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ORIGINAL ARTICLE

Identifying trajectory clusters in breast cancer survivors' supportive care needs, psychosocial difficulties, and resources from the completion of primary treatment to 8 months later

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Abstract

Purpose This study aimed to chart patterns of simultaneous trajectories over 8 months in breast cancer survivors' (BCS) supportive care needs, psychological distress, social support, and posttraumatic growth. Clusters of BCS among these trajectories were identified and characterized.

Methods Of 426 BCS study participants, 277 (65 %) provided full assessments in the last week of primary cancer treatment and 4 and 8 months later. Latent trajectories were obtained using growth mixture modeling for patients who responded to all scores for at least one time point (n=348). Then, classification of BCS was performed by hierarchical agglomerative clustering on axes derived from a multiple factor analysis of trajectory assignments. Self-esteem, attachment security, and satisfaction with care were assessed at baseline.

Results Four trajectory clusters were identified, including two BCS subgroups (63 %) with low needs and low psychological distress. Two others (37 %) exhibited high or increasing needs and concerning levels of psychological distress. These latter clusters were characterized by higher insecure attachment, lower satisfaction with care, and either lower education or younger age, and having undergone chemotherapy.

Conclusion More than a third of BCS present unfavorable patterns in supportive care needs over 8 months after primary cancer treatment. Identified psychosocial and cancer care characteristics point to targets for enhanced BCS supportive care.

Keywords Breast neoplasms · Patient care management · Longitudinal studies · Trajectory · Cluster analysis · Supportive care needs

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Introduction

Supportive care can be defined as care that helps a person with cancer and his/her family cope with cancer and its treatment along the disease trajectory [1]. Supportive care must be adapted to the individual's own specific and evolving care needs. However, current information on the needs experienced by breast cancer survivors (BCS) relies essentially on data analyzed at the group level, using averaged values from all patients [2–5]. So, distinctive individual or subgroup variation in patterns of change in unmet needs remains obscure. Furthermore, a paucity of studies has addressed psychosocial factors in relation to BCS evolving care needs [6].

After completion of primary cancer treatment, BCS often experience various persisting symptoms [7], decreased physical functioning [8], and restriction in overall quality of life

[9]. However, feelings of positive changes in one's life may also result from this challenging life experience [10]. For example, a revision of one's life priorities, a new sense of closeness to others, or an enhanced self-esteem for having handled the plight of illness may indicate "posttraumatic growth" [11]. Yet, a significant number of BCS may still face persistent psychological distress. Depending on assessment times or methods, figures ranging from 35 to 50 % have been provided [12, 13]. The population of BCS has steadily increased over the past decades [14]. Hence, attention to care and support is particularly required for this group of cancer survivors.

Few longitudinal studies [2–5] have specifically addressed BCS needs over the first months after completion of primary treatment (i.e., surgery, radiotherapy with or without chemotherapy) while still undergoing possible endocrine treatment or targeted therapy. This phase represents a transition to life without the close medical monitoring and social support of oncology services [15]. The dense medical attention conveyed during hospital treatment abruptly vanishes while a number of care needs may still be present [2–5, 16, 17]. How these needs are managed in this period may affect future psychological well-being; indeed, psychological distress in the year after BC surgery has been shown to predict impaired psychological status at 6 years of BC survivorship [18].

Following a BC diagnosis, different trajectories of change in psychological distress [19–22] or posttraumatic growth [23, 24] have been observed, including individuals who remain stable (low or high), increase or decrease on indicators of these phenomena. Psychological distress may affect needs [3, 5], so related patterns of evolving needs may arise along with other psychological outcomes. Moreover, as social support provided by health-care providers, family, friends, or peer BC patients [15] often fades away after hospital cancer treatment, the perception of social support may also change.

The primary objective of this study was to chart patterns of change in supportive care needs, psychological distress, posttraumatic growth, and social support during the 8-month period after completion of primary BC treatment.

From co-occurring trajectory profiles among these outcomes, we distinguished independent clusters of BCS with common and interacting difficulties, personal resources, or care needs, which would indicate specific supportive care recommendations for each cluster. We hypothesized four trajectory clusters, including BCS who remain stable (low or high), or decrease or increase on these combined outcomes.

A second aim of this study was to identify potential psychosocial factors related to unfavorable BCS patterns of change after primary treatment. Self-esteem [25] and secure relationship attachment style [26] may be related to the utilization of support and so positively related to the provision of one's care needs. In addition, patient satisfaction may also allow for the reduction of care needs [27]. Information on these hypothesized factors was expected to further inform targets for enhanced supportive cancer care among BCS.

Patients and methods

Data were collected through a longitudinal observational study over 8 months. Between the fourth and 8 months after the completion of BC treatment, an initial cancer surveillance consultation is planned in our hospital. Consecutive recruitment took place between March 2012 and February 2013 at Curie Institute (Paris). Approval from the national *Comité consultatif sur le traitement de l'information en matière de recherche dans le domaine de la santé* (CCTIRS) was obtained.

Patients were invited to participate in the study during the last week of radiotherapy (T1), which was the last hospital primary cancer treatment for all eligible women in this study. Upon agreement to participate, a written informed consent form was signed, and self-reported questionnaires were handed out to be completed at T1, 4 (T2), and 8 (T3) months later and to be returned within 2 weeks of completion.

Inclusion criteria included being aged 18 years or older, diagnosis of local or loco-regional non-metastatic BC, and having undergone surgery with or without chemotherapy. Exclusion criteria comprised linguistic or severe cognitive difficulties or BC recurrence.

Data collected and measures

Medical and socio-demographic data, including age, marital status (being married/with a partner versus single or widowed), educational level (lower than high school, high school/technical school, or university), occupation (currently full- or part-time active versus other), BC stage (stage 0 to III), type of surgery (mastectomy or lumpectomy), axillary node dissection performed, chemotherapy undergone, and possible endocrine therapy initiated, were collected from medical charts.

Outcomes

Psychosocial outcomes were assessed at the last week of radiotherapy and 4 and 8 months later. *Supportive care needs* were assessed by the 34-item Supportive Care Needs Survey [28] including five care need subscales: "Physical and Daily Living," "Psychological," "Health System and Information," "Patient Care and Support," and "Sexuality." *Psychological distress* was evaluated using the 14-item Hospital Anxiety and Depression Scale (HADS) [29] comprising two subscales measuring either anxiety or depressive symptoms. *Posttraumatic growth* was measured with the 21-item Posttraumatic

Growth Inventory (PTGI) [30] assessing the degree to which positive change has occurred in one's life as a result of a stressful life event (here the diagnosis of BC) with five subscales: "Relating to Others," "New Possibilities," "Personal Strength," "Spiritual Change," and "Appreciation of Life." *Social support* was measured with the six-statement Social Support Questionnaire (SSQ-6) [31] including a scale inquiring about the average number of supportive persons in the women's social circle and a scale assessing satisfaction with this social support.

Independent variables

Psychosocial factors were assessed at baseline. *Self-esteem* was evaluated with the Rosenberg Self-Esteem Scale (RSES) [32]. *Attachment security* was measured by the Experiences in Close Relationship Inventory (ECR-16) [33] which assesses attachment anxiety (fear of rejection and abandonment) and avoidance (discomfort with closeness and defensive independence from others). *Satisfaction with care* was measured using the doctors' subscale of the EORTC in-patient satisfaction questionnaire (EORTC IN-PATSAT-32) validated internationally [34]. Detailed information of questionnaire content and psychometric properties is provided online (Appendix 1).

Statistical analysis

Growth mixture modeling (GMM) was carried out to identify trajectories (i.e., changes in questionnaire scores over the 8-month period) among outcomes, including the BCS' response scores derived from the supportive care needs, psychological distress, posttraumatic growth, and social support subscales. Mplus© version 7.2 was used. GMM allows for identifying latent classes of individuals evolving differently through time [35]. Expectation-maximization (EM) algorithm was used for parameter estimation. Missing values across assessment time-points were handled by using a full-information maximum likelihood method (FIML) under missing at random assumption [36]. For each outcome, we used fit criteria to identify the most satisfying one-, two-, three-, or four-class models, testing for quadratic and linear shapes, slope growth factor variance, and equality of residual variances across classes. Then, the appropriate number of classes was selected according to the following five criteria listed in order of priority: (1) a smallest class size greater than 4 % of the total sample, (2) clinical interpretability, (3) a smallest "Sample-Size Adjusted Bayesian Information Criteria" (SABIC) [37–39], (4) model convergence, and (5) an entropy closest to 1 representing that each patient can clearly be assigned to a given trajectory [40].

For each outcome, individuals were assigned to their most probable trajectory. Trajectories were then analyzed using an exploratory Multiple Factor Analysis (MFA) [41], followed by a Hierarchical Agglomerative Clustering (HAC) on all factors in order to obtain clusters of individuals. MFA and HAC were performed with the *FactomineR* package in R© software [42].

Chi-square or Fisher tests ($p<0.05$) were used to determine whether trajectory profiles were globally associated with each cluster, and proportions of BCS in each trajectory were compared between each cluster and the overall sample ($p<0.05$ with Bonferroni's correction).

Finally, bivariate comparisons between clusters and the total sample according to baseline socio-demographic, clinical, and psychological data were performed using chi-square tests and analysis of variance (ANOVA) ($p<0.05$). In MFA, subjects with missing trajectories were excluded from the analysis, resulting in 348 women out of 360 (97 %) available for analyses. Detailed information of statistical analyses is provided online (Appendix 2).

Results

Sample characteristics

Of 426 women approached, 360 (85 %), 317 (74 %), and 283 (66 %) returned questionnaires at T1, T2, and T3, respectively (Fig. 1), while 277 (65 %) patients returned questionnaires at all time-points.

BCS who dropped out at T2 or T3 did not differ from complete cases on most socio-demographic, clinical characteristics, or baseline questionnaire responses, except for posttraumatic subscales, for which incomplete cases had statistically significant higher baseline scores ($p<0.05$). Mean (SD) age was 55 (12) years, and 61 % had education at the university level. Most BCS had been diagnosed with stage 0 or I breast cancer (10 and 47 %, respectively), 21 % underwent a mastectomy, 46 % were treated by chemotherapy, and 73 % had initiated endocrine treatment (Table 1) (Detailed descriptive data are provided online in Appendix 3).

Identification of trajectory profiles

A trajectory represents changes in BCS questionnaire scores over the 8-month period following completion of primary treatment. In most instances, three distinct trajectories were identified for levels of care needs, psychological distress, social support, or posttraumatic growth. In contrast, only two distinct trajectories were identified for the number of persons for social support, scores of depression, and one aspect of posttraumatic growth (the perception of new possibilities). Overall, the satisfaction level of social support was high, precluding a distinction between different trajectories for this assessment.

Detailed fit indices for selecting the number of trajectories are provided online (Appendix 4).

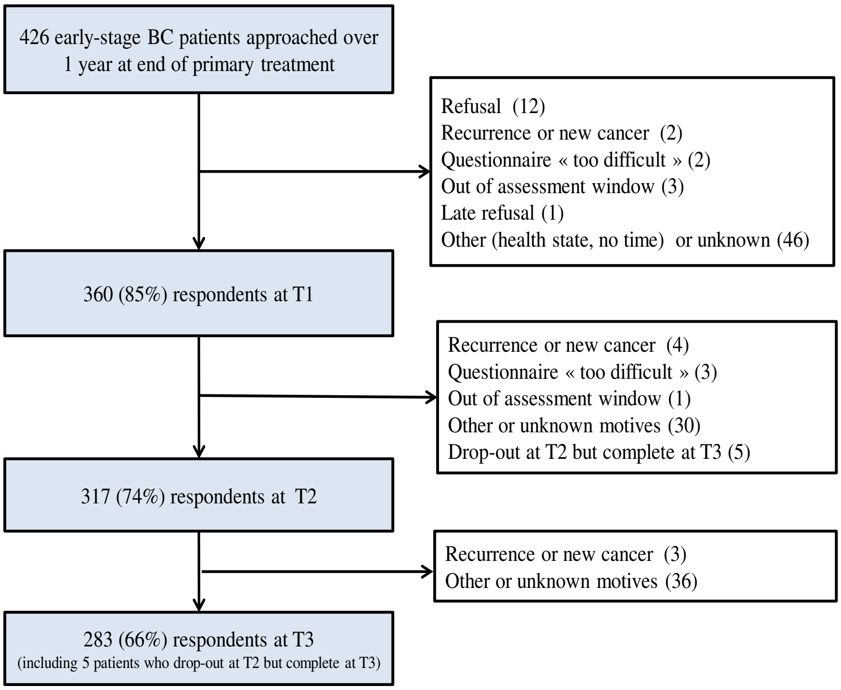


Fig. 1 Study sampling and attrition

As depicted in Fig. 2a, the intensity of psychological needs evolved along three time-stable trajectories of low, medium, and high need scores (on a 0 to 100 scale), comprising 34, 48, and 18 % of BCS, respectively, with average need scores of 15, 40, and 70. Figure 2b displays the average number of persons in the BCS social support circle; two trajectories were identified: one with 37 % BCS showing a slightly decreasing moderate support starting above four persons and another with 63 % BCS showing a low time-stable two-person support (Fig. 2b).

Graphs of trajectory profiles for all outcome subscales are provided and described online (Appendix 5).

Clustering of trajectory profiles

BCS were classified according to similarity of their trajectories for supportive care needs, psychological distress, number of persons in the supportive circle, and posttraumatic growth aspects. Four clusters of BCS were identified according to common trajectories (Fig. 3a, b), featuring supportive care needs and psychological distress as the first component (x axis) and social support and posttraumatic growth as the second component (y axis). Values above 0 (0 = no correlation) on the right of the graphs indicate higher correlations with trajectories of high needs and high distress, and values above 0 on the upper area of the graphs indicate higher correlations with trajectories of low social support and posttraumatic growth trajectories. Dots represent subjects' coordinates according to the two components.

In the lower left area of the graph in Fig. 3a, a first group of BCS (34 % of the sample) may be labeled "supported" because most BCS in this group report the highest social support. A second group labeled "resilient" (29 % of the sample), reports lower social support on average than the first group. The "supported" and "resilient" groups present low anxiety and depression levels across all time-points and mostly low care need trajectories.

The two other groups in the right area of the graph in Fig. 3b have higher care need trajectories. Women in the "borderline" group (32 % of the sample) present possible subclinical anxiety and depression (scores between 8 and 10). The last group labeled "chronic distress" (5 % of the sample) presents an elevated, possibly clinical, anxiety trajectory (scores above 10 for all women) and mostly higher depression trajectory than other subgroups.

Table 2 provides the proportions of BCS in each trajectory profile by cluster. Clusters that are significantly different in proportions from the overall sample for a specific trajectory are highlighted in bold. For example, more than 90 % (117 of 128) of BCS evolving along the highest trajectory in the number of persons for social support belongs to the "supported" subgroup. In contrast, the "borderline" and "chronic distress" subgroups comprise 83 % (52 of 63) of BCS presenting a high trajectory in psychological care needs. The "borderline" subgroup is also characterized by lower social support compared to the overall sample.

Baseline characteristics of trajectory profiles clusters

Women in the "supported" group are characterized by a younger age, a higher educational level, and lower scores for avoidant attachment style (Table 3). BCS in the "resilient"

Table 1 Baseline sample respondents' characteristics (*N*=360)

	Mean	SD	%
Age, years	55.2	(12.4)	
Married/common law			57
Education, university level			61
Occupation (currently active at least a part-time)			22
Breast cancer stage			
0			10.1
I			47
II			33
III			9.9
Mastectomy (yes)			21.1
Axillary dissection (yes)			41.4
Chemotherapy (yes)			45.6
Endocrine treatment initiated (yes)			73.0
Anxious attachment [range 1–7]	3	1.3	
Avoidant attachment [range 1–7]	3.2	1.1	
Satisfaction with care [range 0–100]			
Technical skills	76.9	18.4	
Interpersonal skills	60.7	26.2	
Information provision	65.2	24.3	
Availability	61.3	23.2	
Supportive care needs [range 0–100]			
Physical and daily living	31.2	23	
Psychological	36.2	24.5	
Care and support	27.8	16.6	
Health system and information	35	18.2	
Sexual difficulties	28	31.7	
Anxiety [range 1–21]			
Borderline (8–10)			25.4
Clinical (>10)			21
Depression [range 1–21]			
Borderline (8–10)			14.8
Clinical (>10)			10.9
Self-esteem [range 0–30], high (>25)			37.9
Social support [range 1–6]			
Number of supportive persons	3.2	1.9	
Degree of satisfaction	5.2	0.8	
Posttraumatic growth			
Relating to others range [range 0–35]	19	7.6	
New possibilities [range 0–25]***	10.1	6.1	
Personal strength [range 0–20]*	9.6	5	
Spiritual change [range 0–10]**	3	3.1	
Appreciation of life [range 0–15]	8.5	3.9	

Cronbach's alpha for all scales ≥0.70. Higher questionnaire scores indicates higher insecure attachment, higher anxiety or depression, higher self-esteem, higher satisfaction with care, higher supportive care needs, higher social support, or higher change in posttraumatic growth

SD standard deviation

*$p<0.05$, *$p<0.01$, *$p<0.001$, significantly higher scores in incomplete cases over assessment times than in complete cases

group are older and have a lower rate of chemotherapy, lower scores on anxious attachment style, and a higher satisfaction with doctors' care. Women in the "borderline" group present a lower educational level, lower satisfaction with doctors' care, and higher scores for insecure attachment style, especially of the anxious type. The "chronic distress" group comprises the highest rate of chemotherapy (68 %), the highest scores of both anxious and avoidant attachment style, and additionally lower self-esteem scores.

Discussion

Four groups of BCS evidencing differentiated patterns of combined changes in supportive care needs, psychological distress, social support, and posttraumatic growth were identified over 8 months after hospital primary cancer treatment.

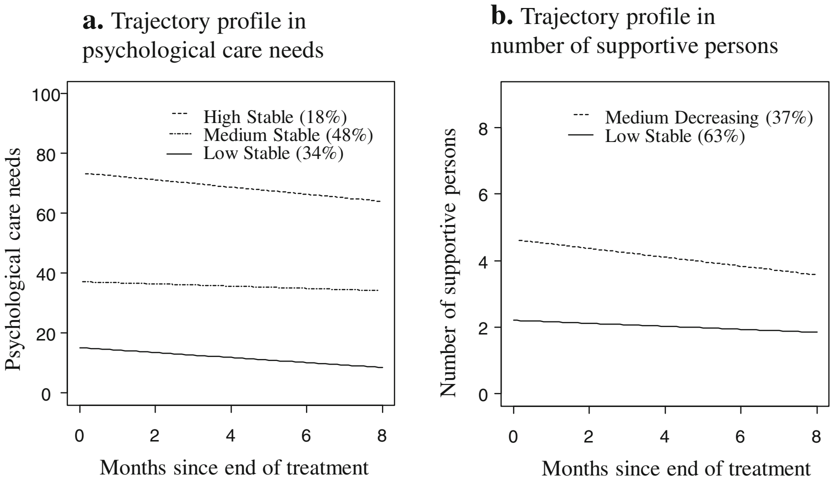
In line with similar studies that addressed the evolution of psychological distress only [19–22], most BCS in this sample (63 %) evidenced psychological adjustment and low care needs. Among these, one BCS group was labeled "resilient" and the other group "supported" for it also manifested moderate social support. Since assessments to chart these trajectories were performed simultaneously, we are unable to ascertain whether, among this latter group, psychological distress elicited social support or was buffered by a social support coping.

We identified two BCS subgroups (37 % of the sample) showing higher levels of psychological distress in line with other studies [12, 13] and higher supportive care needs. These were labeled "borderline" and "chronic distress" as psychological distress was the distinctive feature, with levels suspecting borderline cases in the first group (32 %) and identifying exclusively clinical cases in the second group (5 %), similar to the peak anxiety trajectory (5 %) in Dunn et al. [21].

Overall in this BCS sample, the level of posttraumatic growth was low compared to similar studies up to 1 year after BC diagnosis [10, 23].

Fewer and mostly stable trajectories were found in this study in contrast to studies performed over a similar period of time but focusing specifically on distress [20–22] or posttraumatic growth [23]. Decline or delay in supportive care needs has also been identified, but in advanced BC patients starting chemotherapy [43], showing two or three trajectory profiles and, as in our study, decreasing information needs specifically.

The number of trajectories may be related to the number of assessment time-points, the decision about their minimum size, the statistical approach, and the decision rules. A three-time assessment was found feasible in terms of patients' burden for an 8-month period, and a 4 % (~10 patients) threshold was considered an optimal trajectory size in this study, as it



a. Trajectory profile in psychological care needs

** Score range: 0-100; trajectory label given relatively to the score range.*

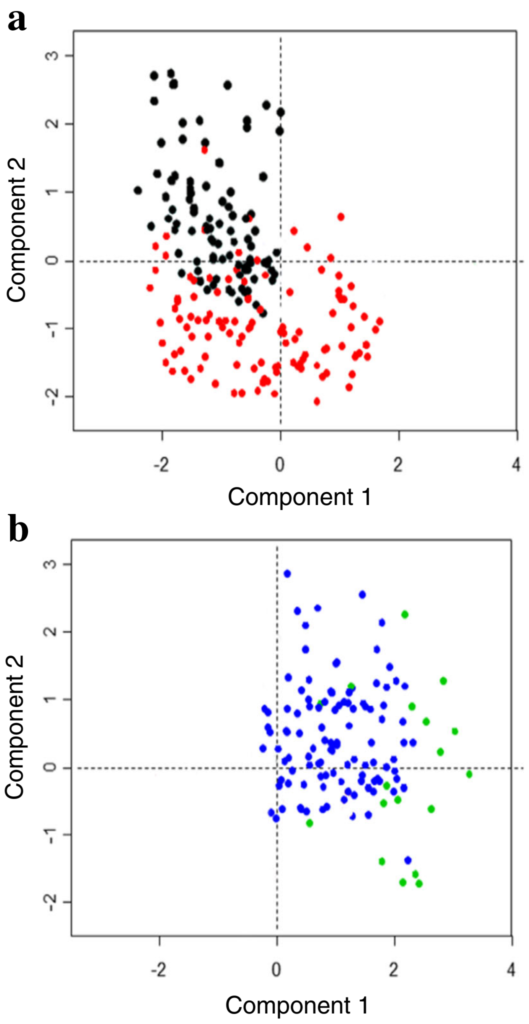
b. Trajectory profile in number of supportive persons

** Score range: 0-9; trajectory label given relatively to score range.*

Fig. 2 **a** Trajectory profile in psychological care needs. **b** Trajectory profile in number of supportive persons

allowed for the detection of clinically important subgroups (e.g., the "high stable" anxiety trajectory).

BCS were younger in the "chronic distress" group and presenting a higher rate of chemotherapy. Younger age has



« Supported » group (34%)
- Highest trajectory of social support
- Highest trajectory of post-traumatic growth

« Resilient » group (29%)
- Low trajectory of psychological distress

« Borderline » group (32%)
- Borderline anxiety and depression (scores: 8-10)

« Chronic distress » group (5%)
- Elevated anxiety (scores ≈ 15)
- Borderline depressive symptoms

Fig. 3 **a** Trajectory clustering—two clusters of BCS with lowest level of needs (63 %). Component 1 is positively correlated with trajectories of high needs and high distress (*right of the graph*). Component 2 is positively correlated with low social support and posttraumatic trajectories (*top of the graph*). *0* = null correlation. *Dots* are defined by each subjects' coordinates according to components 1 and 2. **b** Trajectory clustering—two clusters of BCS with highest level of needs (37 %). Component 1 is positively correlated with trajectories of high needs and high distress (*right of the graph*). Component 2 is positively correlated with low social support and posttraumatic trajectories (*top of the graph*). *0* = null correlation. *Dots* are defined by each subjects' coordinates according to components 1 and 2

Table 2 Clustering of trajectory profiles (*N*=348)

Trajectory profiles *N* (%)	Total sample (*N*=348)	Supported (*n*=117)	Resilient (*n*=100)	Borderline distress (*n*=112)	Chronic distress (*n*=19)
Supportive care needs					
Physical and daily living*					
High stable	75 (22)	17 (15)	**2 (2)**	**41 (37)**	**15 (79)**
Medium stable	152 (44)	53 (45)	37 (37)	**60 (54)**	**2 (11)**
Low stable	121 (35)	47 (40)	**61 (61)**	**11 (10)**	2 (11)
Psychological*					
High stable	63 (18)	**11 (9)**	**0 (0)**	**38 (34)**	**14 (74)**
Medium stable	166 (48)	61 (52)	**37 (37)**	63 (56)	5 (26)
Low stable	119 (34)	45 (38)	**63 (63)**	**11 (10)**	**0 (0)**
Care and support*					
Medium increasing	73 (21)	23 (20)	**6 (6)**	**38 (34)**	6 (32)
Low stable	213 (61)	72 (62)	55 (55)	74 (66)	12 (63)
Low decreasing	62 (18)	22 (19)	**39 (39)**	**0 (0)**	1 (5)
Health system/information*					
High stable	16 (5)	2 (2)	2 (2)	10 (9)	2 (11)
Medium stable	135 (39)	47 (40)	**14 (14)**	**62 (55)**	12 (63)
Low decreasing	197 (57)	68 (58)	**84 (84)**	**40 (36)**	5 (26)
Sexual difficulties					
High stable	26 (8)	28 (24)	17 (17)	35 (31)	9 (47)
High rebound	89 (26)	4 (3)	4 (4)	**15 (13)**	3 (16)
No need stable	233 (67)	85 (73)	**79 (79)**	**62 (55)**	7 (37)
Anxiety*					
High stable	19 (6)	**0 (0)**	**0 (0)**	**0 (0)**	**19 (100)**
Medium stable	161 (46)	58 (50)	**8 (8)**	**95 (85)**	**0 (0)**
Low stable	168 (48)	59 (50)	**92 (92)**	**17 (15)**	**0 (0)**
Depression*					
Medium stable	165 (47)	47 (40)	**16 (16)**	**85 (76)**	**17 (89)**
Low stable	183 (53)	70 (60)	**84 (84)**	**27 (24)**	**2 (11)**
Social support, no. of supportive persons*					
Medium decreasing	128 (37)	**117 (100)**	**3 (3)**	**1 (1)**	7 (37)
Low stable	220 (63)	**0 (0)**	**97 (97)**	**111 (99)**	12 (63)
Posttraumatic growth					
Relating to others					
High stable	184 (53)	68 (58)	52 (52)	52 (46)	12 (63)
Medium stable	25 (7)	41 (35)	37 (37)	54 (48)	7 (37)
Medium increasing	139 (40)	8 (7)	11 (11)	6 (5)	0 (0)
New possibilities					
Medium stable	311 (89)	109 (93)	83 (83)	101 (90)	18 (95)
No growth stable	37 (11)	8 (7)	17 (17)	11 (10)	1 (5)
Personal strength					
High stable	169 (49)	56 (48)	49 (49)	57 (51)	7 (37)
Medium stable	146 (42)	55 (47)	39 (39)	44 (39)	8 (42)
No growth stable	33 (10)	6 (5)	12 (12)	**11 (10)**	4 (21)
Spiritual change					
High stable	59 (17)	19 (16)	10 (10)	23 (21)	7 (37)
Medium stable	100 (29)	34 (29)	28 (28)	34 (30)	4 (21)
No growth stable	189 (54)	64 (55)	62 (62)	55 (49)	8 (42)
Appreciation of life*					
High stable	159 (46)	53 (45)	43 (43)	58 (52)	5 (26)
Medium stable	174 (50)	63 (54)	47 (47)	51 (46)	13 (68)
No growth stable	15 (4)	1 (1)	10 (10)	3 (3)	1 (5)

In bold are proportions of BCS in each trajectory that are statistically different between clusters and the total sample (alpha=5 % with Bonferroni's corrections). The name of trajectories was chosen relatively to the score range

*$p<0.05$ (chi-square or Fisher test), global tests

Table 3 Predictors of clusters of trajectory profiles (N=348)

	Supported (n=117)	Resilient (n=100)	Borderline distress (n=112)	Chronic distress (n=19)
Age (years), mean (SD)**	52 (12)	57 (12)	56 (13)	53 (10)
Married/partnered, *N* (%)	75 (64)	52 (53)	63 (56)	11 (58)
Education level, *N* (%)*				
Lower than high school	5 (4)	7 (7)	14 (13)	1 (5)
High/technical school	27 (23)	31 (31)	41 (37)	8 (42)
University	85 (73)	62 (62)	55 (50)	10 (53)
Occupation (active), *N* (%)	31 (27)	31 (31)	21 (19)	5 (26)
Cancer stage, *N* (%)				
0	11 (10)	10 (10)	13 (12)	1 (5)
I	51 (44)	48 (48)	52 (47)	9 (47)
II	44 (38)	29 (29)	33 (30)	8 (42)
III	9 (8)	12 (12)	12 (11)	1 (5)
Mastectomy, *N* (%)	24 (21)	17 (17)	27 (24)	6 (32)
Axillary dissection, *N* (%)	56 (48)	37 (37)	45 (40)	8 (42)
Chemotherapy, *N* (%)*	61 (52)	39 (39)	47 (42)	13 (68)
Hormonal therapy, *N* (%)	81 (72)	78 (80)	73 (69)	14 (74)
Attachment style mean (SD)				
Anxious****	2.7 (1.2)	2.4 (1)	3.6 (1.3)	4.7 (1.5)
Avoidant****	2.7 (0.9)	3.3 (1.2)	3.6 (1.1)	4 (1)
Satisfaction with doctors' care mean (SD)				
Technical skills***	78 (18)	82 (16)	72 (19)	75 (18)
Interpersonal skills**	62 (27)	67 (24)	55 (26)	57 (26)
Information provision**	68 (23)	69 (23)	58 (25)	67 (25)
Availability	62 (24)	66 (22)	58 (23)	57 (24)
Self-esteem mean (SD)****	24 (4)	24 (4)	20 (6)	15 (5)

*$p<0.05$, **$p<0.01$, ***$p<0.001$, ****$p<0.0001$ (ANOVA for age and chi-square tests for the rest)

been related to BCS higher care needs [2, 3, 5]. In this "chronic distress" subgroup, this was reflected by higher physical, daily living, and psychological needs, which may reflect residual effects of chemotherapy [44]. Symptom distress has been shown to affect distress and needs [2, 3, 22, 44]. A higher rate of chemotherapy was also observed in the "supported" group; however, this group also presented higher perceived social support, which has been associated with lower distress [12].

Higher supportive care needs as featured in the "borderline" subgroup were observed in BCS with lower educational level. This and the "chronic distress" subgroup also displayed higher anxious or avoidant attachment styles and lower satisfaction with doctors' care compared with the other subgroups. In addition, the "chronic distress" subgroup exhibited lower levels of self-esteem.

Other socio-demographic (marital status, occupation) and clinical (BC stage, type of surgery, presence of axillary dissection, or endocrine treatment) characteristics did not differentiate subgroups. In contrast, surgery [3, 19] and axillary dissection [21] have been shown to affect physical and mental health after BC treatment.

In terms of limitations, first, this study was carried out in a single institution and only addressed women with an initial BC diagnosis, so results are specific to population and care provision. Indeed, in other institutions, the number and characteristics of clusters may differ. However, the methods may be replicated in other patient samples to identify targets for care improvement. Second, we may have underestimated the prevalence of high posttraumatic growth since patients lost to follow-up had higher baseline scores on this measure; this may have hampered the possibility to contrast clusters on all posttraumatic growth aspects. Finally, BCS subgroups were compared on socio-demographic and clinical factors, self-esteem, and satisfaction with doctors' care using univariate tests. Since the BCS clusters were obtained by three consecutive statistical procedures with associated loss of information, we chose not to perform multinomial or multivariate logistic regression analyses to avoid additional loss of information from using these statistical models.

The main strength of this study is the innovative statistical approach, i.e., the use of statistical procedures (GMM, MFA, and HAC) that allowed consideration of joint trajectory profiles and thereby highlighting distinct clusters of BCS. Two BCS groups

(37 % of the sample) simultaneously evidenced higher supportive care needs, concerning levels of psychological distress or lower social support trajectories. These features point to the type of supportive care in the aftermath of hospital BC treatment. In addition, analyses of these BCS characteristics identified younger age, lower educational level, insecure attachment, lower satisfaction with hospital care, and having undergone chemotherapy as targets for supportive care. A consultation with a breast cancer nurse or navigator [45] could be provided when BC follow-up is starting, to screen for the woman's own supportive care needs and to inform her on support services available (e.g., written information, patient care liaison booklet, education classes, telephone support, group therapy). Younger BCS or those with lower level of education should be particularly targeted for such intervention. Further research should address the effects of interventions specifically tailored according to evidenced characteristics of poor recovery after BC hospital treatment.

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