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Longitudinal Associations between Coping Strategies, Locus of Control and Health-Related Quality of Life in Patients with Breast Cancer or Melanoma

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1 **Title**

2 **Longitudinal associations between Coping strategies, Locus of Control and Health-Related**
3 **Quality of Life in patients with Breast Cancer or Melanoma**

4

5 **Short running title:** Coping, Control beliefs, Quality of Life

6

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32

33 **Author Contributions**

34 Anna Toscano analyzed the data and drafted the paper; Myriam Blanchin and Véronique Sébille
35 supervised the work and revised the paper; Marianne Bourdon and Angélique Bonnaud Antignac
36 revised the paper; all authors approved the final version of the manuscript.

37

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42

43 **Abstract**

44 **Purpose**

45 A diagnosis of breast cancer or melanoma is a traumatic life event that patients have to face.
46 However, their locus of control (LOC) beliefs and coping strategies as well as the associations with
47 Health-Related Quality-of-Life (HRQoL) changes over time are still not well known and rarely
48 compared by cancer site.

49 **Methods**

50 The objective of this longitudinal study was to assess the association of LOC (Cancer Locus-of-
51 Control Scale) and coping (Brief Cope) changes, with change in HRQoL (EORTC QLQ-C30) over
52 time in newly-diagnosed breast cancer and melanoma patients at 1, 6, 12 and 24-months post-

53 diagnosis. Mixed models were used to compare LOC and coping longitudinal changes as well as
54 their associations with HRQoL changes in early-stage breast cancer and melanoma patients.

55 **Results**

56 Overall, 215 breast cancer and 78 melanoma patients participated to the study. At baseline, HRQoL
57 levels were often higher for breast cancer compared to melanoma patients. For breast cancer and
58 melanoma patients, negative coping strategies and perceived control over the course of illness were
59 negatively and positively associated with HRQoL changes, respectively. For breast cancer patients
60 only, emotional coping and internal causal attribution were negatively associated with HRQoL
61 changes. For both cancer sites, living with a partner correlated with worse HRQoL.

62 **Conclusions**

63 Understanding coping strategies and LOC beliefs used by patients soon after their cancer diagnosis
64 and over the course of illness can help identifying psychological and supportive care to modify
65 maladaptive thoughts and beliefs and promote more adaptive behaviors to ultimately improve
66 patients' well-being and HRQoL.

67 **Keywords**

68 Breast cancer; Melanoma; Coping; Locus of control; Health-related quality of life; Longitudinal
69 data.

70

71 **Total number of:** 1) text pages (including title page(s), abstract, main text, references, and figure
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74

75 **Introduction**

76 A better understanding of cancer patients' experience using Patient-reported outcomes (PRO) is
77 now deemed essential to assess treatment and health care effectiveness (1). A diagnosis of cancer is
78 a traumatic life event that patients have to cope with and which can also lead them to question

79 control beliefs about themselves, about their health, and about the future (2). As reported
80 previously, coping strategies and control beliefs can impact patients' Health-Related Quality of Life
81 (HRQoL) differently. Positive (e.g. acceptance) and negative coping (e.g. cognitive escape-
82 avoidance) strategies were found to be positively and negatively associated with HRQoL,
83 respectively, in breast cancer patients, patients with incurable cancer or with non-small-cell lung
84 carcinoma (3–7). Locus of control (LOC), as first described by Rotter (8), defines the way in which
85 individuals perceive the determinants influencing their life. It is composed of two main factors,
86 which may coexist, the external control (e.g. people who tend to believe that the outcome is
87 primarily determined by external factors beyond their influence) and the internal control (e.g.
88 people who tend to believe that their performance depends mainly on themselves). High external
89 LOC reflecting a propensity to refer to external beliefs, was related to better HRQoL in bone
90 marrow transplantation (9) but lower HRQoL in ovarian cancer patients (10), whereas high internal
91 LOC reflecting a propensity to refer to internal beliefs, was related to higher HRQoL in breast
92 cancer patients (11). Hence, depending on cancer site, the relationship between LOC, coping
93 strategies and HRQoL seems to vary (12) and the way patients face a cancer diagnosis and its
94 aftermath, as well as the impact on their HRQoL may differ. However, few empirical studies have
95 tackled this issue which questions the importance of adapting psychological care and prevention of
96 maladaptive coping and beliefs based on thoughts or behaviors related to coping strategies or LOC,
97 that have been identified as deleterious to HRQoL depending on cancer site. Hence, addressing this
98 topic could be helpful in determining whether the psychological or medical interventions that aim to
99 support the HRQoL of patients should depend on the type of cancer.

100 In the current study, we focused on two cancer sites with similar good prognosis at early stages, but
101 different surgeries, treatments, and symbolism carried by the affected organ (7,13): breast cancer
102 and melanoma. Indeed, patients with breast cancer often experience major surgery and further
103 therapy, including radio-, chemo-, or hormonal therapy and they are confronted with a disease that
104 affects an organ associated with femininity, attractiveness and fertility. By contrast, melanoma

105 patients usually experience minor surgery and a postsurgical treatment that might only involve
106 immunotherapy and they may (or not) be confronted with visible spots or scars on their body.

107 It has been reported that breast cancer and melanoma patients do not experience the same level and
108 trajectory of HRQoL with higher HRQoL for melanoma patients 24 months post-diagnosis (mpd)
109 compared to breast cancer patients (14) and an increase in HRQoL in breast cancer patients between
110 6 and 12 mpd which only occurred from 12 to 24 mpd in melanoma patients (15). These studies,
111 however, did not consider the relationship between coping, LOC, and HRQoL and longitudinal
112 studies remain scarce hence not allowing understanding changes in coping strategies, LOC and
113 HRQoL and identifying how they are related.

114 The aim of this study is to assess the association between changes in coping and LOC with HRQoL
115 changes in breast cancer and melanoma patients to highlight beneficial or deleterious coping
116 strategies and specific beliefs of control related to cancer (reflected by LOC) that could be
117 considered in future supportive patient care. We focused on patients with Stage I or II (early stage,
118 non-metastatic) to better understand the experience of a traumatic first diagnosis of cancer in order
119 to determine whether specific psychological support should be warranted according to cancer site in
120 patients with good prognosis.

121 Our main research hypothesis is that the way patients face and adapt to a cancer diagnosis, using
122 different coping strategies and locus of control, can change over time and have different impact on
123 Health-Related Quality-of-Life (HRQoL) depending on cancer site.

124 **Methods**

125 *Participants*

126 This longitudinal study aims at assessing the changes experienced by patients since diagnosis of
127 breast cancer or melanoma in the Department of Onco-Dermatology and the Cancerology Institute,
128 in Nantes, France. Patients diagnosed with a stage I or II (early stage, non-metastatic) cancer were
129 eligible for the study. The study was approved by an ethical research committee (Comité de
130 Protection des Personnes) hosted by Nantes University hospital and participants were informed

131 about the study and invited to sign an informed consent agreement. Informed consent was obtained
132 from all individual participants included in the study. Patients completed self-administered
133 questionnaires within 1, 6, 12, and 24 mpd. HRQoL, coping, LOC, sociodemographic variables, and
134 medical information were assessed during follow-up.

135

136 *Measures*

137 The EORTC quality of life questionnaire (QLQ-C30) (16), a widely-used scale in oncology studies,
138 was chosen to assess HRQoL. This scale has 30 items and we focused on the 6 functioning
139 dimensions measuring physical (PF), role (RF), emotional (EF), cognitive (CF), social (SF)
140 functioning, and global health (GH). These dimensions are composed of four or seven-point Likert
141 items and the scores range from 0 to 100. A higher score represents a higher level of HRQoL. The
142 Cancer Locus of Control scale (17) assesses specific control beliefs related to cancer. This 14-item
143 scale has 3 dimensions composed of four-point Likert items: perceived control over the course of
144 the illness (ContLOC), internal causal attribution (IntLOC), and religious control (RelLOC). A
145 higher score indicates a higher belief. Coping strategies were assessed with the 28-item Brief Cope
146 questionnaire (18,19) which measures 14 coping dimensions. Coping strategies strongly related to
147 each other were grouped together using a clustering around latent variables method (20) leading to
148 4 clusters and corresponding main strategies: Negative Coping (NegCOP) including behavioral
149 disengagement, self-blame and denial, Emotional Coping (EmoCOP) including instrumental
150 support, emotional support, venting and religion, Positive Coping (PosCOP) including active
151 coping, planning, self-distraction, positive reframing, humor and acceptance, and substance use.
152 Each cluster is composed of four-point Likert items with a higher score indicating a higher use of a
153 given main strategy to deal with stressful life events. Coping and LOC scores were standardized
154 between 0 and 100 to be on the same metric as HRQoL scores.

155 *Statistical Methods*

156 Mixed models are widely used for the analysis of data from longitudinal studies. They allow dealing
157 with repeated measurements by specifying a structure for the correlation between measurements
158 from a same patient. Mixed models can also handle incomplete data. These models include fixed
159 effects that characterize the mean behavior of the sample over time (intercept as mean value at 1-
160 mpd and time variable to assess change in our study) as well as random effects to model individual
161 variation around the mean trajectory (possibly intercept and/or time in our study to model a
162 different value at 1-mpd and/or change for each patient from the mean of the sample). The
163 correlation between measurements of the same patient measured across different occasions is taken
164 into account by specifying the structure of the variance-covariance matrix. The general procedure to
165 build a mixed model relies on different steps. First, fixed effects are specified to model the mean
166 trend in the sample containing all relevant explanatory variables. Second, random effects such as
167 random intercept and/or random time are included one-by-one in the model and the different
168 possibilities are compared using information criteria, such as Akaike Information Criteria (AIC)
169 (22). Third, models with different relevant covariance structures are compared using also
170 information criteria. Nullity of the parameters of each fixed effect is tested with a F-test. Eventually,
171 model is reduced by deleting non-significant fixed effects (mean trend and explanatory variables) to
172 obtain the best fitting model.

173 Changes of each LOC and main coping strategies were investigated using mixed models (21) by
174 cancer site. Fixed (intercept: mean score value at 1-mpd and time) and random (intercept and/or
175 time to model different score values at 1-mpd and/or changes from one patient to another from the
176 mean of the sample) effects were considered. For each dependent variable (LOC or main coping
177 strategies) and each cancer site, addition of random effects and structure for the variance-covariance
178 matrix were based on the AIC. A significant time effect resulted in considering the corresponding
179 LOC or coping variable as a time-dependent covariate in the following multivariable analyses of
180 HRQoL changes, otherwise, their values at 1-mpd were used.

181 To assess the effect of coping strategies, LOC and sociodemographic variables on HRQoL changes,
182 a mixed model was fitted on each HRQoL dimension for each cancer site. Age, level of education,
183 perceived standard of living, and living with a partner at 1-mpd were included as fixed effects. As
184 recommended, time and all potential interactions between LOC or coping and time (23) were
185 included in the fixed effects part of the model. The inclusion of the main effects as well as
186 interactions allows distinguishing between the mean effect of the covariate on HRQoL over time
187 (main effect) and a change from the mean effect at a given time (interaction with time). The
188 addition of a random intercept, or time, and the structure of the covariance matrix were based on the
189 AIC. The fixed-effect part of the best fitting model was reduced by deleting first non-significant
190 interactions and last non-significant main effects using the AIC and p-value of the Wald test. Model
191 assumptions were checked looking at the normality and homoscedasticity of the residuals. SAS 9.2
192 Proc MIXED was used for the analyses.

193

194 **Results**

195 Patients were recruited from November, 2010 to December, 2012. Overall, 215 breast cancer and 78
196 melanoma patients completed the questionnaires at 1-mpd (Table 1). Breast cancer patients were all
197 female; melanoma patients were predominantly male (58%). Patients were on average 52 years old
198 and mostly lived with a partner (82%). Based on the reporting of patients during follow-up, almost
199 all breast cancer patients had surgery (99.5%) and radiotherapy (88.8%), hormonal therapy (76.7%),
200 or chemotherapy (53.5%). Melanoma patients were almost all treated by immunotherapy (97.4%)
201 and few received chemotherapy (16.7%).

202 *Usage of coping and LOC*

203 At 1-mpd (Table 1), the ContLOC was the strongest belief and PosCOP the most used coping
204 strategy for both cancer sites. As patients rarely reported to use substance, this strategy was not
205 considered in subsequent analyses.

206 TABLE 1

207 *Longitudinal change in coping and LOC*

208 Changes over time of each LOC and main coping strategies by cancer type were first investigated.
209 For breast cancer and melanoma patients, EmoCOP and ContLOC scores significantly decreased
210 over time, indicating that patients use less and less EmoCOP and ContLOC over time. IntLOC and
211 NegCOP significantly increased over time for breast cancer and melanoma patients, respectively.
212 PosCOP significantly decreased over time for melanoma patients. All these covariates were
213 considered as time-dependent for all further analyses. The variables not changing over time were
214 considered as time-independent variables; their values at 1-mpd were used for all further analyses.

215 *Longitudinal change in HRQoL*

216 The levels of most HRQoL dimensions at 1-mpd (estimated values of the intercept in Table 2) were
217 higher for patients with breast cancer compared to patients with melanoma, except CF. Breast
218 cancer patients tend to have a better HRQoL at 1 mpd than melanoma patients.

219 *Time effect*

220 For breast cancer patients, PF, GH, RF, and SF scores decreased steeply from 1 to 6-mpd, then
221 slightly increased from 6 to 12-mpd, and remained stable from 12 to 24-mpd. Globally, during the
222 2-year follow-up (24 vs 1 mpd in Table 2), PF, RF, SF scores had an average decrease of -5.3, -7.5,
223 and -4.9 points, respectively whereas GH, EF, and CF remained globally stable. Overall, HRQoL of
224 breast cancer patients on PF, GH, RF and SF dimensions deteriorated significantly soon after
225 diagnosis, then improved significantly until 1 year after diagnosis and remained stable afterwards
226 without recovering their initial levels. By contrast, for melanoma patients, EF and PF scores linearly
227 increased (+3.3 points on average between each visit) and decreased (-2.6 points on average
228 between each visit) over time, respectively, while the other HRQoL dimensions remained stable.
229 Thus, HRQoL improved over time for EF and worsened over time for PF.

230 *Covariates' effects: common to breast cancer and melanoma*

231 NegCOP and living with a partner were negatively associated with changes in EF, SF, and RF, SF,
232 respectively. For example, an increase of 10 points in the NegCOP score (higher usage of this
233 strategy) was associated with an average decrease of 3 and 5 points in EF score (worse HRQoL on
234 this dimension) for breast cancer and melanoma patients, respectively. Moreover, ContLOC and age
235 were positively associated with changes in GH, RF, and SF, EF, respectively. As compared to other
236 patients, patients living with a partner experienced a decrease in most HRQoL dimensions (except
237 PF and CF) ranging from 7 to 18 points on average for melanoma patients and from 7 to 9 for breast
238 cancer patients for RF and SF dimensions.

239 *Covariates' effects: breast cancer*

240 For breast cancer patients, PosCOP was positively associated with EF changes. EmoCOP and
241 IntLOC were negatively associated with changes in PF, GH, SF, and EF, GH, CF, RF, respectively.
242 In addition, EmoCOP was negatively associated with breast cancer patients' EF but only at 1 mpd.
243 Change in the EF mean scores depending on the level of EmoCOP are shown in Figure 1. Patients
244 with higher scores of EmoCOP (observed third quartile of EmoCOP scores) had a lower mean level
245 of EF at 1 mpd compared to the patients with lower EmoCOP scores (first quartile). From 6-mpd,
246 the EF mean scores were higher than 1-mpd scores and similar whatever the level of EmoCOP.

247 *Covariates' effects: melanoma*

248 For melanoma patients, PosCOP was positively associated with PF changes. RelLOC was
249 negatively associated with changes in EF and SF.

250

251 **Discussion**

252 This study assessed the association of change in coping and LOC dimensions over time with change
253 in HRQoL for breast cancer and melanoma patients. For both cancer sites, PosCOP was the most
254 used coping strategy followed by EmoCOP. Moreover, ContLOC was the strongest belief followed
255 by IntLOC. The mean levels of HRQoL at 1-mpd (except for CF) were higher for breast cancer

256 compared to melanoma patients, the difference ranging from +8 to +69 points, the mean scores of
257 the RF and SF dimensions having the largest difference between the two cancer sites. This might be
258 due to the different social support perceived by patients (7) and could be related to the fact that
259 breast cancer is often fully recognized as a serious illness, whereas melanoma is often more
260 trivialized at an early stage (14). Hence, breast cancer patients might find more support from family
261 and friends than melanoma patients at diagnosis. Interestingly, our study also highlighted that
262 different coping strategies and LOC dimensions were associated with HRQoL changes and that
263 some strategies and specific beliefs were more adaptive than others; these findings were either
264 similar or different for both cancer sites.

265 NegCOP strategies such as behavioral disengagement, self-blame and denial were negatively
266 associated with HRQoL over time. It affected almost all HRQoL dimensions (except RF) for
267 melanoma patients but only EF and SF dimensions for breast cancer patients. The usage of negative
268 coping may prevent from the traumatic information processing necessary to positive adjustment
269 over time and was previously reported as being maladaptive and to correlate with worse HRQoL
270 and mood in breast cancer and melanoma patients (24–26). Similarly, IntLOC (self-attribution for
271 illness onset) correlated with worse HRQoL but only in breast cancer patients. Such feelings of self-
272 blame and counterfactual thinking are often linked with negative adjustment over time (27,28).
273 EmoCOP often consisting in the sharing of thoughts and feelings with others was also associated
274 with worse HRQoL over time for breast cancer patients. Emotionally expressive strategies, aiming
275 at managing negative emotions, can sometimes be ineffective in improving HRQoL (29,30). The
276 social sharing of thoughts and feelings may also not facilitate psychological adjustment in case of a
277 perceived unsupportive social context (31,32). Indeed, the patients' social environment (friends,
278 relatives, partner, etc.) may find it difficult to face the illness of their friend or partner over time
279 (33,34) and have negative supportive attitudes impacting coping strategies and HRQoL (2).

280 For both cancer sites, ContLOC was positively associated with HRQoL changes. It has been
281 assumed that to reach and maintain control over time, patients use some adaptive cognitive

282 compensation mechanisms, such as evaluating other domains in life or positive illusions, that seem
283 to be beneficial for psychological functioning in cancer (35). By contrast, living with a partner, was
284 negatively associated with HRQoL regarding RF and SF for both cancer sites, and also EF and GH
285 for melanoma patients. Both supportive and unsupportive or even aversive partner interactions have
286 been reported in cancer patients (36) and found to improve or reduce HRQoL, respectively, which
287 highlights the importance of investigating patient-partner dyads relationships and possibly screening
288 for problematic partner behaviors.

289 Although our study did not intend to generalize results and to make guidelines for wider
290 populations, the clinical and sociodemographic characteristics of the breast cancer and melanoma
291 patients included in our study seemed to be comparable with broader populations with these early-
292 stage cancer types. Regarding clinical psychological characteristics, we found that in our sample
293 ContLOC and PosCop were the most used coping strategy as compared to other beliefs and coping
294 strategies. These psychological characteristics were also found in other samples of breast cancer
295 patients at early stage (17). Similar results were also found in other studies (e.g., for acceptance,
296 active coping, planning, and positive reframing) in breast cancer (5) and melanoma patients (26).

297 ***Clinical implications***

298 Current medical guidelines addressing HRQoL usually do not take into account the heterogeneity of
299 psychological experiences depending on the cancer site and our results can provide new directions
300 regarding psychological support. When facing cancer diagnosis, patients can experience several
301 negative emotions (anger, shame, frailty...). The sense of self-blame or self-attribution for illness
302 onset must be evaluated to better support patients using maladaptive coping strategies or having
303 detrimental specific control beliefs about cancer to eventually improve their HRQoL. This could
304 suggest psychosocial interventions such as cognitive restructuring or problem-solving techniques to
305 help patients identify maladaptive thoughts and replace them with more adaptive ones, or to seek
306 alternatives solutions or define realistic goals to cope with the situation (37). Also, it could be useful
307 to work on the acceptance of experiencing negative emotions and to maintain a sense of perceived

308 control. Acceptance and Commitment Therapy (ACT) could be relevant as it may help to increase
309 perceived control over the disease which was shown to correlate with better HRQoL in our study.
310 ACT aims at increasing psychological flexibility which can improve psychological adjustment and
311 HRQoL (38).

312 Furthermore, it is necessary to also take into consideration partners' mental state due to the illness,
313 to propose dyadic social support for example. Psycho-educational approach could be relevant with
314 interventions aiming at providing information about the disease and its consequences to patients and
315 their relatives to help them sharing their experience about cancer and its treatments, and to better
316 understand and accept its consequences on their daily lives.

317 *Study limitations*

318 The study was based on a sample of breast cancer and melanoma patients at early stage (stage I and
319 II, classified using the TNM classification system), diagnosed for the first time for breast cancer or
320 melanoma, with an age ranging from 18 to 65. Hence, generalization to older patients and to
321 patients with more severe stages cannot be made. Patients with chronic and/or psychiatric condition,
322 addiction (e.g. alcohol or drugs use) or undergoing antidepressant treatment for more than three
323 months were excluded as well as patients having chronic pain syndrome with an antalgic treatment
324 for more than three months before the diagnosis of cancer. Unfortunately, we do not have the
325 information and how many patients were screened but did not meet the criteria for inclusion. Since
326 the sample of breast cancer patients was composed only of women and the sample of melanoma
327 patients included men and women, gender and cancer site effects might be confounded. Also,
328 although our findings support an association between coping, LOC and HRQoL changes, causality,
329 but also reverse causality cannot be confirmed nor ruled out (39, 40). Finally, there weren't
330 sufficiently detailed information on the patients' treatments, use of psychological support or on the
331 partners' experience which may interfere with patients' LOC, coping and HRQoL.

332 In conclusion, our study supports the evidence that different coping strategies and specific beliefs of
333 control related to cancer reflected by LOC are associated with HRQoL changes for breast cancer

334 and melanoma patients. A better understanding of the coping strategies and LOC used by patients
335 soon after their cancer diagnosis and over the course of illness can help identifying psychological
336 and supportive care to modify maladaptive thoughts and beliefs and promote more adaptive
337 behaviors to ultimately improve patients' well-being and HRQoL.

338

339 **References**

- 340 1. Basch E. Patient-Reported Outcomes — Harnessing Patients' Voices to Improve Clinical
341 Care. *N Engl J Med*. 2017;376(2):105–8.
- 342 2. Lepore SJ. A social–cognitive processing model of emotional adjustment to cancer. In:
343 Baum A, Andersen BL, editors. *Psychosocial interventions for cancer*. Washington, DC, US:
344 American Psychological Association; 2001. p. 99–116.
- 345 3. Nipp RD, El-Jawahri A, Fishbein JN, Eusebio J, Stagl JM, Gallagher ER, et al. The
346 relationship between coping strategies, quality of life, and mood in patients with incurable cancer.
347 *Cancer*. 2016;122(13):2110–6.
- 348 4. Chabowski M, Jankowska-Polańska B, Lomper K, Janczak D. The effect of coping strategy
349 on quality of life in patients with NSCLC. *Cancer Manag Res*. 2018;10:4085–93.
- 350 5. Stanton AL, Danoff-Burg S, Cameron CL, Bishop M, Collins CA, Kirk SB, et al.
351 Emotionally expressive coping predicts psychological and physical adjustment to breast cancer. *J*
352 *Consult Clin Psychol*. 2000;68(5):875–82.
- 353 6. Avis NE, Crawford S, Manuel J. Quality of life among younger women with breast cancer. *J*
354 *Clin Oncol Off J Am Soc Clin Oncol*. 2005;23(15):3322–30.
- 355 7. Lehto U-S, Ojanen M, Kellokumpu-Lehtinen P. Predictors of quality of life in newly
356 diagnosed melanoma and breast cancer patients. *Ann Oncol Off J Eur Soc Med Oncol*.
357 2005;16(5):805–16.
- 358 8. Rotter JB. Generalized expectancies for internal versus external control of reinforcement.
359 *Psychol Monogr*. 1966;80(1):1–28.
- 360 9. Broers S, Kaptein AA, Le Cessie S, Fibbe W, Hengeveld MW. Psychological functioning
361 and quality of life following bone marrow transplantation: a 3-year follow-up study. *J Psychosom*
362 *Res*. 2000;48(1):11–21.
- 363 10. Brown AJ, Sun CC, Urbauer DL, Bodurka DC, Thaker PH, Ramondetta LM. Feeling
364 powerless: Locus of control as a potential target for supportive care interventions to increase quality
365 of life and decrease anxiety in ovarian cancer patients. *Gynecol Oncol*. 2015;138(2):388–93.
- 366 11. Pahlevan Sharif S. Locus of control, quality of life, anxiety, and depression among
367 Malaysian breast cancer patients: The mediating role of uncertainty. *Eur J Oncol Nurs Off J Eur*
368 *Oncol Nurs Soc*. 2017;27:28–35.

- 369 12. Lashbrook MP, Valery PC, Knott V, Kirshbaum MN, Bernardes CM. Coping Strategies
370 Used by Breast, Prostate, and Colorectal Cancer Survivors: A Literature Review. *Cancer Nurs.*
371 2018;41(5):E23–39.
- 372 13. Schmidt JL, Wetzel CM, Lange KW, Heine N, Ortman O. Patients' experience of breast
373 reconstruction after mastectomy and its influence on postoperative satisfaction. *Arch Gynecol*
374 *Obstet.* 2017;296(4):827–34.
- 375 14. Engel J, Schlesinger-Raab A, Emeny R, Hölzel D, Schubert-Fritschle G. Quality of life in
376 women with localised breast cancer or malignant melanoma 2 years after initial treatment: a
377 comparison. *Int J Behav Med.* 2014;21(3):478–86.
- 378 15. Bourdon M, Blanchin M, Tessier P, Campone M, Quéreux G, Dravet F, et al. Changes in
379 quality of life after a diagnosis of cancer: a 2-year study comparing breast cancer and melanoma
380 patients. *Qual Life Res Int J Qual Life Asp Treat Care Rehabil.* 2016;25(8):1969–79.
- 381 16. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European
382 Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use
383 in international clinical trials in oncology. *J Natl Cancer Inst.* 1993;85(5):365–76.
- 384 17. Cousson-Gélie F, Irachabal S, Bruchon-Schweitzer M, Dilhuydy JM, Lakdja F. Dimensions
385 of cancer locus of control scale as predictors of psychological adjustment and survival in breast
386 cancer patients. *Psychol Rep.* 2005;97(3):699–711.
- 387 18. Carver CS. You want to measure coping but your protocol's too long: consider the brief
388 COPE. *Int J Behav Med.* 1997;4(1):92–100.
- 389 19. Muller L, Spitz E. Multidimensional assessment of coping: validation of the Brief COPE
390 among French population. *L'Encéphale.* 2003 Dec;29(6):507–18.
- 391 20. Vigneau E, Qannari EM. Clustering of Variables Around Latent Components. *Commun Stat*
392 *- Simul Comput.* 2003;32(4):1131–50.
- 393 21. Verbeke G, Molenberghs G. *Linear Mixed Models for Longitudinal Data.* Berlin: Springer;
394 2000. 568 p.
- 395 22. Akaike H. A new look at the statistical model identification. *System identification and time-*
396 *series analysis.* *IEEE Trans Autom Control.* 1974;19(6):716–23.
- 397 23. Cheng J, Edwards LJ, Maldonado-Molina MM, Komro KA, Muller KE. Real longitudinal
398 data analysis for real people: building a good enough mixed model. *Stat Med.* 2010;29(4):504–20.
- 399 24. Brennan J. Adjustment to cancer - coping or personal transition? *Psychooncology.*
400 2001;10(1):1–18.
- 401 25. Brunault P, Champagne A-L, Huguet G, Suzanne I, Senon J-L, Body G, et al. Major
402 depressive disorder, personality disorders, and coping strategies are independent risk factors for
403 lower quality of life in non-metastatic breast cancer patients. *Psychooncology.* 2016;25(5):513–20.
- 404 26. Tesio V, Ribero S, Castelli L, Bassino S, Leombruni P, Caliendo V, et al. Psychological
405 characteristics of early-stage melanoma patients: a cross-sectional study on 204 patients. *Melanoma*
406 *Res.* 2017;27(3):277–80.

- 407 27. Frazier P, Berman M, Steward J. Perceived control and posttraumatic stress: A temporal
408 model. *Appl Prev Psychol*. 2001;10(3):207–23.
- 409 28. Pagnini F, Bercovitz K, Langer E. Perceived control and mindfulness: Implications for
410 clinical practice. *J Psychother Integr*. 2016;26(2):91–102.
- 411 29. Gilbertson-White S, Campbell G, Ward S, Sherwood P, Donovan H. Coping With Pain
412 Severity, Distress, and Consequences in Women With Ovarian Cancer. *Cancer Nurs*.
413 2017;40(2):117–23.
- 414 30. Khalili N, Farajzadegan Z, Mokarian F, Bahrami F. Coping strategies, quality of life and
415 pain in women with breast cancer. *Iran J Nurs Midwifery Res*. 2013;18(2):105–11.
- 416 31. Lepore SJ, Revenson TA. Social Constraints on Disclosure and Adjustment to Cancer. *Soc*
417 *Personal Psychol Compass*. 2007;1(1):313–33.
- 418 32. Boinon D, Sultan S, Charles C, Stulz A, Guillemeau C, Delalogue S, et al. Changes in
419 psychological adjustment over the course of treatment for breast cancer: the predictive role of social
420 sharing and social support. *Psychooncology*. 2014;23(3):291–8.
- 421 33. Ginter AC, Braun B. Social support needs of breast cancer patients without partners. *J Soc*
422 *Pers Relatsh*. 2019;36(1):43–62.
- 423 34. Li Q, Loke AY. A literature review on the mutual impact of the spousal caregiver-cancer
424 patients dyads: “communication”, “reciprocal influence”, and “caregiver-patient congruence.” *Eur J*
425 *Oncol Nurs Off J Eur Oncol Nurs Soc*. 2014;18(1):58–65.
- 426 35. Ranchor AV, Wardle J, Steptoe A, Henselmans I, Ormel J, Sanderman R. The adaptive role
427 of perceived control before and after cancer diagnosis: A prospective study. *Soc Sci Med*.
428 2010;70(11):1825–31.
- 429 36. Coker AL, Follingstad DR, Garcia LS, Bush HM. Partner interfering behaviors affecting
430 cancer quality of life. *Psychooncology*. 2017;26(8):1205–14.
- 431 37. Gudenkauf LM, Ehlers SL. Psychosocial interventions in breast cancer survivorship care.
432 *Breast Edinb Scotl*. 2018 Apr;38:1–6.
- 433 38. Hulbert-Williams NJ, Storey L. Psychological flexibility correlates with patient-reported
434 outcomes independent of clinical or sociodemographic characteristics. *Support Care Cancer Off J*
435 *Multinatl Assoc Support Care Cancer*. 2016;24(6):2513–21.
- 436 39. Danhauer SC, Crawford SL, Farmer DF, Avis NE. A longitudinal investigation of coping
437 strategies and quality of life among younger women with breast cancer. *J Behav Med*. 2009
438 Aug;32(4):371–9.
- 439 40. Paek M-S, Ip EH, Levine B, Avis NE. Longitudinal Reciprocal Relationships Between
440 Quality of Life and Coping Strategies Among Women with Breast Cancer. *Ann Behav Med Publ*
441 *Soc Behav Med*. 2016;50(5):775–83.

442

443

	All the patients (N=293)	Breast cancer patients (N=215)	Melanoma patients (N=78)
	n(%)	n(%)	n(%)
<i>Gender</i>			
Female	248 (84.6%)	215 (100%)	33 (42.3%)
<i>Living with a partner</i>			
Yes	240 (81.9%)	178 (82.8%)	62 (79.5%)
Missing data	2 (0.7%)	2 (0.9%)	0 (0.0%)
<i>Education</i>			
> Elementary school	245 (83.6%)	181 (84.2%)	64 (82.0%)
Missing data	4 (1.4%)	4(1.9%)	0 (0.0%)
<i>Standard of living</i>			
High	36 (12.3%)	24 (11.2%)	12 (15.4%)
Intermediate	236 (80.5%)	175 (81.4%)	61 (78.2%)
Low	16 (5.5%)	12 (5.6%)	4 (5.1%)
Missing data	5 (1.7%)	4 (1.9%)	1 (1.3%)
	Mean (SD)	Mean (SD)	Mean (SD)
<i>Age</i> (years)	52.2 (9.9)	53.0 (8.6)	51.3 (12.7)
<i>Coping dimensions</i>			
NegCOP	16.0 (15.6)	16.6 (16.6)	14.4 (12.1)
EmoCOP	36.0 (17.8)	38.2 (18.2)	30.4 (15.4)
PosCOP	50.6 (16.6)	50.7 (17.4)	50.6 (14.4)
SUBUSE	6.5 (15.6)	6.0 (14.9)	7.7 (17.3)
<i>LOC dimensions</i>			
IntLOC	31.6 (21.2)	32.4 (21.9)	29.4 (19.5)
ConLOC	67.8 (19.6)	67.2 (20.5)	69.1 (16.8)
RelLOC	13.3 (21.2)	13.7 (21.4)	12.1 (21.0)

NegCOP: negative coping; EmoCOP: emotional coping; PosCOP: positive coping; SUBUSE: substance use; IntLOC: internal locus of control; ConLOC: control over the course of the illness; RelLOC: religious locus of control. Range of the coping and locus of control scores: 0-100

444 **Table 1.** Characteristics of breast cancer and melanoma patients within 1 month post-diagnosis

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Table 2. Results of the multivariate analyses of the coping, locus of control and sociodemographic variables on the dimensions of Health-Related Quality of Life

	Emotional Functioning (EF)				Physical Functioning (PF)				Global Health (GH)			
	Breast cancer		Melanoma		Breast cancer		Melanoma		Breast cancer		Melanoma	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Intercept	59.58**	8.18	33.74*	9.75	95.57**	2.05	88.04**	3.80	67.71**	2.94	33.16**	7.76
NegCOP	-0.27*	0.07	-0.50**†	0.10	--	--	-0.57**†	0.13	--	--	-0.23*†	0.08
EmoCOP	-0.30**†	0.05	--	--	-0.06*†	0.03	--	--	-0.11*†	0.04	--	--
PosCOP	0.15*	0.07	--	--	--	--	0.19*†	0.05	--	--	--	--
IntLOC	-0.12*†	0.04	--	--	--	--	--	--	-0.13*†	0.03	--	--
ConLOC	--	--	0.28*†	0.08	--	--	--	--	0.15*†	0.04	0.21*†	0.07
RelLOC	--	--	-0.24*	0.08	--	--	--	--	--	--	--	--
Age	0.34*	0.13	0.42*	0.14	--	--	--	--	--	--	0.41*	0.12
Living with a partner	--	--	-13.50*	4.28	--	--	--	--	--	--	-10.16*	3.66
Standard of living	--	--	--	--	--	--	--	--	7.34*	2.76	--	--
Time	--	--	--	--	--	--	--	--	--	--	--	--
6 vs 1 mpd			3.30*	1.20	-12.37**	1.15	-2.62*	0.97	-6.87*	1.74	--	--
12 vs 6 mpd			3.30*	1.20	5.28**	0.94	-2.62*	0.97	6.88**	1.32	--	--
24 vs 12 mpd			3.30*	1.20	1.76*	0.66	-2.62*	0.97	0.45	1.24	--	--
24 vs 1 mpd			9.89*	3.59	-5.33**	0.92	-7.85*	2.91	0.46	1.63	--	--
Interactions between EmoCOP and time	0.22** (6 mpd)	0.04										
	0.26** (12 mpd)	0.04	--	--	--	--	--	--	--	--	--	--
	0.22** (24 mpd)	0.05	--	--	--	--	--	--	--	--	--	--
Interactions between NegCOP and time	--	--	--	--	--	--	0.13*	0.05	--	--	--	--

Table 2 (Continued)

	Cognitive Functioning (CF)				Role Functioning (RF)				Social Functioning (SF)			
	Breast cancer		Melanoma		Breast cancer		Melanoma		Breast cancer		Melanoma	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Intercept	66.59**	7.18	91.01**	2.10	92.72**	4.47	23.91	12.35	87.55**	7.26	38.13*	10.72
NegCOP	--	--	-0.36**†	0.08	--	--	--	--	-0.20*	0.06	-0.31*†	0.12
EmoCOP	--	--	--	--	--	--	--	--	-0.13*†	0.04	--	--
IntLOC	-0.14*†	0.04	--	--	-0.12*†	0.05	--	--	--	--	--	--
ConLOC	--	--	--	--	0.10*†	0.05	0.25*†	0.10	--	--	0.25*†	0.09
RelLOC	--	--	--	--	--	--	--	--	--	--	-0.19*	0.09
Age	0.37*	0.13	--	--	--	--	0.61*	0.19	0.31*	0.12	0.52*	0.16
Living with a partner	--	--	--	--	-8.79*	3.05	-13.38*	5.78	-6.73*	2.80	-17.53*	4.95
Time	--	--	--	--	--	--	--	--	--	--	--	--
6 vs 1 mpd					-17.79**	2.21			-14.39**	1.76		
12 vs 6 mpd					10.17**	2.00			7.58**	1.90		
24 vs 12 mpd					0.10	1.63			1.94	1.71		
24 vs 1 mpd					-7.52*	2.02			-4.87*	1.57		

* p-value<0.05

** p-value <0.0001

†=Time-dependent variable.

Reference levels: household living standard: low intermediate, education: ≤ certificate of elementary school, living with a partner: no, time: time 1. mpd: months post-diagnosis; NegCOP: negative coping; EmoCOP: emotional coping; PosCOP: positive coping; IntLOC: internal locus of control; ConLOC: control over the course of the illness; RelLOC: religious locus of control.

Figure

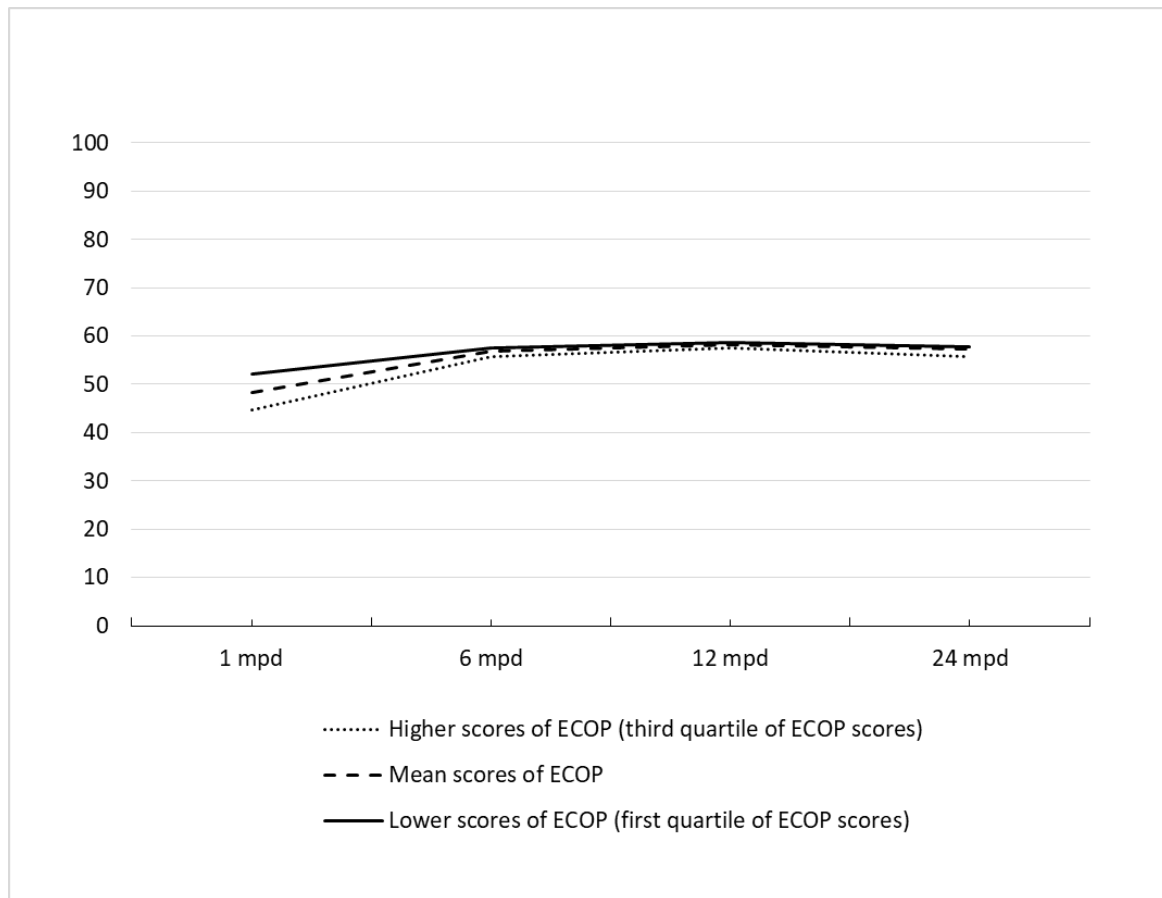


Figure 1. Mean scores of emotional functioning over time according to the level of emotional coping in breast cancer patients. *EF* emotional functioning, *ECOP* emotional coping, *mpd* months postdiagnosis. Observed levels of emotional coping in the sample: mean: 39.9, 1st quartile: 25, 3rd quartile: 50