Goal adjustment, physical and sedentary activity, and well-being and health among breast cancer survivors

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Abstract

Objective: This longitudinal study examined whether goal adjustment capacities (i.e., goal disengagement and goal reengagement) would predict breast cancer survivors’ emotional well-being and physical health by facilitating high levels of physical activity and low levels of sedentary activity.

Methods: Self-reports of goal adjustment capacities were measured among 176 female breast cancer survivors at baseline. Self-reports of physical activity, sedentary activity, daily affect, and daily physical health symptoms (e.g., nausea or pain) were measured at baseline and 3-month follow-up.

Results: Goal reengagement predicted high levels of positive affect and low levels of physical symptoms at baseline and increases in positive affect over 3 months. The combination of high goal disengagement and high goal reengagement was associated with particularly large 3-month increases in positive affect. The effects of goal reengagement on baseline affect and physical health were mediated by high baseline levels of physical activity, and the interaction effect on 3-month changes in positive affect was mediated by low baseline levels of sedentary activity.

Conclusions: Goal adjustment capacities can exert beneficial effects on breast cancer survivors’ well-being and physical health by facilitating adaptive levels of physical and sedentary activity. Integrating goal adjustment processes into clinical practice may be warranted.

Keywords: breast cancer; subjective well-being; physical health; physical activity; sedentary activity; goal adjustment

Introduction

A breast cancer diagnosis and subsequent treatment are traumatic events for many women [1]. Breast cancer is among the most frequent cancers and the leading causes of cancer death among women, although the survival rates are steadily increasing (87% survive the first 5 years) [2]. Nonetheless, many women who survive breast cancer experience challenges to their well-being and physical health [3–5]. Such emotional and health challenges may derive from genetic and treatment influences [6–8]. Moreover, these problems can be due to the negative consequences of a woman’s lifestyle (e.g., lack of physical activity or unhealthy eating) [9]. For example, many breast cancer survivors are overweight or obese (estimates are as high as 48%) [10], and survivors tend to be less active than women who have not been diagnosed with breast cancer [6,10,11].

Physical activity is an effective coping strategy to counteract lifestyle-related problems [12,13]. It is safe, feasible, and effective for enhancing well-being and health among breast cancer survivors [14]. Recent guidelines have suggested that breast cancer survivors should engage in at least 150 min of moderate-to-vigorous intensity physical activity every week to gain health benefits [13]. Unfortunately, few breast cancer survivors are engaging in recommended levels of physical activity [15], and improving physical activity is a public health concern in this population. Furthermore, sedentary activity (i.e., activities requiring sitting, such as watching television, computer use, homework, and reading) has been associated with a range of health problems including cardiometabolic diseases and cancer risk [16–18], although it may also exert short-term psychological benefits by providing distraction or relaxation time [19]. Because breast cancer survivors can be at increased risk of cardiometabolic disease [6], high sedentary behavior may be of particular concern for this population, and reducing sedentary behavior is thus another important health priority among breast cancer survivors. Yet, there is limited research examining both sedentary activity and physical activity in this population, and research is needed to examine factors that could be associated with these lifestyle behaviors and associated levels of well-being and health. Such research may help to identify individuals who are at risk of low physical activity and high sedentary behavior and lead to the development of intervention strategies that may be implemented in clinical practices to modify the processes in question.

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A psychological construct that could influence lifestyle activity among breast cancer survivors relates to individuals’ goal adjustment capacities [20]. These capacities reflect a person’s general tendencies to disengage from unattainable goals and to reengage in new goals [21]. Goal disengagement entails a reduction of effort and commitment from goals that are no longer feasible or maladaptive, and goal reengagement includes the identification of, commitment to, and pursuit of new goals when unattainable goals are encountered. Goal adjustment capacities are thought to be adaptive tendencies because disengagement prevents accumulated failure and frees resources for other goal pursuits, whereas reengagement fosters new goal pursuits and through this process may facilitate purpose in life [21].

There is evidence from populations confronting normative (e.g., developmental problems) and non-normative stressors (e.g., caregivers of ill family members) that goal disengagement capacities forecast less emotional distress, more adaptive biological functioning (e.g., reduced cortisol output and systemic inflammation), and fewer physical health problems [22–25], whereas goal reengagement capacities predict higher levels of positive affect [23]. Recent work further suggests that effective coping could underlie the link between goal adjustment capacities and subjective well-being [25]. Such a process could take place because stressful life circumstances (e.g., a cancer diagnosis) often require individuals to focus their resources on addressing the stressor, which can be facilitated by the abandonment of unfeasible or ineffective goals (e.g., career pursuits or television watching). Thus, individuals who are capable of abandoning such goals may invest sufficient time and energy in effectively addressing a stressor [25].

Although no research has examined the importance of goal adjustment capacities among breast cancer survivors, it is possible that these capacities contribute to adaptive outcomes in this population. First, goal disengagement capacities may make it easier for a breast cancer survivor to stop pursuing ineffective sedentary activities (e.g., television or computer use) as well as goals that have become unattainable because of the cancer (e.g., work or sexual goals [26,27]). Such a process may facilitate acceptance of goal-related constraints and may reduce a cancer survivor’s distress [28,29]. Second, the engagement in new goals may increase the likelihood that relatively sedentary breast cancer survivors engage in enhanced physical activity, given that goal reengagement capacities promote the identification and pursuit of new meaningful goals. Considering that physical activity and sedentary behavior are distinct behavioral processes and not regarded as opposite ends of a continuum [30,31], any improvements in one or the other lifestyle behavior (or both) may have health-enhancing outcomes. By influencing adaptive activities, goal adjustment capacities could further protect breast cancer survivors’ emotional well-being and physical health.

Moreover, goal disengagement and goal reengagement capacities can interact in predicting adaptive outcomes, although there is a lack of longitudinal research documenting how these capacities work together (for cross-sectional effects, see [21,32,33]). In the context of breast cancer, it seems likely that high goal disengagement in conjunction with high goal reengagement capacities are most beneficial because this combination could increase the likelihood that a person abandons ineffective sedentary activity or engages in adaptive physical activity. Further, these synergistic effects could appear because giving-up goals can be difficult and is not always successful [34]. In such circumstances, the psychological benefits stemming from new goal pursuits may make it easier for a person to withdraw commitment from a maladaptive goal and thereby safeguards the influence of goal disengagement capacities on the reduction of sedentary activities. In addition, engagement in physical activity could be compromised if individuals have insufficient resources. Such problems may occur if lower goal disengagement capacities contribute to constraints of time and energy (e.g., a person becomes stretched too thin). Thus, adaptive effects of goal reengagement capacities on physical activity and well-being and health may be observed particularly among breast cancer survivors who are able to disengage.

In sum, we hypothesized that goal adjustment capacities would facilitate well-being and health among breast cancer survivors through their effects on high physical activity and low sedentary activity. To test this hypothesis, we conducted cross-sectional and longitudinal analyses using a sample of female breast cancer survivors. More specifically, we examined whether high levels of goal disengagement and goal reengagement capacities would exert beneficial main effects and interaction effects on levels of, and increase in, emotional well-being and physical health. Moreover, we expected that these adaptive effects of goal adjustment capacities would be mediated by levels of, and changes in (only for predicting longitudinal outcomes), physical and sedentary activity.

**Method**

**Procedures**

Female breast cancer survivors were recruited through advertisements and oncologist referrals from medical clinics and hospitals in the Montreal area. Women were eligible if they met the following criteria: (i) ≥18 years of age, (ii) first diagnosis of breast cancer within the past year, (iii) ≤20 weeks postprimary treatment (i.e., surgery or chemotherapy), (iv) ability to provide informed consent, (v) ability to read and speak in English or French, and (vi) report no health concerns that prevent them from engaging in physical activity. Women who met the eligibility criteria provided consent and completed questionnaires at baseline (T1) and 3-month follow-up (T2). Each assessment included a main questionnaire and daily questionnaires on three nonconsecutive days in the week following the main questionnaire. The study was approved by the University and Hospital Ethics boards.
Participants

Breast cancer survivors (N=177) were recruited at T1, and 145 women (82%) completed the T2 session. Because of missing data in the outcomes, the analyses presented herein are based on 176 women at T1 and 138 women at T2. Missing data of single predictors or mediators did not exceed 3% for the main study variables at T1 and were replaced with the sample mean. At T1, study participants were between 28 and 79 years old. The majority had been diagnosed with stage I or II breast cancer (74.8%). On average, these women were 10.59 months (standard deviation [SD] = 3.55) past cancer diagnosis and 2.89 months (SD = 2.86) past their last cancer treatment. The cancer treatments endured the goal new goals to pursue reengagement capacities (e.g., ‘It’s easy for me to reduce my effort towards the goal’) and six items measured participants’ goal reengagement capacities (e.g., ‘I think about other new goals to pursue’). We computed mean scores of the goal disengagement items (α = 0.76) and the goal reengagement items (α = 0.89). The means, SDs, and correlations of the goal adjustment scales were within the range typically observed in other samples (see Table 1) [21,23].

Physical and sedentary activity was assessed at T1 and T2 by using an adapted version of the Leisure Time Exercise Questionnaire [35]. Participants were asked to report the number of times per week they typically engage in different activities and the average duration of each activity bout. Weekly total minutes were calculated by multiplying the frequency of activity by the total minutes. Activities included vigorous (e.g., running or vigorous bicycling), moderate (e.g., downhill skiing or easy bicycling), and sedentary intensities (e.g., television/video watching or compute/video games). Given the known health benefits of moderate-to-vigorous physical activity [36], we combined vigorous and moderate activities. Measures of change in physical and sedentary activity were calculated in separate regression analyses, by predicting T2 levels of activity by the corresponding T1 levels and saving the residuals for further analysis.

Emotional well-being was measured at T1 and T2 by administering 24 items from the Profile of Mood States used in previous research [37,38]. On three nonconsecutive days following the main questionnaire, participants were asked to report the extent to which they had experienced 9 positive emotions (e.g., happy, calm, or energetic) and 15 negative emotions (e.g., angry, sad, or afraid) during the day, using five-point Likert-type scales (from 0 = not at all to 4 = extremely). We computed mean scores across days of positive emotions (zs > 0.94) and negative emotions (zs > 0.94). Measures of changes in positive and negative affect were obtained by predicting in separate regressions T2 levels of affect by T1 levels of affect and saving the residuals for further analysis.

Physical symptoms were measured at T1 and T2 by asking participants at the end of the three nonconsecutive days to report whether they had experienced any of 12 symptoms during the day (e.g., joint pain, difficulty breathing, headaches, and sleeping difficulties). The symptom checklist was selected from the Primary Care Evaluation of Mental Disorders screening questionnaire [39]. Many of these symptoms have been shown to be prevalent among breast cancer survivors [40,41]. We excluded two symptoms from the analyses (i.e., pain during sexual intercourse and fainting spells) because they were infrequently reported (<1%) and unlikely to be ameliorated by physical activity. For each wave, we counted the number of symptoms experienced across days. To obtain a measure of 3-month changes in

Table 1. Means and (standard deviations) and zero-order correlations between main study variables

<table>
<thead>
<tr>
<th></th>
<th>M (SD)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Goal disengagement (T1)</td>
<td>2.82 (0.50)</td>
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<td>2. Goal reengagement (T1)</td>
<td>3.66 (0.69)</td>
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<tr>
<td>3. Physical activity (T1)</td>
<td>153.46 (155.16)</td>
<td>0.05</td>
<td>0.17*</td>
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<tr>
<td>4. Physical activity (T2)</td>
<td>160.38 (141.04)</td>
<td>0.10</td>
<td>0.17*</td>
<td>0.43**</td>
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<tr>
<td>5. Sedentary activity (T1)</td>
<td>841.66 (678.36)</td>
<td>-0.13</td>
<td>0.04</td>
<td>0.15</td>
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<tr>
<td>6. Sedentary activity (T2)</td>
<td>870.51 (929.33)</td>
<td>-0.21*</td>
<td>-0.02</td>
<td>-0.04</td>
<td>0.08</td>
<td>0.48**</td>
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<tr>
<td>7. Positive affect (T1)</td>
<td>2.04 (0.73)</td>
<td>0.14</td>
<td>0.28**</td>
<td>0.22**</td>
<td>0.01</td>
<td>-0.07</td>
<td>-0.10</td>
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<tr>
<td>8. Positive affect (T2)</td>
<td>2.12 (0.73)</td>
<td>0.13</td>
<td>0.30**</td>
<td>0.25**</td>
<td>0.11</td>
<td>-0.21**</td>
<td>-0.18*</td>
<td>0.68**</td>
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</tr>
<tr>
<td>9. Negative affect (T1)</td>
<td>0.70 (0.49)</td>
<td>-0.26**</td>
<td>-0.18*</td>
<td>-0.20**</td>
<td>-0.01</td>
<td>-0.12</td>
<td>0.07</td>
<td>-0.55**</td>
<td>-0.29**</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10. Negative affect (T2)</td>
<td>0.69 (0.57)</td>
<td>-0.17*</td>
<td>-0.03</td>
<td>-0.17*</td>
<td>-0.09</td>
<td>0.02</td>
<td>0.12</td>
<td>-0.35**</td>
<td>-0.51**</td>
<td>0.57**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Physical symptoms (T1)</td>
<td>5.41 (5.00)</td>
<td>-0.14</td>
<td>-0.18*</td>
<td>-0.17*</td>
<td>-0.08</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.38**</td>
<td>-0.38**</td>
<td>0.41**</td>
<td>0.36**</td>
<td></td>
</tr>
<tr>
<td>12. Physical symptoms (T2)</td>
<td>5.13 (5.03)</td>
<td>-0.02</td>
<td>-0.14</td>
<td>-0.17*</td>
<td>-0.02</td>
<td>0.06</td>
<td>0.01</td>
<td>-0.36**</td>
<td>-0.41**</td>
<td>0.33**</td>
<td>0.42**</td>
<td>0.67**</td>
</tr>
</tbody>
</table>

Correlations involving T2 variable are based on 138 participants. All other correlations are based on 176 participants.

*p ≤ 0.05.
**p ≤ 0.01.
physical symptoms, residuals were calculated by predicting in a regression T2 levels by T1 levels of physical symptoms.

Covariates. To minimize the possibility of spurious associations, sociodemographic, cancer, and lifestyle-related variables that are commonly used as covariates among breast cancer survivors and may be associated with the outcome measures were included in the analyses [42]. Sociodemographic variables included participants’ age (M = 54.86, SD = 10.83), education (from 0 = did not complete high school to 5 = postgraduate degree; M = 3.19, SD = 1.49), and partnership status (0 = single, divorced, or widowed; 1 = married or cohabitating; M = .66, SD = .47). In addition, we assessed smoking (0 = daily, 1 = occasionally, and 2 = not at all; M = 1.88, SD = .42), alcohol consumption (from 0 = less than once a month to 6 = every day; M = 2.53, SD = 1.93), and BMI (M = 26.23, SD = 5.80). Finally, the participants reported their cancer stage (M = 1.79, SD = .82), time since cancer diagnosis (M = 10.59 months, SD = 3.33), and their last cancer treatment (M = 2.89 months, SD = 2.86).

Statistical Analyses
Preliminary analyses were conducted to examine changes in affect, physical symptoms, and lifestyle activity over time (with t-tests) and zero-order correlations between the main study variables. Moreover, we tested our hypotheses by conducting hierarchical regression analyses. Effects of goal adjustment capacities on indicators of well-being and health were tested by predicting T1 levels and 3-month changes of positive affect, negative affect, and physical health symptoms by (i) the main effects of goal disengagement and goal reengagement and the covariates and (ii) the interaction between goal disengagement and goal reengagement. All predictor variables were standardized prior to conducting the analyses. Subsequently, the original regression analyses were repeated in multiple mediation models to test whether T1 levels of, and/or 3-month changes in (only for the longitudinal analyses), physical and sedentary activity would mediate the effects of goal adjustment on indicators of emotional well-being and physical health. As outlined by Preacher and Hayes [43], these analyses can demonstrate mediation through the identification of indirect effects. Indirect effects were calculated on the basis of 5000 bootstraps and were evaluated as significant if the 95% bias-corrected confidence interval (BCI) of the indirect effects did not cross zero.

Results
Preliminary analyses
Results from t-test analyses documented that physical activity, sedentary activity, positive affect, negative affect, and physical symptoms did not change significantly over 3 months in the entire sample, ts (137) = −0.57 to 0.67, ps > 0.50. In addition, Table 1 illustrates the zero-order correlations between the main study variables. Goal disengagement was significantly associated with less sedentary activity (T2) and less negative affect (T1 and T2). Goal reengagement was associated with more physical activity (T1), more positive affect and less negative affect (T1 and T2), and fewer physical symptoms (T1). In addition, T1 levels of physical activity were associated with more positive affect, less negative affect, and fewer physical symptoms (both T1 and T2). Finally, sedentary activity (both T1 and T2) was associated with less negative affect at T2.

Goal adjustment as predictor of emotional well-being and physical health
Six regression analyses were conducted to examine the effects of goal adjustment capacities on T1 levels and 3-month changes in positive affect, negative affect, and physical health symptoms. The first step of the analyses showed significant effects of the covariates. T1 levels of physical symptoms were significantly predicted by more recent treatment (β = −0.16, p = 0.05), lower BMI, (β = −0.17, p = 0.02), less alcohol consumption (β = −0.20, p < 0.01), and less education (β = −0.17, p = 0.03). Higher T1 levels of positive affect were predicted by more distant treatment (β = 0.27, p < 0.01), less time since diagnosis (β = −0.23, p < 0.01), and more alcohol consumption (β = 0.16, p = 0.03). Age predicted lower T1 levels of negative affect (β = −0.18, p = 0.02), and a more severe cancer stage predicted increases in negative affect over 3 months (β = 0.20, p = 0.03).

Above and beyond the effects of the covariates, the first step of the analyses showed that goal disengagement significantly predicted lower T1 levels of negative affect, and goal reengagement predicted higher T1 levels of positive affect and lower T1 levels of physical symptoms (see Table 2). Moreover, goal reengagement predicted larger 3-month increases in positive affect (see Table 3).

Finally, the analyses demonstrated a significant interaction effect of goal disengagement and goal reengagement on 3-month changes in positive affect (see Table 3). The interaction effect was illustrated by plotting changes in positive affect for participants who scored one SD above and below the mean of goal disengagement and goal reengagement (see upper panel of Figure 1). Particularly large increases in positive affect were observed among women who were able to reengage in new goals and to disengage from unattainable goals. Follow-up analyses showed that goal reengagement forecasted increases in positive affect among women who reported relatively high goal disengagement (β = 0.39, p < 0.01) but not relatively low goal disengagement (β = 0.05, p = 0.68). Further, goal disengagement was positively associated with increases in positive affect among women who were better able to reengage in new goals (β = 0.16, p = 0.17) but negatively among women with lower goal reengagement capacities (β = −0.18, p = 0.14).
Goal adjustment, lifestyle activity, and well-being and health

Table 2. Hierarchical regression analyses predicting baseline levels of positive affect, negative affect, and physical symptoms by participants’ goal disengagement and goal reengagement capacities

<table>
<thead>
<tr>
<th>T1 Positive affect</th>
<th>T1 Negative affect</th>
<th>T1 Physical symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>β</td>
<td>F</td>
</tr>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal disengagement (GD)</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>Goal reengagement (GR)</td>
<td>0.07</td>
<td>0.30</td>
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<tr>
<td>Interaction</td>
<td></td>
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<tr>
<td>GD × GR</td>
<td>0.00</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Analyses were controlled for age, education, partnership status, body mass index, smoking, drinking, cancer stage, and time since diagnosis and last treatment. Degrees of freedom were 1, 164 for main effects and 1, 163 for interaction effects.

Table 3. Hierarchical regression analyses predicting 3-month changes in positive affect, negative affect, and physical symptoms by participants’ goal disengagement and goal reengagement capacities

<table>
<thead>
<tr>
<th>Δ Positive affect</th>
<th>Δ Negative affect</th>
<th>Δ Physical symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>β</td>
<td>F</td>
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<tr>
<td>Main effects</td>
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<tr>
<td>Goal disengagement (GD)</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Goal reengagement (GR)</td>
<td>0.03</td>
<td>0.20</td>
</tr>
<tr>
<td>Interaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GD × GR</td>
<td>0.03</td>
<td>0.19</td>
</tr>
</tbody>
</table>

Analyses were controlled for age, education, partnership status, body mass index, smoking, drinking, cancer stage, and time since diagnosis and last treatment. Degrees of freedom were 1, 126 for main effects and 1, 123 for interaction effects.

The mediating roles of physical and sedentary activity

To examine whether physical and sedentary activity statistically explained the observed associations, we first examined whether T1 levels of physical and sedentary activity would mediate the main effects of goal reengagement on T1 levels of positive affect and physical symptoms. As illustrated in Figure 2, the analyses demonstrated that goal reengagement exerted significant indirect effects on T1 positive affect (95% BCI [0.103, 0.013]) and physical health symptoms (95% BCI [−0.090, −0.004]) through relatively high levels of physical activity. However, the effects of goal reengagement were not mediated by sedentary activity (positive affect: 95% BCI [0.010, −0.019]; physical symptoms: 95% BCI [0.013, −0.012]).

Second, we examined whether T1 levels of physical and sedentary activity would mediate the main effect of goal disengagement on T1 levels of negative affect. The bootstrap analysis did not confirm a significant indirect effect of goal disengagement on levels of negative affect through physical activity (95% BCI [0.037, −0.017]) or sedentary activity (95% BCI [0.068, −0.004]).

Finally, we tested whether the observed main effect of goal reengagement and the interaction effect between goal disengagement and goal reengagement on 3-month changes in positive affect were mediated by T1 levels in, and/or 3-month changes of, participants’ physical and sedentary activity. Bootstrap analyses did not confirm significant mediation for the main effect of goal reengagement on changes in positive affect through T1 levels of (physical activity: 95% BCI [0.101, −0.003], sedentary activity: 95% BCI [0.063, −0.039]), or 3-month changes in (physical activity: 95% BCI [0.002, −0.102], sedentary activity: 95% BCI [0.010, −0.056]), lifestyle activity. However, Figure 3 documents a significant mediation effect of the interaction between goal disengagement and goal reengagement on 3-month changes in positive affect through T1 levels of sedentary activities, (95% BCI [−0.106, .003]), but not through T1 levels of physical activities (95% BCI [0.063, −0.008]) or 3-month changes in lifestyle activity (physical activity: 95% BCI [0.050, −0.020], sedentary activity: 95% BCI [0.033, −0.012]).

To interpret the latter mediation effect, T1 levels of sedentary activity were plotted one SD above and below the mean of goal disengagement and goal reengagement (see lower panel of Figure 1). The results showed that particularly low levels of sedentary activity were observed among participants who had relatively high levels of both goal disengagement and goal reengagement. Follow-up analyses showed that goal disengagement was significantly associated lower levels of sedentary activities among women who were better able to reengage in new goals (β = −0.26, p = 0.01) but not among their counterparts who had lower goal reengagement capacities (β = 0.04, DOI: 10.1002/pon
Moreover, goal reengagement capacities were associated with lower levels of sedentary activity among participants who were better able to abandon unattainable goals ($\beta = -0.15, p = 0.15$) but associated with higher levels of sedentary activities among participants with lower goal disengagement capacities ($\beta = 0.15, p = 0.14$).

**Discussion**

The study’s results demonstrate that breast cancer survivors who are better able to reengage in new goals reported higher T1 levels of physical activity than their counterparts with lower goal reengagement capacities. Moreover, T1 levels of physical activity mediated the effect of goal reengagement on T1 levels of positive affect and physical health symptoms. In addition, the lowest T1 levels of sedentary activity were observed among women who were able to disengage from unattainable goals and to reengage in new goals, which mediated subsequent 3-month increases in positive affect. The analyses did not confirm mediation effects of changes in physical or sedentary activity, and the results suggest only partial mediation involving rather small effect sizes.

These findings suggest that women’s goal adjustment capacities were meaningfully associated with physical and sedentary activity at T1 and subsequent changes in these activities did not further contribute to goal adjustment effects on well-being and health. Moreover, they are consistent with the hypothesis that goal reengagement capacities could facilitate breast cancer survivors’ physical activity, and through this mechanism, exert relative immediate emotional and physical health benefits. In addition, they suggest that the combination of high goal disengagement and high goal reengagement can predict reduced levels of sedentary activity and associated improvements in emotional well-being. This process may occur if engagement in new goals produces psychological benefits that support disengagement from goals that are difficult for a person to abandon (e.g., sedentary activity). Subsequently, goal reengagement capacities could improve levels of

**Figure 1.** Effects of participants’ goal disengagement and goal reengagement capacities on 3-month changes in positive affect (upper panel) and baseline levels of sedentary activity (lower panel). Predictor variables are plotted one standard deviation above and below the sample means.

**Figure 2.** Results from multiple mediation models testing the associations between baseline levels of goal reengagement capacities, physical and sedentary activity, and positive affect and physical health symptoms. Values represent standardized regression coefficients. The coefficient in parentheses represents the direct effect without incorporating the mediators. Solid lines indicate significant paths in the mediation analyses. Bootstrap analyses showed that baseline levels of physical activity exerted significant indirect effects on the associations between goal reengagement and positive affect and between goal reengagement and physical symptoms.
positive affect, among women who are able to disengage, because the reduction of sedentary activity has provided them with the resources necessary for engaging in new activities. Such new goal pursuits can extend beyond lifestyle activity (e.g., visiting relatives or engaging in cultural activities) and are likely to benefit breast cancer survivors’ well-being and health.

Consistent with previous research, the results further showed that goal disengagement capacities were associated with lower negative affect [23,25]. However, this effect was not mediated by participants’ physical or sedentary activity. The lack of mediation may be explained by the occurrence of additional problems that frequently arise in the context of breast cancer (i.e., sexual problems, return to work demands, spiritual practices [41]) that are unlikely to be ameliorated by adaptive lifestyle activity.

Finally, we note that there were some differences between the reported interactions for predicting T1 levels of sedentary activity and changes in positive affect. In particular, high sedentary activity was observed among women who are incapable of disengaging from unattainable goals but have an easier time engaging in new goals (see Figure 1), whereas declines in positive affect emerged among women who tend to disengage from unattainable goals but have a difficult time finding new goals (see Figure 1). Low subjective well-being has been documented in other research of vulnerable individuals who tend to disengage from unattainable goals without engaging in new goals, and this effect was explained by a substantial loss of meaningful goals [21,23]. It is therefore plausible that some women in the current study have abandoned meaningful goals in the first few months following treatment for breast cancer—although they experienced it as challenging to regain their life roles beyond cancer. In addition, the higher levels of sedentary activity found among women who have difficulty disengaging and easily engage in new goals may imply that newly adopted goals do not always represent adaptive physical activities. Instead, some new goals could also be associated with increased sedentary activity, such as computer work or television watching, that may be useful as a coping strategy to manage life stress in the aftermath of cancer treatments.

Limitations
There are limitations to this research. First, it is possible that a reversed process could explain the reported cross-sectional data. For example, emotional distress or physical problems could have made it more difficult for women to engage in new goals and interfere with physical activity. However, we feel that this limitation does not compromise the overall interpretation of results, as our study did not enroll women who experienced physical health problems that could interfere with physical activity. In addition, our prospective analyses demonstrated that both goal adjustment capacities
and lifestyle activity predicted changes in emotional well-being over 3 months.

Second, the observed effects of goal adjustment capacities on changes in well-being and health were not mediated by changes in lifestyle activity. This lack of mediation may have occurred because goal adjustment capacities could already have contributed to changes in lifestyle activity shortly after diagnosis or treatment. Moreover, the correlation analyses (see Table 1) suggest that goal disengagement was associated with lower sedentary behavior 3 months later (which was independent from T1 sedentary behavior in supplemental analyses); however, these changes in sedentary behavior were unrelated to changes in well-being and health. Such a pattern of results may be observed if changes in behavior need to precede changes in well-being and health. Future research should examine these possibilities by recruiting women shortly after they have been diagnosed with breast cancer and follow them over a longer time.

Finally, this study focused on daily physical symptoms (e.g., joint pain or difficulty breathing) because such symptoms are frequently experienced among breast cancer survivors [40,41] and can represent early signs of developing diseases [44]. Nonetheless, future research should predict more severe health problems over extended time. Such research should also cover a wider range of behavioral variables, dispositional constructs, and health-relevant biological processes to illuminate the psychological processes that contribute to well-being and health among breast cancer survivors.

Conclusions

The study’s findings show evidence for a psychological mechanism that can be associated with physical and sedentary activity and predict well-being and health among breast cancer survivors. The identification of this mechanism will be helpful for scientists and practitioners who work with this population because physical activity represents a non-pharmaceutical treatment that can improve well-being and health [6,11]. However, there is a paucity of research on the psychological processes that can predict such lifestyle behaviors among breast cancer survivors [45]. Our research addresses this gap by revealing that goal adjustment capacities play a pivotal role in facilitating not only high physical activity but also low sedentary activity, and thereby protect positive affect among women with breast cancer. Moreover, given that it is possible to influence adjustment to specific goals [46], it may be beneficial to foster goal adjustment processes in clinical practice guidelines targeting health active survivorship among women diagnosed and treated for breast cancer.

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Conflict of interest

None of the authors has a conflict of interest to declare related to this project.

References

Goal adjustment, lifestyle activity, and well-being and health