by the training in the experimental group compared with the control group, as the result of participants regaining control over their inner sensations thanks to the interoception-focused training. Second, on an emotional level, training survivors in their personal interoceptive ability will help them to be aware of their own inner sensations, reducing anxiety and negative emotions in the end. Finally, on a behavioral level, survivors might better manage their checking behaviors (for example, diminishing the need for checking) and social activities and intimacy by decreasing shame and anxiety.

General conclusion

We have seen earlier from the introduction to this dissertation that addressing self-representations and, in particular, bodily issues is essential to promote QoL in breast cancer patients and survivors. Self involves cognitions, emotions, and behaviors, with relevant consequences on health and well-being outcomes. It is paramount to consider the relationship between breast cancer and body issues in order to explore how each patient/survivor can deal with them. Currently, there is a lack of specific theoretical conceptualizations of bodily issues and available psychological interventions to manage them. Specifically, the main thesis of the present dissertation is that BI should be evaluated not only on an aesthetical level. BI refers to an overall self-representation of the body, which highlights appreciation of the aesthetic appearance in particular (for this reason, this construct is indeed relevant in other psychological issues more focused on appearance, such as eating disorders). However, BI conceptualized in terms of appearance does not completely address all of the issues related to breast cancer and its bodily challenges, because those are notably connected to inner sensations of pain and discomfort; the effects of invasive treatment; and the fear of recurrence of a threat coming from inside the body, sometimes perceived as a "stranger" or a "traitor". On this basis, the Injured Self-construct was proposed.

The present research project's general objective was to explore the role of self in breast cancer patients and survivors. Since the relevance of bodily issues in a general population, the present dissemination focused on body and related cognitions and emotions in a breast cancer population. This process leads to exploring BI firstly, as at the core of body representations, giving some more space to BC as another relevant construct. Considering a larger overview, it is useful to enrich the theoretical knowledge about bodily representations in order to address all of the main relevant features. Starting from the background, the last study corroborated the essential involvement of BC in a psychological intervention for breast cancer survivors.

This dissertation presented five experimental studies and one study protocol to deepen the relationship between breast cancer, the Injured Self, and the possible efficacy of psychological interventions. Specifically, the first study evidenced bodily representations' relevance in a general population. Findings of this study lead to better exploring the body and its related emotions as main points of interest in an oncological context too, considering

the complex changes during and after treatments. Coherently, the review and meta-analysis study highlighted the efficacy of different types of psychological interventions on BI in breast cancer survivors. Building on these results, we conducted an integrated online intervention comprising both postural exercises and psychological support focused on BI issues for breast cancer survivors. Findings showed that an integrated and group intervention focused on both physical activities and psychological sessions can promote well-being in breast cancer survivors. Then, we explored another interesting construct to build a more comprehensive background regarding BI. Firstly, an exploratory study evidenced the impact of BC, emotions, and metacognition processes on BI. Finally, another qualitative study showed the relevance of addressing Injured Self issues associated with BC in breast cancer survivors. In particular, in this study women reported positive changes in their body perception after a psychological intervention in a group focused on a BC approach.

Considering the results of the presented studies, four main conclusions can be drawn:

- bodily issues strongly impact breast cancer patients and survivor's well-being. In order to promote QoL, it is necessary to explore and manage the body' characteristics and needs and its related consequences on a cognitive, emotional, and behavioral level;
- BI is insufficient to embrace the bodily issues in breast cancer patients and survivors. A new construct, namely Injured Self, as a specific and cancer-related representation, has been proposed;
- bodily-representations and the Injured Self specifically involved a more extensive overview in which also other constructs, such as BC, should be integrated;
- it is possible to consider many types of interventions to address Injured Self in breast cancer patients and survivors. The present project demonstrated the effectiveness of integrated programs of both physical activities and psychological sessions in groups. Moreover, immersive BI-altering technology (e.g., VR) may be a helpful instrument to promote improvement in bodily representations in the future.

In the end, all results highlight the importance of considering the Injured Self in breast cancer patients and survivors. Different types of programs can be helpful in tailoring interventions to the patients' needs and characteristics. Moreover, future research may also

involve VR and explore further relevant constructs and interventions, aiming to better address bodily-representations and the Injured Self in breast cancer patients and survivors and promote QoL even after some years from successful treatments.

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