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3 Resilience in the year after cancer diagnosis: a cross-lagged panel 4 analysis of the reciprocity between distress and well-being

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8 **Abstract** This study examined prospective reciprocity
9 between psychological distress and subjective well-being
10 and the role of change in psychosocial resources in the
11 reciprocity in the year following cancer diagnosis. Psycho-
12 logical distress (Hospital Anxiety and Depression Scale),
13 subjective well-being (Chinese Affect Scale and Satisfaction
14 with Life Scale), and psychosocial resources of 180 Chinese
15 patients were assessed at diagnosis (Time 1) and at 3-month
16 (Time 2) and 12-month (Time 3) follow-up. Cross-lagged
17 panel analysis demonstrated significant cross-lagged effects
18 between psychological distress and subjective well-being.
19 Time 2 to Time 3 change in perceived collective control
20 (i.e., control over cancer in collaboration with close social
21 partners) significantly mediated the cross-lagged effect of
22 Time 2 well-being on Time 3 distress, and the mediating
23 effect was stronger at medium or higher Time 2 distress. The
24 findings suggest that whereas distress and well-being
25 reciprocally predict each other throughout cancer adaptation,
26 change in perceived collective control could mediate the
27 prospective relationship of well-being on distress.

28 **Keywords** Psychological resilience · Psychological
29 distress · Subjective well-being · Resource change ·
30 Colorectal cancer

31 Introduction

32 A large body of literature has highlighted the pitfall of
33 regarding primarily psychological distress as the legitimate

outcome and suggested the importance of investigating
subjective well-being in stress adaptation (Chesney et al.,
2005; Lazarus, 2003; Lyubomirsky et al., 2005; Masse
et al., 1998; Seligman & Csikszentmihalyi, 2000). Absence
of psychological distress does not adequately reflect posi-
tive mental health or psychological well-being of people
with cancer (Camfield & Skevington, 2008; Hope et al.,
2009). Nevertheless, the current cancer literature empha-
sizes exclusively recovery from psychological distress and
attains little importance to conservation and enhancement
of psychological well-being such as positive affectivity and
satisfaction with life. Even though cancer-specific quality
of life instruments aim to assess different aspects of
well-being, most items in emotional well-being subscales
(e.g., mental health component scale in SF-36) are nega-
tively worded into feelings of sadness, nervousness, and
worry, duplicating measures of psychiatric symptoms. This
study aims to use cross-lagged panel analysis to examine
simultaneously the reciprocal relationships between psy-
chological distress and subjective well-being and the role
of change in psychosocial resources in the reciprocal
relationships over the year after a colorectal cancer diag-
nosis. In this study, Subjective well-being consisted of
positive affect and satisfaction with life. Positive affect
referred to affective states that are pleasant (e.g., joy, peace,
and excitement), as opposite to unpleasant and possibly
distressing negative affect including tension, anger, and
depression (Watson et al., 1988). Satisfaction with life
referred to a judgmental process in which one evaluates her/
his life condition with reference to her/his unique subjective
standard (Pavot & Diener, 1993).

Zautra et al., (2009, 2010) suggest the need to investi-
gate psychological adaptation as a set of temporal pro-
cesses that overlap and interact with each other, so as to
enable better prediction and prevention of poorer adjust-

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69 ment. A two-part definition of resilience is thus formulated
70 to address two fundamental aspects of adaptation, namely
71 recovery and sustainability. Recovery refers to the capacity
72 to recover from the negative psychophysiological sequelae
73 that are brought about by stressful events. Sustainability
74 refers to the capacity to maintain or gain positive physical
75 and psychological health throughout stressful encounters.
76 Recovery is important at the acute phase of stressful events
77 or in response to an acute stressor, whereas sustainability
78 bears significance in coping with on-going and sometimes
79 chronic demands.

80 If sustaining subjective well-being is an indispensable
81 pathway of stress resilience, then the simultaneous develop-
82 ment of distress and well-being throughout the cancer process
83 should be investigated. A concurrence of psychological dis-
84 tress and subjective well-being has been observed in various
85 chronic medical situations (Folkman, 1997; Lazarus, 2003).
86 Positive affect directly predicted lower levels of negative
87 affect and inversely moderated the positive association
88 between pain intensity and negative affect among women
89 with fibromyalgia, osteoporosis, and rheumatoid arthritis
90 (Strand et al., 2006; Zautra et al., 2005). Positive affect of
91 patients with advanced cancer has also been found to be lower
92 than that of the age-matched population norm; lower levels of
93 positive affect was predictive of higher anxiety and depres-
94 sion (Voogt et al., 2005). Our recent study found that Chinese
95 people with colorectal cancer reporting higher levels of anx-
96 iety and depressed moods demonstrated loss in positive affect,
97 whereas those reporting lower levels of distress demonstrated
98 a gain in positive affect in the 3 months after diagnosis (Hou
99 et al., 2010a).

100 As Zautra et al.'s model outlines, the recovery and the
101 sustainability pathways interact with each other while
102 develop independently over a stress process. It is reasonable
103 to expect bidirectional influences between psychological
104 distress and subjective well-being during cancer diagnosis
105 and treatment. Previous prospective studies suggest that
106 recovery from psychological distress is independent of sus-
107 taining subjective well-being. Older patients (breast, colon,
108 and prostate cancer) reported significant decline in both
109 depressed moods but only negligible improvement in well-
110 being (i.e., scores on the positive items in Center for Epi-
111 demologic Studies Depression Scale) in the year postdiag-
112 nosis (Stommel et al., 2004). Notwithstanding improvement
113 in diverse domains of quality of life and diminishing cancer-
114 specific stress responses (i.e., intrusive thoughts and avoid-
115 ance symptoms), the levels of positive affect reported by
116 older people with prostate cancer were lower than those of
117 noncancer counterparts throughout the year after radical
118 prostatectomy (Thornton et al., 2004). No studies to date have
119 investigated the prospective reciprocal relationships
120 between psychological distress and subjective well-being in
121 coping with cancer.

Resource change could be the underlying mechanism
that drives the intertwined developmental processes of
distress and well-being. The conservation of resources
theory (Hobfoll, 1998) suggests that traumatic or disruptive
life events have the power of depleting people's personal
and social resources because people need to mobilize these
resources to offset ongoing situational demands. Preven-
tion of depletion of psychosocial resources and secondarily
maintenance of or gain in existing resources are crucial for
maintaining healthy functioning in adaptation to stress
(Hobfoll, 1998; Hobfoll et al., 2009). People newly diag-
nosed with cancer have demonstrated change in optimism
(Pinquart et al., 2007; Schofield et al., 2004; Schou et al.,
2005), self-esteem (Vinokur et al., 1990), perceived control
(Henselmans et al., 2009), and perceived social support
(Alferi et al., 2001; Hipkins et al., 2004). Decrease in social
relationship quality has been found to mediate the positive
association between abuse histories and psychiatric symp-
toms during the treatment process for heterogeneous can-
cers (Banou et al., 2009). Studies have also demonstrated
that psychological morbidity among Chinese colorectal
cancer patients is strongly related to general physical dis-
tress including lack of energy and pain, and gastrointestinal
tract symptoms such as stomach pain, gas, and belch
(e.g., Law et al., 2008).

It is well established that a subset of people with cancer
report significant psychological distress including anxiety
and depressed moods at some point during the year
after diagnosis (Massie, 2004; Mitchell et al., 2011; van't
Spijker et al., 1997). Therefore, to capture arguably the
most disruptive period, this study assessed Chinese people
with colorectal cancer thrice at diagnosis and at 3- and
12-month follow-up. Because psychosocial resources in
adaptation represent a broad rubric of personal possessions,
personalities, and social interactions and relationships, a
thorough examination of all possible processes is imprac-
tical. This study examined resources that are important and
common across most if not all cultures and have been
found to buffer people with cancer of cancer-related dis-
tress (Diener et al., 2003; House et al., 1988; Peterson,
2000; Reis et al., 2000; Skinner, 1996). Personal resources
included dispositional optimism, defined as positive out-
come expectancies (Scheier et al., 2001), and dispositional
hope, defined as a motivated state to reach desired goals
(*Will*) together with a sense that one will be able to suc-
cessfully generate a plan to attain them (*Ways*) (Snyder
et al., 1991). Adjustment-specific perceived control was
defined as perceived control over cancer-related symptoms
and difficulties by oneself or in collaboration with family
and friends (Hou, 2010). Social resources included generic
social relationship quality, defined as perceived family
commitment and intimacy and friendships (Hou et al.,
2009a), and perceived social support, defined as received

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|-----|--|--|-----|
| 175 | emotional and instrumental support (Hou et al., 2009a). It | recruitment was conducted in the largest government-funded | 221 |
| 176 | was hypothesized that (1) distress and well-being are pro- | oncology unit in the Queen Elizabeth Hospital, Hong Kong, | 222 |
| 177 | spectively inversely associated with each other in the year | between July 2006 and March 2007. Clinical oncologists | 223 |
| 178 | after diagnosis, and (2) change in psychosocial resources | introduced the purpose of the study to 263 (86 %) of the 305 | 224 |
| 179 | inversely mediates the prospective associations between | suitable patients in the oncology unit; voluntary participation | 225 |
| 180 | distress on well-being and positively mediates that of well- | and data confidentiality were emphasized. The remainder | 226 |
| 181 | being on distress. | ($n = 42$) either were too sick to participate or could not be | 227 |
| | | identified at the time of recruitment. The interviewer then | 228 |
| | | confirmed the eligibility of potential participants by referring | 229 |
| 182 | Methods | to their hospital charts. After being fully apprised of the study, | 230 |
| 183 | Participants | 234 (89 %) patients gave their written consent and completed | 231 |
| 184 | This study was part of a larger prospective psychosocial | the baseline assessment (Time 1) in the unit via face-to-face | 232 |
| 185 | research project among Chinese people with colorectal | interview. Among them, 215 completed the 3-month follow- | 233 |
| 186 | cancer in Hong Kong (Hou et al., 2009a, 2010a, 2010b; Hou | up (Time 2; death: $n = 11$; lost contact: $n = 8$) and 182 | 234 |
| 187 | & Wan, 2012). Inclusion criteria were (1) 21 years of age or | completed the 12-month follow-up (Time 3; death: $n = 24$; | 235 |
| 188 | older, (2) Cantonese fluency, (3) histological diagnosis of | lost contact: $n = 11$) via structured telephone interview. | 236 |
| 189 | colorectal cancer within 12 weeks' time, and (5) no prior | Because the participants who were deceased or out of touch at | 237 |
| 190 | malignancies and associated therapies. Exclusion criteria | Time 2 and Time 3 could represent unique subsamples of the | 238 |
| 191 | included active Axis I psychiatric disorders, linguistic/ | population due to differences in cancer, physical, and psy- | 239 |
| 192 | intellectual difficulties, brain metastasis, or serious medical | chological statuses, only the data from 180 participants who | 240 |
| 193 | condition(s) such as hypertension, diabetes, and cardiovas- | completed assessment at all three time-points was used. | 241 |
| 194 | cular disease. The 234 participants ranged in age between 29 | | |
| 195 | and 82 years ($M = 64.44$, $SD = 10.55$, median = 67); 89 | Measures | 242 |
| 196 | (38 %) were female and 182 (78 %) were married. Sixty- | <i>Demographic and medical characteristics</i> | 243 |
| 197 | three (27 %) participants reported receiving no formal edu- | A standardized pro-forma was used to obtain demographic | 244 |
| 198 | cation, 77 (33 %) only primary education (6 years in | information including age, sex, marital status, current | 245 |
| 199 | school), and 94 (40 %) at least secondary education | household size, education level, employment status, and | 246 |
| 200 | (≥ 7 years in school). Fifty-seven (24 %) reported an aver- | age household income level. A Chart Review Data Sheet was | 247 |
| 201 | age monthly household income of less than HK\$5,000, | used to obtain diagnostic (site/sub-site, stage, time since | 248 |
| 202 | 68 (29 %) reported \$5,001-\$10,000, 71 (30 %) reported | diagnosis) and treatment (type and time of surgery and | 249 |
| 203 | \$10,001-\$20,000, 24 (10 %) reported \$20,001-\$30,000, and | adjuvant therapies) information from hospital charts. | 250 |
| 204 | 14 (6 %) reported an income exceeding \$30,000 (US\$1 | | |
| 205 | \approx HK\$7.80). Forty participants (17 %) reported a full-time/ | <i>Psychological distress</i> | 251 |
| 206 | part-time employment and the remainder reported being | Anxiety and depressed moods at Time 1, Time 2, and Time | 252 |
| 207 | housewives ($n = 48$, 21 %), retired ($n = 109$, 47 %), or | 3 were measured using the 14-item Chinese Hospital | 253 |
| 208 | unemployed ($n = 37$, 16 %). A total of 124 (53 %) partici- | Anxiety and Depression Scale (Leung et al., 1993). Seven | 254 |
| 209 | pants had colon cancer and 110 (47 %) had rectal cancer; | items assessed anxiety and depressive symptoms respec- | 255 |
| 210 | seven (3 %) had Stage I, 47 (20 %) Stage II, 133 (57 %) | tively. Participants answered each item on a 4-point scale | 256 |
| 211 | Stage III, and 47 (20 %) Stage IV disease based on the | (e.g., 0 = <i>not at all</i> , 1 = <i>not very much</i> , 2 = <i>quite a lot</i> , | 257 |
| 212 | American Joint Committee on Cancer staging system. Most | 3 = <i>very much indeed</i>). Anxiety and depression scores | 258 |
| 213 | participants ($n = 203$; 87 %) had curative or palliative sur- | were calculated respectively by summing across seven | 259 |
| 214 | gical resection, 67 (29 %) of whom had a permanent colos- | items (range = 0–21). Alphas for the anxiety and depres- | 260 |
| 215 | tomy. Fifty-two percent of the participants (111/215) at the | sion subscales ranged between .89 and .94 on the three | 261 |
| 216 | 3-month follow-up and 11 % of the participants (20/182) at | administrations. | 262 |
| 217 | the 12-month follow-up reported undergoing chemotherapy. | | |
| 218 | Procedure | <i>Subjective well-being</i> | 263 |
| 219 | Upon obtaining Ethics Committees' approvals from the | Subjective well-being was assessed at all time-points using | 264 |
| 220 | University of Hong Kong and the Hospital Authority, | two scales. The 10-item positive affect subscale of Chinese | 265 |

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|-----|---|---|-----|
| 266 | Affect Scale (Hamid & Cheng, 1996) assessed frequency | were summed to form an overall score. Alphas for the two | 314 |
| 267 | of positive emotional experience in the past 2 weeks on a | administrations were .88 and .94, respectively. | 315 |
| 268 | 5-point scale: 0 = <i>not at all</i> , 1 = <i>rarely</i> , 2 = <i>sometimes</i> , | | |
| 269 | 3 = <i>often</i> , and 4 = <i>all the time</i> . The Chinese Affect Scale | | |
| 270 | is linguistically and psychometrically equivalent to the | | |
| 271 | English Positive and Negative Affect Schedule. The scale | | |
| 272 | demonstrated $\alpha > .85$ in Chinese young and middle-aged | | |
| 273 | adults (Hamid & Cheng, 1996) and $\alpha > .90$ in the current | | |
| 274 | administrations. Satisfaction with Life Scale (Diener et al., | | |
| 275 | 1985) assessed participants' well-being in terms of satis- | | |
| 276 | faction and fulfillment of their current state. Participants | | |
| 277 | indicated agreement with each item on a 4-point scale | | |
| 278 | (1 = <i>strongly disagree</i> , 4 = <i>strongly agree</i>). Scores were | | |
| 279 | calculated by summing across the five items (range = | | |
| 280 | 5–20). Mounting research has reported good internal con- | | |
| 281 | sistency of the scale, with Cronbach's alphas above .80 | | |
| 282 | across studies (Pavot & Diener, 1993). Previous studies | | |
| 283 | showed that the scale is a reliable and valid measure of | | |
| 284 | subjective well-being among Chinese medical patients | | |
| 285 | (Cheng & Chan, 2006) as well as general populations | | |
| 286 | (Diener et al., 1995). Alpha for the scale was $> .90$ in the | | |
| 287 | current three administrations. | | |
| 288 | <i>Dispositional optimism</i> | | |
| 289 | Two scales were administered at Time 1 and Time 3. The | | |
| 290 | 6-item Chinese Revised Life Orientation Test (Lai et al., | | |
| 291 | 1998) assessed positive outcome expectancies on a 4-point | | |
| 292 | scale (1 = <i>strongly disagree</i> , 4 = <i>strongly agree</i>). Three | | |
| 293 | negatively worded (pessimism) items were reverse scored | | |
| 294 | and summed with three positively worded (optimism) | | |
| 295 | items, sample item: " <i>In uncertain times, I usually expect</i> | | |
| 296 | <i>the best</i> ." (Scheier et al., 1994). Alphas on the current two | | |
| 297 | administrations were .76 and .84, respectively. The Chi- | | |
| 298 | nese version of the 8-item Hope Scale assessed bifacet | | |
| 299 | dispositional hope, <i>Will</i> and <i>Ways</i> , sample item: " <i>I can</i> | | |
| 300 | <i>think of many ways to get out of jam</i> ." (Snyder et al., 1991). | | |
| 301 | Participants rated each item on a 4-point scale as in the | | |
| 302 | Chinese Revised Life Orientation Test. Alphas for the | | |
| 303 | Hope Scale were .84 and .74, respectively on the current | | |
| 304 | administrations. | | |
| 305 | <i>Social relationship quality</i> | | |
| 306 | The Social Relational Quality Scale (Hou et al., 2009b) | | |
| 307 | assessed quality of the relationships with family and | | |
| 308 | friends in the general sense at Time 1 and Time 3 with a | | |
| 309 | 4-point scale (1 = <i>strongly disagree</i> , 4 = <i>strongly agree</i>), | | |
| 310 | sample items: " <i>When I am upset, my family will be upset</i> | | |
| 311 | <i>too</i> ."; " <i>I am committed to maintaining my relationship</i> | | |
| 312 | <i>with my family</i> ." (family relationship); " <i>I can rely on my</i> | | |
| 313 | <i>friends in different situations</i> ." (friendship). The 17 items | | |
| | | <i>Perceived control</i> | 316 |
| | | Two 5-item subscales in the Cancer Experience and Effi- | 317 |
| | | cacy Scale (Hou, 2010) were used at Time 2 and Time 3. | 318 |
| | | Perceptions of personal and collective control over the | 319 |
| | | cancer course, symptoms, and related problems were | 320 |
| | | assessed: personal control sample item: " <i>What I do can</i> | 321 |
| | | <i>determine whether the symptoms of my colon/rectal cancer</i> | 322 |
| | | <i>get better or worse</i> ."; collective control sample item: " <i>By</i> | 323 |
| | | <i>joining with family and friends, I have a great deal of</i> | 324 |
| | | <i>control over the problems arising from my colon/rectal</i> | 325 |
| | | <i>cancer</i> ." Participants answered each item on a 5-point | 326 |
| | | scale (1 = <i>strongly disagree</i> , 5 = <i>strongly agree</i>). Alphas | 327 |
| | | for the personal and collective control scales were .83 and | 328 |
| | | .84, respectively in the two current administrations. | 329 |
| | | <i>Social support</i> | 330 |
| | | Three items assessed sufficiency of received emotional and | 331 |
| | | instrumental support at Time 1 and Time 3 (Seeman & | 332 |
| | | Berkman, 1988). Participants indicated on a 4-point scale | 333 |
| | | for each item (1 = <i>a lot</i> , 4 = <i>received sufficient support</i>), | 334 |
| | | sample item: " <i>Could you have used more help with daily</i> | 335 |
| | | <i>tasks than you received</i> ?" Overall sufficiency was indexed | 336 |
| | | by summing across the three items. Alphas for the two | 337 |
| | | administrations were .67 and .64, respectively. | 338 |
| | | <i>Physical symptom distress</i> | 339 |
| | | A 9-item checklist assessed general and colorectal cancer- | 340 |
| | | specific symptoms at Time 1, Time 2, and Time 3: stom- | 341 |
| | | achache, gas/bloating, belching, proctalgia, sleeping prob- | 342 |
| | | lems, fatigue, pain, nausea, and loss of appetite (Given | 343 |
| | | et al., 1994; Hou et al., 2009a). Participants rated the | 344 |
| | | presence and severity of each symptom in the past week on | 345 |
| | | a four-point scale from 0 (<i>not at all</i>) to 3 (<i>very much</i>). | 346 |
| | | Alphas for the three administrations were .71, .78, and .78, | 347 |
| | | respectively. | 348 |
| | | Analytic plan | 349 |
| | | The scores on anxiety, depressed moods, positive affect, | 350 |
| | | and life satisfaction at all time-points were fisher-trans- | 351 |
| | | formed into <i>z</i> scores. The average <i>z</i> scores on anxiety and | 352 |
| | | depressed moods were used to indicate psychological dis- | 353 |
| | | tress whereas those on positive affect and life satisfaction | 354 |
| | | to indicate subjective well-being. Correlations between | 355 |
| | | distress and well-being at all time-points (Time 1: $r = -$ | 356 |
| | | .60; Time 2: $r = -.68$; Time 3: $r = -.82$; $p < .001$) were | 357 |

358 lower than those between anxiety and depressed moods
359 (Time 1: $r = .63$; Time 2: $r = .77$; Time 3: $r = .88$;
360 $p < .001$) and between positive affect and life satisfaction
361 (Time 1: $r = .62$; Time 2: $r = .74$; Time 3: $r = .89$;
362 $p < .001$). The correlations suggested that the indices
363 of psychological distress and subjective well-being were
364 empirically distinguishable. Two cross-lagged panel mod-
365 els were constructed using the *Mplus* version 6.1 (Muthén
366 & Muthén, 2008); Time 3 scores on distress and well-being
367 were the outcome measures in all models. First, to address
368 *Hypothesis 1*, a fundamental model was constructed to
369 explore the associations between distress and well-being
370 across the three time-points. Based on the stationarity
371 assumption for cross-lagged panel analysis (Kenny &
372 Zautra, 1995), the autoregressive paths of distress and well-
373 being at all time-points and the two pairs of cross-lagged
374 paths were constrained to be equal. The more parsimonious
375 constrained model was accepted if Chi square difference
376 test did not reveal significant difference of it from the
377 unconstrained model.

378 Next, to address *Hypothesis 2*, the mediating effects
379 (also known as modifying effects) of change in psycho-
380 social resources on the cross-lagged effects between Time
381 2 and Time 3 distress and well-being were tested one-by-
382 one. Time 1 scores on positive outcome expectancies,
383 dispositional hope, generic social relationship quality, and
384 perceived social support, and Time 2 scores on adjustment-
385 specific perceived control were subtracted from the Time 3
386 scores to obtain a measure reflecting change. Two forms of
387 moderated mediation were then tested: (1) an antecedent
388 (Time 2 distress/well-being) interacts with a mediator to
389 predict an outcome (Time 3 distress/well-being) and (2) an
390 additional variable (Time 2 distress/well-being) not inclu-
391 ded in the mediation model interacts with the mediator to
392 predict the outcome (Preacher et al., 2007). High and low
393 levels of Time 2 scores on distress and well-being were
394 indicated by one *SD* above/below the mean whereas
395 medium level by within one *SD* of the mean. Associations
396 between the interaction terms (i.e., Time 2 distress/well-
397 being \times resource change) and Time 3 distress and well-
398 being were examined (Aiken & West, 1991; Preacher et al.,
399 2007).

400 Among all demographic and medical variables, corre-
401 lations revealed that age, income, and education level were
402 significantly correlated with the scores on anxiety,
403 depressed moods, positive affect, and life satisfaction
404 ($r = -.12$ to $.31$, $p < .05$). In addition, previous studies
405 showed that an advanced stage and receipt of adjuvant
406 therapies predicted higher psychological distress and lower
407 subjective well-being (e.g., Sharma et al., 2007). These
408 variables, together with the scores on physical symptom
409 distress, were included as covariates at specific time-
410 point(s) in all models. The Comparative Fit Index (CFI),

Nonnormed Fit Index (NNFI), Incremental Fit Index (IFI),
residual mean squared error of approximation (RMSEA),
and standardized root mean square residual (SRMR) were
used to evaluate data model fit (Fan et al., 1999). The
model was accepted if all fit indices $>.90$ and the RMSEA
and SRMR $<.08$.

Results

The results of the cross-lagged panel analysis are summarized
in Table 1. The cross-lagged model of distress and well-being
with covariates including demographic and medical charac-
teristics and physical symptom distress (*Hypothesis 1*) dem-
onstrated good data-model fit: $\chi^2(18) = 41.22$, $p < .01$;
CFI = .96; NNFI = .91; IFI = .96; RMSEA = .09; SRMR
= .04. To construct a more parsimonious model (Hawkey
et al., 2010; Kubacka et al., 2011), the autoregressive paths of
distress and well-being across time-points and the cross-lag-
ged paths from distress to well-being and from well-being to
distress were constrained to be equal: $\chi^2(22) = 44.04$,
 $p < .01$; CFI = .96; NNFI = .93; IFI = .96; RMSEA
= .08; SRMR = .04. Chi square difference test revealed no
difference between the unconstrained and the constrained
models [$\chi^2_{diff}(4) = 2.82$, $p = .588$]. Therefore, the more par-
simonious constrained model was used for subsequent anal-
yses (Fig. 1).

In the constrained model, the standardized regression
coefficients of autoregressive paths were all significant
($p < .001$). The regression paths for distress from Time 1
to Time 2 ($\beta = .26$) and from Time 2 to Time 3 ($\beta = .27$)
were significant ($p < .001$); the regression paths for well-
being between time-points were also significant ($\beta = .34$,
 $p < .001$). All cross-lagged paths between time-points
were significant (distress to well-being: $\beta = -.14$, $p < .05$;
well-being to distress: $\beta = -.16$, $p < .05$).

The change scores on each psychosocial resource were
then added to the fundamental model as a mediator of the
cross-lagged associations between Time 2 and Time 3
distress and well-being (*Hypothesis 2*). The mediating
effect was also specified to be moderated by the level of
Time 2 distress/well-being (Preacher et al., 2007). A total
of six change scores were computed for the following
measures: Time 1 to Time 3: positive outcome expectan-
cies, dispositional hope, social relationship quality, and
perceived social support; Time 2 to Time 3: perceived
personal and collective control. After adding the change
scores on perceived collective control, data-model fit
indices remained good: $\chi^2(37) = 69.89$, $p < .001$;
CFI = .95; NNFI = .91; IFI = .95; RMSEA = .07; SRMR
= .05 (Fig. 2). All autoregressive paths and cross-lagged
paths except for the one from Time 2 distress to Time 3
well-being were significant. Time 2 well-being ($\beta = -.38$,

Table 1 Standardized estimates in the 3-wave cross-lagged panel model

| Model | Goodness-of-fit indices | | | | | | Mediating effect |
|--|-------------------------|-----|------|-----|-------|------|--|
| | χ^2 (df) | CFI | NNFI | IFI | RMSEA | SRMR | |
| Unconstrained fundamental model | 41.22* (18) | .96 | .91 | .96 | .09 | .04 | – |
| Constrained fundamental model | 44.04* (22) | .96 | .93 | .96 | .08 | .04 | – |
| Conditional model with change scores ^a on | | | | | | | |
| T1–T3 positive outcome expectancies | 101.64** (37) | .91 | .84 | .91 | .10 | .04 | – |
| T1–T3 dispositional hope | 134.41** (37) | .87 | .77 | .87 | .12 | .05 | – |
| T1–T3 social relationship quality | 86.89** (37) | .92 | .87 | .93 | .09 | .05 | – |
| T2–T3 personal control | 79.71** (37) | .94 | .89 | .94 | .08 | .05 | – |
| T2–T3 collective control | 69.89** (37) | .95 | .91 | .95 | .07 | .05 | T2 well-being—change in collective control—T3 distress |
| T1–T3 perceived social support | 94.25** (37) | .91 | .84 | .91 | .09 | .05 | – |

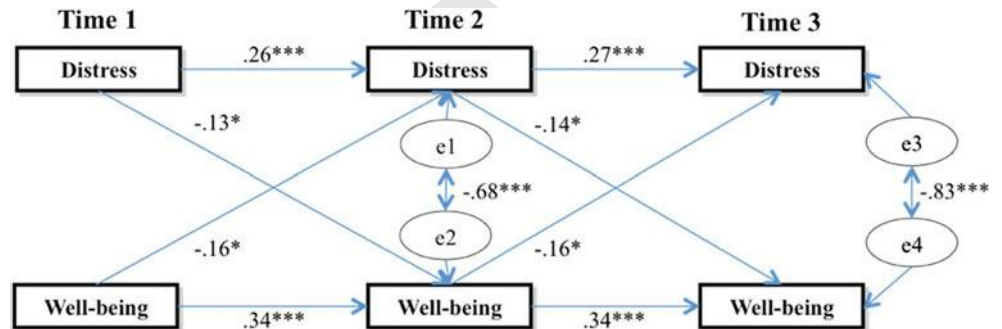
χ^2 (df) = Chi square value (degree of freedom)

CFI comparative fit index, NNFI non-normed fit index, IFI incremental fit index, SRMR standardized root mean square residual, RMSEA root mean square error of approximation, T1 time 1, T2 time 2, T3 time 3. A model was accepted if the CFI, NNFI, and IFI > .90 and the RMSEA and SRMR < .08

^a Change scores were calculated by subtracting the T1/T2 scores from the T3 scores

* $p < .01$, ** $p < .001$

Fig. 1 Fundamental cross-lagged panel model



461 $p < .001$) but not distress ($\beta = -.20$, $p = .081$) predicted
 462 the change scores on collective control; the change scores
 463 predicted Time 3 distress ($\beta = -.34$, $p < .001$) and well-
 464 being ($\beta = .35$, $p < .001$). The mediation model of Time 2
 465 well-being—change in collective control—Time 3 distress
 466 was tested (Preacher & Hayes, 2004). Standardized mediating
 467 effect of change in collective control on the cross-lagged
 468 association between Time 2 well-being and Time 3 distress
 469 was significant (Estimate = .13, Sobel's $z = 2.80$, $p < .01$).
 470 To investigate the moderated mediating effect(s), Time 3
 471 distress and well-being were regressed respectively on two
 472 interaction terms: Time 2 distress/well-being \times change in
 473 collective control. Standardized moderated mediating effects
 474 were significant at medium (Estimate = .13, Sobel's
 475 $z = 2.76$, $p < .01$) and high (Estimate = .21, Sobel's
 476 $z = 2.65$, $p < .01$) levels of Time 2 distress and at low
 477 (Estimate = .12, Sobel's $z = 2.13$, $p < .05$), medium
 478 (Estimate = .13, Sobel's $z = 2.76$, $p < .01$), and high (Esti-
 479 mate = .13, Sobel's $z = 2.25$, $p < .05$) levels of Time 3

well-being. Whereas change in collective control mediated
 the negative association between Time 2 well-being and Time
 3 distress across different levels of Time 2 well-being, the
 mediating effect was stronger when Time 2 distress was at
 medium or higher levels.

Discussion

The 3-wave cross-lagged panel analysis and found that
 distress and well-being significantly predicted each other
 between consecutive time-points, controlling for the effects
 of demographic and medical characteristics and physical
 symptom distress. Among psychosocial resources includ-
 ing positive outcome expectancies, dispositional hope,
 adjustment-specific perceived personal and collective
 control, generic social relationship quality, and perceived
 social support, Time 2 to Time 3 change in perceived
 collective control significantly mediated the cross-lagged

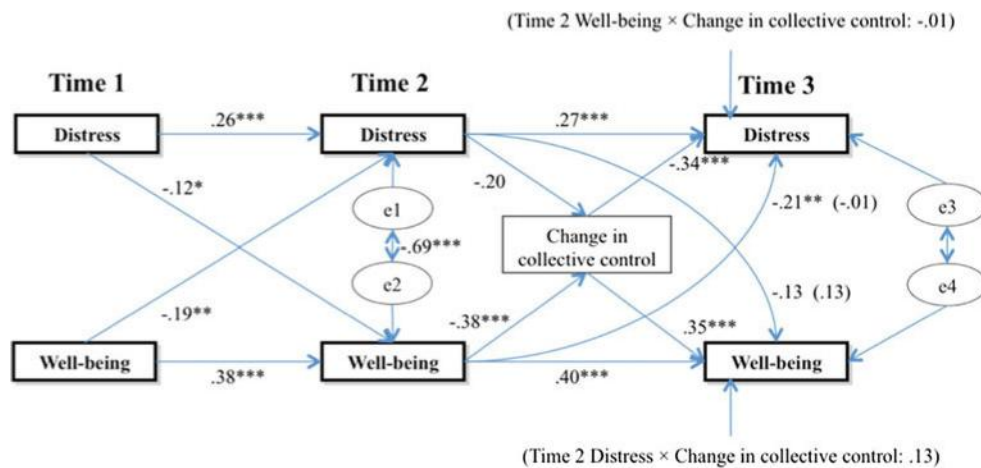


Fig. 2 Moderated mediation model with change in collective control as the mediator. Distress = psychological distress, Well-being = subjective well-being. Mediating and moderating effects are presented in parentheses. To enhance readability of the figures, standardized regression coefficients of the study variables on

covariates (i.e., age, income, educational level, scores on physical symptom distress, stage, and receipt of adjuvant therapies) are not shown. The full figures including covariates are available from the corresponding author. * $p < .05$, ** $p < .01$, *** $p < .001$

Author Proof

association between Time 2 well-being and Time 3 distress. The mediating effect sustained across different levels of Time 2 well-being and was stronger when Time 2 distress was at medium or higher levels.

Most studies of people with cancer have focused on psychological distress and have defined resilience solely as maintenance of low psychological distress without taking subjective well-being into account. This emphasis on psychological distress could contribute to the tendency for most conventional psycho-oncology interventions and services to focus primarily on reducing psychological distress while leaving subjective well-being almost unattended (Jacobsen & Jim, 2008). The lifespan development and psychological trauma literature has long advocated for more attention to the human potential to demonstrate resilience in unfolding adversity, be it restoration of ordinary psychological functioning, maintenance of low distress, or gain in well-being beyond original levels (Block & Block, 1980; Bonanno, 2004; Bonanno et al., 2002; Luthar et al., 2000; Wallace et al., 2001; Zautra et al., Zautra et al., 2010).

A lack of positive affect, life satisfaction, and meaning in life is a typical feature of psychological disorders including anxiety and depression (Fava et al., 2005; Seligman et al., 2006). Given that cancer diagnosis and treatment are closely associated with anxious and depressed moods, a need for more interventions that enhanced subjective well-being of these people is obvious. The utility of well-being interventions has been demonstrated in a meta-analysis of 49 studies of clinical and non-clinical samples (Sin & Lyubomirsky, 2009). Apart from a significant positive association with subjective well-being in 49 studies, well-being interventions were also significantly

inversely associated with psychological distress across 25 studies. A recent study has found that demographic variables including age, sex, marital status, and educational level predicted life satisfaction (i.e., scores on Satisfaction with Life Scale) but not psychological distress (i.e., scores on Symptom Checklist) among 1,276 people newly diagnosed with colorectal cancer (Rinaldis et al., 2012). However, the findings provided limited information about how distress and well-being interact with each other over the course of diagnosis and treatment. Using validated measures of psychological distress and subjective well-being, this prospective study demonstrated the reciprocal relationships between distress and well-being and tested the role of psychosocial resources in the distress-well-being associations.

Our findings suggest the applicability of Zautra's two-part model of resilience (Zautra, 2009; Zautra et al., 2010) to explaining multiple dimensions of cancer adaptation. Being one of the most comprehensive theoretical frameworks of resilience to date (Dunkel Schetter & Dolbier, 2011; Rutter, 1996), Zautra's model argues that resilience consists of interactive processes between positive (i.e., sustainability) and negative (i.e., recovery) psychological functioning. Among cancer populations, significant decline in depressed moods but limited improvement in well-being were observed in the year after diagnosis (Stommel et al., 2004). Lower positive affect has been identified among people with prostate cancer regardless of improved quality of life in the year after treatment (Thornton et al., 2004). Our previous findings further suggest that maintenance of and gain in positive affect mediated and moderated the positive association between physical symptom distress at diagnosis and depressed moods at 3-month follow-up (Hou

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562 et al., 2010a). None of them have simultaneously examined
563 the benefit of psychosocial resources on recovering from
564 distress and gaining well-being, not to mention investi-
565 gating the dynamics between psychosocial resources and
566 the distress and well-being pathways.

567 Extending the previous evidence, the present study used
568 cross-lagged panel analysis, a robust statistical method, to
569 show the mediating effect of change in psychosocial
570 resources on the distress-well-being associations during the
571 first year after a cancer diagnosis. More specifically, the
572 mediating effect of change in perceived collective control
573 on the impact of Time 2 well-being on Time 3 distress is
574 dependent on Time 2 distress: when Time 2 distress was at
575 medium or higher levels, the mediating effect was stronger.
576 Personality and social resources such as optimism, per-
577 ceived control, and social support tend to predict positive
578 affective health (e.g., positive affect) whereas risk factors
579 such as neuroticism tend to predict negative affective
580 health (Marshall et al., 1992; Watson et al., 1999). The
581 findings add to the body of evidence by suggesting that
582 positive psychological functioning and resources could
583 predict health domains of the opposite affective valence
584 among people with cancer. In particular, when distress is
585 high and might decrease the benefit of well-being on
586 reducing distress, maintenance of or gain in psychosocial
587 resources, such as collective control in the present study,
588 could compensate for or improve the reduced benefit of
589 well-being throughout the cancer treatment process.

590 Last but not least, novel evidence is provided for the
591 relevance of situation-specific control beliefs in adaptation
592 to cancer. Asians hold a strong belief in the interdepen-
593 dence among close social partners and place less emphasis
594 on Western cultural imperatives of personal agency and
595 accomplishment (Fiske et al., 1998). While perceived
596 personal control is associated with psychological well-
597 being among Caucasian Americans in the face of job
598 demands, confidence in interpersonal cooperation is asso-
599 ciated with less psychosomatic and depressive symptoms
600 among Chinese (Schaubroeck et al., 2000). Perceived
601 collective control has also been reported to buffer the
602 negative impact of economic strain for Native Americans,
603 who share with East Asians the cultural imperative of
604 interdependence among close social partners (Hobfoll
605 et al., 2002). Cancer is considered a life-threatening yet
606 low-control condition (Thompson et al., 1993). Perceived
607 collective but not all personal control has been found to
608 mediate the positive association between family relation-
609 ship quality and life satisfaction among Chinese people
610 with cancer (Hou & Wan, 2012). Adding to these previous
611 findings, this study showed that it is the gain in perceived
612 collective control that enhances the benefit of well-being
613 on reducing distress during the first year of cancer diag-
614 nosis. Future studies could examine whether higher per-

ceived control in collaboration with family members
contributes significantly to the stress-resistant impact of
well-being in adaptation to different stressful situations
among East Asians as well as people with other sociocul-
tural backgrounds.

Limitations and conclusions

A number of limitations warrant discussion. First, the
participants were a convenience Chinese sample from one
tertiary clinic in Hong Kong. There is ample evidence
suggesting that Asian people differ from Western people in
perceiving and experiencing emotions. Emotional well-
being is related to a balance between positivity and nega-
tivity within the East Asian sociocultural contexts, such as
states of calmness, serenity, and peacefulness, that is
achieved through moderation instead of maximizing posi-
tive affect and minimizing negative affect (Uchida &
Kitayama, 2009). Adaptive functioning is defined as high
positive affect and low negative affect in the West, whereas
it is defined as “yin-yang” of emotions in the East Asian
cultural contexts—not to be too overjoyed or too dis-
heartened (Bond, 1993). Cross-cultural studies found that
Caucasians tend to report higher levels of positive affect
and stronger inverse associations between positive affect
and negative affect, whereas East Asians tend to report
similar levels of positive affect and negative affect and
weak associations between the two states (Kitayama et al.,
2000; Mesquita & Karasawa, 2002; Schimmack et al.,
2002). The sociocultural characteristics of the present
Chinese sample limit the generalizability of the results to
other peoples. Second, this study focuses on patients with
one cancer type, i.e., colorectal cancer, while variability
exists in the prevalence of psychological distress across
cancer sites in the year after diagnosis (Dalton et al., 2009;
Zabora et al., 2001). Future studies should investigate
whether the present findings are replicable in other cancer
populations. Third, the measure of physical symptom dis-
tress was not a formal instrument and selected for parsim-
ony, and all of the measures come from self-reports; the
association of ongoing treatment with physical symptoms
was not fully controlled for, although we found that receipt
of adjuvant therapies was not correlated with both physical
and psychological distress and subjective well-being.
Lastly, the reliability of the 4-item social support scale at
Time 1 and Time 3 was less than optimal ($\alpha < .70$),
and the sample size in the cross-lagged panel modeling
($n = 180$) was relatively small. Some cautions are there-
fore needed in interpreting the findings.

Notwithstanding these limitations, this prospective study
contributes to the theoretical and empirical literature of
psychological resilience and psycho-oncology. Empirical

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665 support for the dynamics between recovery and sustain-
 666 ability pathways in Zautra et al.'s two-part model of resil-
 667 ience is still lacking. This study is one of the first prospective
 668 investigations on the hypothesized bidirectional influences
 669 between distress and well-being processes. In addition, the
 670 findings support implementation of well-being interventions
 671 in cancer populations. Practicing regular grateful thinking
 672 and effective goal attainment have been found to be associ-
 673 ated with subjective well-being of young and middle-age
 674 adults (Emmons & McCullough, 2003; Lyubomirsky et al.,
 675 2011; MacLeod et al., 2008). Cancer service can be incor-
 676 porated with education programs such as teaching of regular
 677 grateful thinking and effective strategies to identify and
 678 attain desirable goals. Increased positive emotional experi-
 679 ence during diagnosis and treatment could then contribute to
 680 lower psychological distress of patients in the long run. The
 681 benefit of increased sense of well-being could further be
 682 strengthened by empowering close social partners to partic-
 683 ipate in pragmatic assistance for managing cancer related
 684 problems, which facilitates higher perceived collective
 685 control over cancer among the patients.

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