

Psychosocial Vulnerability, Resilience Resources, and Coping with Infertility: A Longitudinal Model of Adjustment to Primary Ovarian Insufficiency

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Abstract

Background The infertility associated with primary ovarian insufficiency (POI) presents significant emotional challenges requiring psychosocial adjustment. Few investigations have explored the longitudinal process of adaptation to POI.

Purpose This longitudinal investigation tests a model of adjustment to POI that includes separate psychosocial vulnerability and resilience resource factors.

Methods Among 102 women with POI, personal attributes reflective of vulnerability and resilience were assessed at baseline. Coping strategies were assessed 4 months later and measures of distress and well-being 12 months later.

Results As hypothesized, confirmatory factor analysis yielded separate, inversely correlated vulnerability and resilience resource factors at baseline, and distress and well-being factors at 12 months. Contrary to predictions, maladaptive and adaptive coping strategies were not bi-factorial. Moreover, a single stand-alone strategy, avoidance (i.e., refusing to

acknowledge stress), mediated the association between baseline vulnerability and 12-month distress.

Conclusions For women with POI, interventional studies targeted to reduce avoidance are indicated.

Keywords Infertility · Coping · Adaptation · Risk · Resilience · POI · Premature menopause · Premature ovarian failure

Abbreviations

POI Primary ovarian insufficiency

Infertility is a common, chronic, and challenging health problem requiring the adjustment of important life goals for many women. The causes of this condition are many and adaptation varies considerably. Approximately 7 % of married women between the ages of 15 and 44 are infertile [1]. Regardless of the precipitant, the repercussions of such a diagnosis have the potential to be emotionally and psychologically devastating [2]. Because the personal and societal value placed on biological parenting is so great, women who are unable to bear children often feel isolated [3]. Many experience a diminished sense of self-worth and feel a loss of control [4]. Rates of depression and anxiety among women with infertility are comparable to rates in women suffering from cancer, hypertension, myocardial infarction, and HIV [5]. Among those confronting health threats, only persons with chronic pain demonstrate higher rates of depression than women with infertility [5].

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Spontaneous 46,XX primary ovarian insufficiency (POI) is a distinct type of infertility whereby a woman loses normal function of her ovaries before the age of 40 [6]. It is diagnosed when a woman under the age of 40 experiences four or more consecutive months of amenorrhea, with two or more follicle stimulating hormone (FSH) serum levels in the menopausal range [7, 8]. Consequently, the condition is akin to early onset menopause. POI affects approximately 1 % of women [9], and only 5–10 % of women who carry this diagnosis conceive and carry a child to term [7]. Consistent with the general infertility literature, when compared with healthy controls, women with POI report greater shyness, social anxiety, general anxiety, depression, and negative affect along with lower levels of self-esteem, social support, and positive affect [10–12]. Although women with POI are psychologically disadvantaged relative to healthy controls, many do adjust to their condition and maintain adaptive levels of psychosocial functioning. Indeed, many women adjust to the condition without experiencing elevations in psychological distress suggesting that there is great variation in adjustment to POI [12].

What might account for these differences in adaptation among women with POI? Models of adaptation to health threats have tended to be one-dimensional, meaning they emphasize risk factors, maladaptive coping, and negative outcomes. Emerging models take a two-dimensional approach by incorporating positive factors such as resilience, adaptive coping, and positive outcomes [13]. The current study applies this comprehensive perspective to evaluate a two-dimensional model of adaptation over time in a sample of women with POI (see Fig. 1). In brief, we asked whether baseline personal attributes, reflective of both vulnerability and resilience among women with POI, can predict adaptive and maladaptive coping 4 months later, which, in turn, can predict well-being and distress 1 year after baseline.

Individual Difference Factors: Predictors of Distress and Well-being

For three decades, models of adaptation to stress have focused on vulnerability factors as key determinants of outcomes. Perhaps the most widely applied framework is that of *diathesis-stress*, which postulates that pre-existing negative psychosocial traits interact with stressors to predict poor coping, leading to diminished psychological adjustment. Consistent with this framework, research suggests that some negative personal attributes can influence selection of coping responses in the context of stress [14], resulting in the selection of strategies that are not helpful [15]. For instance, neuroticism has been linked to more frequent use of less effective coping strategies (i.e., escapism, withdrawal, wishful thinking), which are more passive or avoidant strategies [15, 16]. Yet, it is also the case that positive traits can buffer individuals against the

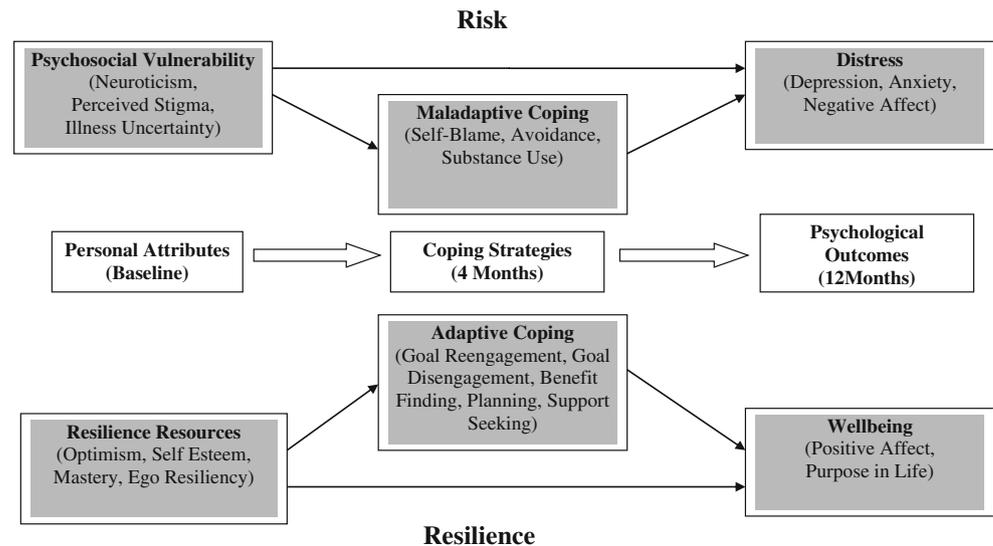
deleterious effects of stress. For example, extraversion is related to strategies rated as more effective (i.e., rational action, positive thinking, self-adaptation), strategies classified as more active or approach-oriented [15].

Mancini and Bonanno [17] propose that a latent resilience trait (indicated by personality traits, beliefs) may be critical in determining the process by which individuals cope with and adapt to stress [17]. Further, they suggest that the contributions of psychosocial resilience to adaptation are distinct from those of psychosocial risk. Investigators have proposed models including variables from multiple domains to identify relevant latent factors representative of resilience and risk [18]. Building on the diathesis stress model by including traits reflective of resilience, Wright, Zautra, and Going predicted two separate latent factors, one comprised of resilient traits and the other comprised of vulnerability traits, that would be associated with aspects of health among persons with arthritis [18]. This model is noteworthy. First, it is two-dimensional. Second, it proposes latent risk and resilience factors comprised of individual difference indicators. Finally, the model was developed and applied in the context of a health threat.

Evidence drawn from women managing the stress of infertility suggests that both positive and negative psychosocial traits are associated with emotional outcomes [19–22], highlighting the potential applicability of a two-dimensional framework for understanding adaptation in this context. For example, high levels of optimism, self-esteem, and intrinsic religiosity have all been associated with psychological well-being and/or reduced distress among those with infertility [19–22]. In contrast, high levels of neuroticism, helplessness, perceived stigma, and illness uncertainty have been associated with greater psychological distress [12, 23]. In fact, positive and negative individual traits together among women coping with infertility account for nearly 50 % of the variance in adjustment.

A key mechanism linking psychosocial traits with outcomes among those managing a health threat is coping responses. In the context of infertility, positive reappraisal, goal reengagement, and goal disengagement have each been associated with better adjustment [12, 21, 24, 25]. Avoidance, distancing, rumination, catastrophizing, and self-blame have been strongly associated with maladaptive outcomes, such as depression, negative affect, and infertility-related distress [24, 26–28]. Findings with regard to use of planful problem solving and support seeking remain mixed, with some investigations linking them to positive outcomes [21] and others, to poor ones [28]. Thus, some coping strategies appear to promote good and others poor adjustment to the stress of infertility. Taken together, the existing evidence suggests that psychosocial traits and coping strategies predict adjustment among women facing infertility. However, several key gaps remain in our understanding of adaptation to infertility. First, among women coping with infertility, no study to our

Fig. 1 Path model of risk and resilience in women with spontaneous 46,XX POI



knowledge has evaluated whether psychosocial traits reflect two distinct underlying dimensions of individual differences, one associated with risk and the other with resilience. Second, no research has evaluated whether coping responses reflect two underlying dimensions of coping, one maladaptive and one adaptive in women facing this stressor.

Distress and Well-being as Separate Dimensions of Health

Investigations probing adjustment in the context of health threats frequently focus on psychological constructs that predict distress but ignore the prediction of well-being. This approach assumes distress and well-being are polar opposites. For this to hold true, the absence of distress should be associated with elevated levels of psychological adjustment [29]. Yet, findings from several studies suggest this may not be the case [30, 31]. Indeed, some people simultaneously exhibit elevated levels of both distress and well-being, while others endorse the absence of both. Researchers have proposed that well-being is more than the “absence of pathology” [13], and empirical findings have been consistent with this theory [29, 32, 33]. For example, a 2005 investigation by Keyes sought to distinguish the presence of mental health, termed “flourishing,” from mental illness, termed “languishing” [33]. The use of confirmatory factor analysis and structural equation modeling revealed that these two constructs represented distinct, but correlated latent factors ($r=-0.53$).

Recent cross-sectional evidence specifically lends support for a two-dimensional model of vulnerability and resilience among women seeking treatment for infertility [28]. Benyamini et al. found that measures of infertility-related distress and well-being emerged as distinct, but correlated

subscales (r between observed scale scores= -0.38) (measured by the Infertility Specific Well-being and Distress Scales) [28].

Among women seeking infertility treatment, more problem management (i.e., planning and seeking social support) was associated with more distress, but was unrelated to well-being. In contrast, both self-nurturing and positive reinterpretation predicted greater well-being, but were unrelated to distress. Additionally, among women with infertility, maladaptive coping strategies (i.e., self-blame) predict negative affect but not positive affect, and positive strategies predict positive affect but not negative affect [34]. These findings point to the legitimacy of exploring distress and well-being as distinct outcomes in women confronting infertility.

Applying a Two-Dimensional Model of Risk and Resilience to Infertility

The present study tested a two-dimensional model of adaptation to POI over the course of 1 year (see Fig. 1). Our first aim is to identify latent factors comprised of measures indicative of baseline resilience and vulnerability (time 1), measures of adaptive and maladaptive coping 4 months later (time 2), and measures of well-being and distress at 1 year follow-up (time 3). Thus, the components of the model are expected to be represented by six factors: resilience resources and psychosocial vulnerability, adaptive and maladaptive coping, and well-being and distress. Once identified, the resilience resources and psychosocial vulnerability factors at time 1 are expected to predict the differential use of adaptive and maladaptive coping strategies at time 2, which, in turn, are expected to predict distinct distress and well-being outcomes at time 3. That is, a constellation of pre-existing resilience resources is expected to predict both adaptive coping and indices of well-

being, whereas a constellation of traits indicative of psychosocial vulnerability will predict both maladaptive coping and distress.

Method

Participants

One hundred and two women between the ages of 18 and 42 were enrolled in the investigation. Eligible women (1) reported oligo/amenorrhea (menstrual irregularity) for a period lasting at least 4 months prior to age 40, and (2) two FSH serum levels (at least 1 month apart) in the menopausal range. Participants with POI resulting from surgery, radiation, chemotherapy, and/or karyotype abnormalities were excluded. The study was approved by the Institutional Review Board at the NIH, and informed consent was obtained from all participants.

Procedure and Measures

Women with 46,XX POI were recruited via published and internet advertisements between June 2005 and February 2006 and were asked to participate in a 12-month longitudinal pilot study to assess psychosocial adjustment, coping, and emotional well-being. Participants completed a battery of questionnaires at four separate intervals (baseline, 4, 8, and 12 months). For the current study, only baseline, month 4, and month 12 responses were utilized. Measures of psychosocial traits/attitudes assessed at baseline (time 1), coping strategies measured at month 4 (time 2), and outcomes measured at month 12 (time 3) were included in analyses. Measures with strong reliability and validity were selected to optimize assessment of a wide range of psychosocial constructs with theoretical or empirical relevance for adjustment in the context of infertility. Time 1 measures focused on constructs related to psychosocial vulnerability and resilience resources. Psychosocial vulnerability was comprised of (a) neuroticism [Big 5 Inventory [35]], (b) perceived stigma [Lennon Stigma Scale [36]], and (c) illness uncertainty [Mishel Uncertainty in Illness [37]]. Resilience resources were comprised of (a) optimism [Life Orientation Test-Revised [38]], (b) self-esteem [Rosenberg Self-Esteem scale [39]], (c) mastery [Pearlin Mastery scale [40]], and (d) ego resilience [The Ego Resilience Scale [41]]. Time 2 measures focused on coping and were derived from the Brief COPE [42], the goal disengagement and reengagement scale [43], and Antoni's 16-item Benefit Finding scale [44]. The Brief COPE was modified to specify the extent to which respondents utilized a variety of coping strategies as a means to deal specifically with their POI (e.g., avoidance, self-blame, support seeking, planning). The goal disengagement and reengagement scale was modified to specify the extent to which respondents engaged with or disengaged from

the goal of getting pregnant. Similarly, the Benefit Finding scale was modified to assess the use of this strategy in the context of POI. Time 3 measures focused on constructs related to psychological distress and well-being. Assessment of distress included (a) depression [Center for Epidemiologic Studies Depression scale [45]], (b) anxiety [State-Trait Anxiety Inventory [46]], and (c) negative affect [Positive and Negative Affect Schedule [47]]. Assessment of well-being included (a) purpose in life [Positive Mental Well-being Inventory [48]] and (b) positive affect [Positive and Negative Affect Schedule [47]]. A complete list of the scales utilized, including the number of items, response scale ranges, mean item scores, reliabilities, sources, and administration time(s) of assessment for the reported statistics is given in Table 1.

Data Analysis

First, distributional properties of all study variables were examined to evaluate deviations from normality in SPSS Version 19.0. Next, latent factors of personal attributes, coping, and adjustment were tested using a series of confirmatory factor analyses (CFA) with full information maximum likelihood estimation (FIML) in MPLUS 6.0 [49]. Chi-square tests of fit were examined to evaluate model fit. Both goodness and badness of fit indices are reported, including the comparative fit index [CFI [50]], root mean square error of approximation [RMSEA [51]], and standardized root mean square residual [SRMR [52]]. CFI values greater than 0.95, RMSEA values equal to or less than 0.06, and SRMR values less than or equal to 0.08 were considered to reflect good fit [53]. It is important to note, however, that RMSEA and CFI can be unreliable with sample sizes less than 200 [54]. Because the present sample is small ($n=102$), ambiguity among the three indices prompted strongest consideration of SRMR when interpreting model fit. Latent correlations between factors were estimated to determine whether the factors represented separable constructs (e.g., is the psychosocial vulnerability factor distinct from resilience resources?). Chi-square difference tests were utilized to compare nested models. Composites reflecting the underlying factor structure were then formed by standardizing each of the relevant indicators and summing them. When composites represented indicators of similar valence (i.e., with loadings of the same sign), standardized scores were added together to represent each latent construct. When constructs included indicators of both positive and negative valence, items were recoded before standardizing so higher scores reflected better adaptation.

Finally, single mediator models were probed in MPLUS 6.0 [49] with FIML to provide parameter estimates in the presence of missing data. This procedure retains participants with missing dependent variables in the analyses without producing biased coefficient estimates and standard errors that would normally occur as a function of non-normality and/or missing data. Specifically, the following paths were estimated:

Table 1 Scale names, number of items, item response scale, source, and reliabilities

Scale	<i>N</i>	Number of items	Response scale	Mean (SD)	Skew (kurtosis)	Reliability	Time assessed
Neuroticism [35]	102	8	1–5	3.00 (.79)	–.001 (–0.45)	0.80 ^a	1
Perceived stigma [36]	101	5	1–6	4.31 (1.13)	–0.73 (–0.03)	0.78 ^a	1
Illness uncertainty ^d [37]	100	11	1–5	2.79 (.77)	–0.41 (–0.47)	0.87 ^a	1
Optimism [38]	102	6	1–5	3.27 (.78)	–0.74 (–0.12)	0.82 ^a	1
Self-esteem [39]	101	10	1–4	3.26 (.54)	–0.56 (–0.20)	0.88 ^a	1
Perceived mastery [40]	102	7	1–4	3.08 (.62)	–0.63 (–0.09)	0.78 ^a	1
Ego resilience [41]	102	14	1–4	3.17 (.43)	–0.64 (0.29)	0.80 ^a	1
Brief cope: avoid [42]	86	2	0–3	.25 (.45)	1.89 (3.15)	0.53 ^b	2
Brief cope: blame [42]	86	2	0–3	.48 (.58)	1.03 (.22)	0.37 ^b	2
Brief cope: planning [42]	86	4	0–3	1.73 (.84)	0.07 (–0.78)	0.88 ^a	2
Brief cope: supp seek [42]	86	7	0–3	1.27 (.73)	0.34 (–0.82)	0.90 ^a	2
Goal disengage [43]	83	4	0–4	2.15 (1.16)	–0.10 (–0.77)	0.91 ^a	2
Goal reengage [43]	83	6	0–4	2.91 (1.03)	–1.00 (0.39)	0.95 ^a	2
Benefit finding [44]	86	16	1–5	2.62 (.95)	0.14 (–0.78)	0.95 ^a	2
Anxiety [46]	80	20	0–3	1.99 (.56)	0.71 (1.12)	0.94 ^a	1,3 ^c
Depression [45]	80	20	0–3	.65 (.52)	1.26 (1.57)	0.91 ^a	1,3 ^c
Negative affect [47]	80	10	1–5	2.00 (.64)	0.83 (0.18)	0.87 ^a	1,3 ^c
Positive affect [47]	80	10	1–5	3.34 (.78)	–0.47 (0.78)	0.93 ^a	3
Purpose in life [48]	80	9	1–6	4.92 (.78)	–1.62 (3.79)	0.85 ^a	3

Note: Measures: neuroticism (Big 5 Inventory); perceived stigma (Lennon Stigma Scale); illness uncertainty (Mishel Uncertainty in Illness); optimism (Life Orientation Test-Revised); self-esteem (Rosenberg's Self-esteem Scale); perceived mastery (Pearlin Mastery Scale); ego resilience (Ego Resilience Scale); avoidance, self-blame, planning, support seeking (Brief COPE); goal disengagement and goal reengagement (Goal Disengagement and Reengagement Scale); benefit finding (Benefit Finding Scale); anxiety (State Trait Anxiety Inventory); depression (Center for Epidemiologic Studies Depression Scale); positive and negative affect (Positive and Negative Affect Schedule); purpose in life (Positive Mental Well-being Inventory)

^a Cronbach's alpha in current sample

^b Pearson correlation in current sample

^c Because baseline distress was controlled for, distress measures were administered at times 1 and 3

^d Only 14 of the original 23 original scale items were relevant for POI

(1) independent variable predicting mediator (*a* path), (2) mediator predicting dependent variable in an equation also containing the independent variable (*b* path), and (3) the mediated or indirect effect (i.e., the product of the *a* and *b* paths, *ab*) were carried out with bootstrapped estimates of the standard errors. Demographic and illness-related variables, including age at diagnosis, time since diagnosis, parental status (no children versus at least one child), and income, were considered as potential covariates because they have been linked with study variables in infertility samples [55–58]. Only income was related to study variables in the current study; thus, only income was probed as a potential covariate.

Results

Preliminary Analyses

Sample The average age of study participants was 32 (SD=5.35); the average time since diagnosis was approximately

41 months. The sample was predominantly white (78 %), married/partnered (63 %), and college educated (81 %). Additionally, approximately 32 % of the sample endorsed having at least one child, 23 % had a biological child, and the remaining 9 % achieved parenthood via adoption or egg donation.

Distributional Properties Mean item scores, standard deviations, skewness, kurtosis, and intercorrelations for key variables are presented in Table 1. As a whole, the sample reported moderate levels of self-esteem, mastery, and ego resiliency and endorsed feeling stigmatized. Accordingly, they manifested traits reflective of resilience and vulnerability. Additionally, they used moderate levels of adaptive coping and infrequently used maladaptive strategies. Finally, they reported some degree of both distress and well-being.

Attrition Of the 102 women who completed time 1 assessments, 16 did not complete the time 2 assessment (month 4) and an additional 6 did not complete the time 3 assessment (month 12). Utilizing the Bonferroni correction method to

adjust for the 16 comparisons of baseline measures between the 80 participants who completed all measures and the 22 with missing data failed to reveal group differences on any variables. Of relevance for the proposed model, participants with complete data did not differ from those with missing data on any baseline, mediator, or outcome measure.

Factor Structure of Personal Attributes, Coping, and Adjustment

Personal Attributes Optimism, mastery, self-esteem, and ego resiliency were expected to load together on a single resilient resource factor, whereas neuroticism, perceived stigma, and illness uncertainty were expected to load together on a single psychosocial vulnerability factor. This two-factor model yielded good fit, $\chi^2(13)=17.05$, *ns*, CFI=0.986, RMSEA=0.055 [90 % CI 0.00, 0.12], SRMR=0.038, with a latent correlation between these two factors of $r=-0.88$. We next estimated a single-factor model including all of the indicators. This solution yielded adequate to good fit, $\chi^2(14)=21.23$, *ns*, CFI=0.975, RMSEA=0.070, 90 % CI [0.00, 0.13], SRMR=0.044. The chi-square difference test revealed better fit of the two-factor model versus the one factor model, $\Delta\chi^2(1)=4.18$, $p<.05$. Consequently, the two-factor solution was retained. Indicators and standardized factor loadings for the final two-factor solution are given in Table 2.

Coping A two-factor model was also examined for coping, including the five adaptive coping measures (i.e., planning, support seeking, goal disengagement and reengagement, benefit-finding) as one factor and two maladaptive coping measures (i.e., avoidance, self-blame) as a second factor. However, the model did not converge. Thus, a one-factor model including all seven indicators was tested, but the fit for this model was poor, $\chi^2(14)=38.54$, $p<.001$, CFI=0.75, RMSEA=0.14, SRMR=0.12.

An alternative empirically derived model was specified; higher levels of goal disengagement and goal reengagement, along with low levels of self-blame, were specified to load on one factor (“letting go and moving on”); and planning, support seeking, and benefit finding were specified to load on a second factor (“approach coping”). The model yielded adequate fit, $\chi^2(7)=11.11$, *ns*, CFI=0.96, RMSEA=0.08; 90 % CI [0.00, 0.17], SRMR=0.07. The factors were not significantly correlated ($r=0.19$, *ns*). A one-factor model including all six indicators was also estimated. This model yielded significantly worse fit [$\Delta\chi^2(1)=37.02$, $p<.01$] than the two-factor model. See Table 2 for the indicators and standardized factor loadings of the retained two-factor solution. Because avoidance did not emerge as a significant indicator in any model and was not included in the final factor analysis for coping variables, it was retained as a stand-alone variable.

Adjustment Negative affect, depression, and anxiety were expected to comprise a latent construct referred to as distress, whereas positive affect and purpose in life were hypothesized to make up a second factor, well-being. The two-factor model yielded adequate to good fit, $\chi^2(4)=6.66$, *ns*, CFI=0.988, RMSEA=0.091; 90 % CI [0.00, 0.21], SRMR=.024, with a latent correlation between the factors of $r=-0.85$. We next estimated a one-factor model that included all five measures. The chi-square goodness of fit test was significant, $\chi^2(5)=11.45$, $p<.05$, CFI=0.971, RMSEA=0.126; 90 % CI [0.02, 0.23], SRMR=0.037. The chi-square difference test indicated better fit for the two-factor versus the one-factor model, [$\Delta\chi^2(1)=4.71$, $p<.05$]; thus, the two-factor model was retained. See Table 2 for the indicators and standardized factor loadings.

Bivariate Associations Among Measured Composites

Prior to testing the mediation models depicted in Fig. 1, we examined the observed correlations among composite measures of personal attributes, coping, and adjustment, depicted in Table 3. The resilience resource composite was inversely correlated with psychosocial vulnerability ($r=-0.68$), and the well-being composite was inversely correlated with distress ($r=-0.69$). Notably, though correlated, these composites were differentially associated with certain coping constructs. For example, resilience resources was positively correlated with letting go/moving on ($r=0.39$, $p<.01$), which in turn, was correlated with well-being ($r=0.38$, $p<.01$) but not distress. Vulnerability was also significantly correlated with letting go/moving on ($r=-0.29$, $p<.01$), as well as with avoidance ($r=0.31$, $p<.01$), which in turn was related to distress ($r=0.35$, $p<.01$), but not well-being.

Remaining associations revealed that correlated factors (e.g., psychosocial vulnerability/resilience resources, distress/well-being) shared similar patterns with other constructs. Specifically, psychosocial vulnerability was significantly and moderately associated with distress ($r=0.33$, $p<.01$) and well-being ($r=-0.38$, $p<.01$). Resilience resources, too, was moderately associated with distress ($r=-0.36$, $p<.01$) and strongly with well-being ($r=0.53$, $p<.01$). Neither resilience resources nor psychosocial vulnerability were significantly correlated with approach coping. Of note, with regard to potential covariates, only income was significantly associated with study variables.

Mediation

Only two coping measures (i.e., letting go/moving on, avoidance) were related to both personal attributes and adjustment; thus, only two mediation models linking personal attributes with adjustment were evaluated. The models were model 1 psychosocial vulnerability → avoidance → distress and model

Table 2 Final factor solutions

Time	Factor	Loading	Psychosocial vulnerability	Lambda
Time 1	Resilience resources			
	Optimism	0.815	Neuroticism	0.697
	Self-esteem	0.834	Illness uncertainty	0.666
	Mastery	0.784	Perceived stigma	0.608
	Ego resiliency	0.633		
Time 2	Approach coping	Loading	Letting go/moving on	Lambda
	Planning	0.553	Global disengagement	0.617
	Support seeking	0.968	Goal reengagement	0.876
	Benefit finding	0.373	Self-blame	−0.374
Time 3	Well-being	Loading	Distress	Lambda
	PAFF	0.744	NAFF	0.872
	PIL	0.744	CESD	0.908
			STAI	0.802

Standardized loadings are reported

NAFF negative affect, CESD Center for Epidemiologic Studies Depression Scale, STAI State Anxiety Inventory, PAFF positive affect, PIL purpose in life

2 resilience resources→letting go/moving on→well-being. In model 1, initial distress was controlled so that the model reflected the mediation of change in distress over time. Psychosocial vulnerability and resilience resources were highly correlated. Therefore, in the mediation analysis of vulnerability, resilience resources were statistically controlled. In the mediation analysis of resilience resources, vulnerability was statistically controlled, as was baseline well-being.

With regard to model 1 (see Fig. 2), with baseline distress controlled, higher vulnerability predicted greater avoidance (*a* path), and greater avoidance predicted higher distress at outcome (*b* path). It is noteworthy that this mediational relationship was found when resilience resources were statistically controlled. Moreover, avoidance mediated the association

between psychosocial vulnerability and distress indirect effect (*ab*)=0.10 (SE=0.04); 95 % CI [0.03, 0.21]. Income was examined as a control variable but was not significant and so not retained in the final models. There was some disagreement across indices regarding adequacy of fit, $\chi^2(2)=5.60$, *ns*, CFI=0.886, RMSEA=0.133; 90 % CI [0.00, 0.27], SRMR=0.028. As stated earlier, because CFI and RMSEA can be unreliable with sample sizes less than 200 [54], the SRMR was given strongest consideration when evaluating fit. Thus, this solution is judged to be adequate. Though it is not standard to report variance accounted for when using this analytic strategy, we include it to assist with interpretation. Together, psychosocial vulnerability and avoidant coping (the hypothesized predictors) accounted for 19 % of the total

Table 3 Intercorrelations among calculated composites and demographic characteristics of sample

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10. ^b	11.
1. Resilience	–	−0.68**	0.14	0.39**	−0.14	−0.36**	0.53**	0.05	−0.04	0.01	0.29**
2. Psych Vuln		–	−0.12	−0.29**	0.31**	0.33**	−0.38**	0.04	−0.02	0.08	−0.22*
3. Approach			–	0.04	0.15	0.02	0.19	0.16	−0.12	−0.16	−0.05
4. Letting Go				–	−0.25*	−0.19	0.38**	0.08	0.21	0.19	0.07
5. Avoid ^a					–	0.35**	−0.20	−0.01	0.01	−0.13	−0.24*
6. Distress						–	−0.69**	0.04	0.13	0.18	−0.19
7. Well-being							–	0.00	−0.01	−0.10	0.35**
8. Age Dx								–	−0.12	0.22	−0.03
9. Time Dx									–	−0.05	−0.02
10. Parent ^b										–	0.12
11. Income											–

Bolded values represent significant correlations between study factors. Italicized items represent significant correlations between study variables and demographic variables. Correlations between time 1 composites, *n*=102; time 1 and time 2 variables, *n*=86; all correlations with time 3 variables, *n*=80

p*<.05; *p*<.01

^a Standardized avoidance score

^b Parental status—point biserial correlations (0=no children, 1=at least one child)

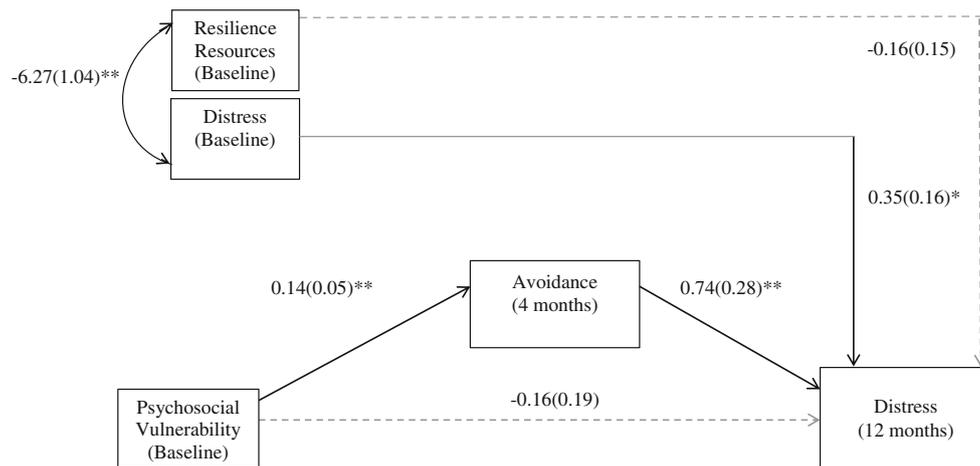


Fig. 2 Finalized path model depicting the association between psychosocial vulnerability and distress mediated by avoidance. *Note:* Unstandardized paths are shown with estimated standard errors in parentheses. * $p \leq .05$; ** $p < .01$; *** $p < .001$; dashed lines denote non-

significant pathways; solid lines denote significant pathways; the double-headed arrow represents the unstandardized covariance coefficient. Indirect effect (ab)=0.10 (0.04), 95 % CI (0.03, 0.21), CFI=0.886, RMSEA=0.133 (90 % CI 0.00, 0.269), SRMR=0.028

variance in distress at 12 months. With the control variables added (baseline distress and baseline resilience), an additional 8.5 % of variance in 12 month distress was accounted for.

With regard to model 2, resilience resources predicted letting go/moving on (a path) but letting go/moving on failed to predict well-being over and above resilient resources (b path); thus, letting go/moving on failed to mediate the association between resilience resources and well-being, Indirect effect (ab)=0.04 (SE=0.03); 95 % CI [-0.01, 0.12].

Summary of Results

Consistent with hypotheses, support was garnered for distinct representations of personal attributes in two factors, (1) psychosocial vulnerability and (2) resilience resources. Likewise, findings supported separate representations of adjustment (i.e., distress and well-being). Results were not consistent with a theoretical conceptualization of separate and distinct adaptive and maladaptive coping constructs. However, an empirically derived model suggested an alternative conceptualization of coping in this sample that was comprised of two adaptive coping factors: (1) continued pursuit and attention to biological parenthood, that is—approach coping, and (2) strategies indicative of letting go /moving on. Avoidance, a stand-alone, maladaptive strategy, emerged as the only significant mediator between psychosocial vulnerability and distress.

Discussion

The current investigation drew on recent paradigm shifts within the field to better understand how women adjust to POI, a specific type of infertility. Specifically, these shifts include

recognition that (a) distinct factors comprised of personal attributes may promote “resilience” or convey “risk” in the context of stress, (b) mental health is two-dimensional, comprised of both well-being and distress, and (c) adaptive and maladaptive coping strategies may operate as mediators of the links between personal attribute factors and outcomes. Latent factors representing resilience resources, psychosocial vulnerability, adaptive coping, maladaptive coping, well-being, and distress were proposed. These latent factors were thought to group into a temporally ordered, two-dimensional model reflecting risk and resilient processes for women diagnosed with POI. With one exception (i.e., coping), the underlying factor structure that emerged was largely consistent with the proposed model. In particular, as hypothesized resilience resources emerged as distinct from but related to psychosocial vulnerability; well-being emerged as distinct from but related to distress. Moreover, there was some indication of mediated effects for coping that were consistent with a risk pathway. Since resilience resources were more strongly related to well-being than the putative mediator of letting go, results failed to support a similar mediated resilience pathway through letting go.

Personal Attributes

The current findings regarding the two-dimensional structure of resilience attributes (i.e., optimism, self-esteem, mastery, and ego resiliency) and vulnerability attributes (i.e., neuroticism, illness uncertainty, and perceived stigma) are consistent with those of prior investigations of individuals facing a health challenge. For example, among Mexican-American women with elevated cardiometabolic risk, resilience and vulnerability also fell along two distinct but highly related dimensions [59]; life engagement, self-esteem, and social support loaded

on one factor. Pessimism, anxiety, depression, hopelessness, hostility, and loneliness loaded on the other.

Although the existing evidence is consistent with a two-dimensional model, there is some variability in the literature with respect to how “vulnerability” and “resilience” factors are operationalized. For example, two distinct vulnerability and resilience factors emerged in a sample of patients with chronic pain [60]. The constellation of anxiety, depression, emotionality, interpersonal sensitivity, and pessimism characterized vulnerability, while the constellation of active coping, acceptance, purpose in life, and optimism characterized resilience. Of note, factors were correlated -0.30 , which is much lower than the latent correlation reported here or among women with cardiometabolic risk [59]. What can account for the discrepant findings? One possibility is that combining trait levels of personal attributes, along with situational coping and state adjustment, as Smith and Zautra (2008) did, yields risk and resilience factors that are less strongly correlated than are factors comprised solely or mainly of stable personal attributes alone. Another possibility is that the magnitude of the relation between risk and resilience hinges on the particular attributes under consideration, an area ripe for additional investigation.

Nevertheless, the current findings add to existing evidence suggesting resilience resources reflect general beliefs about the self and the world. In other words, those scoring high on the construct believe they are capable people and good things will happen to them. Those who score high on vulnerability are prone to experience negative emotion, social alienation, and at least in the case of POI, uncertainty about their condition.

Coping

A number of models have framed coping strategies along two dimensions, one adaptive and the other maladaptive. For example, problem-focused coping is often thought to be adaptive and emotion-focused coping maladaptive [61]. Present findings failed to support this two-dimensional conceptualization of coping in POI. Instead, strategies reflecting continued pursuit and attention to biological parenthood, that is—approach coping (planning, support seeking, benefit finding) were distinct from strategies indicative of letting go/moving on (higher levels of goal disengagement/alternative goal pursuit and lower levels of self-blame).

The current findings align to some extent with those of Benyamini et al. in their investigation of women with infertility. They identified coping meta-constructs and labeled them (1) practical management (investing in self, planning, spiritual coping), (2) approach/avoidance (denial, self-blame, positive reinterpretation), and (3) recruiting spousal support [28]. The practical management construct included emotional and instrumental strategies, similar to the approach coping factor

identified in the present study. The approach/avoidance construct was similar to the letting go/moving on factor in the present investigation that involved reorienting in order to move forward. However, some differences were observed between the two studies. Specifically, the former investigation found that positive reinterpretation did not load with planning. Additionally, support seeking emerged as a stand-alone construct. These differences may be due, in part, to differences in sample characteristics. The average duration of infertility in the current sample was longer than the duration reported by Benyamini et al. Only 18 % of their sample carried the diagnosis for more than 3 years whereas a full 35 % of the present sample received their diagnosis more than 3 years prior to study entry. Coping dimensions may look different for those with a more recent diagnosis when compared with those who have carried it longer and may be in a different phase of adjustment. Indeed, an earlier study of women with breast cancer suggests that dimensions of coping may change as a function of time [62]; the investigation revealed that though coping meta-constructs remained relatively stable, subtle variations in their makeup were evident.

In both the current work and that of Benyamini et al., distinct coping factors or constructs emerged, but in neither case were coping factors consistent with an “adaptive” versus “maladaptive” framework [28]. What is adaptive largely depends on context [63]. For example, problem-focused coping is widely acknowledged to be adaptive when a situation is controllable and emotion-focused coping when the issue is uncontrollable [64]. Accordingly, a model pitting “good coping” versus “bad coping” is undoubtedly an oversimplification because what is helpful in one situation may be detrimental in another.

Adjustment

A two-dimensional representation of well-being (purpose in life, positive affect) and distress (depression, anxiety, negative affect) was proposed and retained. Although the latent correlation between the factors was high, the two-factor model provided a better fit to the data than did a one-factor model. Accordingly, differentiation between positive and negative affective outcomes was small in this sample with POI, but nevertheless present.

Of relevance to the present investigation, Wright et al. (2008) identified a construct of risk and an alternative one of resilience in a sample of people with early knee osteoarthritis [18]. Risk was comprised of negative affect, depression, and neuroticism. Resilience included positive affect, vitality, and extraversion. As in the current investigation, the latent correlation among the factors was also high ($r=-0.70$). Neuroticism is highly related to negative affect and reflects a predisposition to experience it [65, 66]. By contrast, extraversion is related to positive affect [65, 66]. Accordingly, though Wright

et al. (2008) termed these factors “risk” and “resilience,” one might argue that the factors actually reflect negative and positive affectivity, consistent with the outcome factors (distress and well-being) in the present sample. Thus, results with respect to affective adjustment were comparable across the two studies, but stand in contrast to research reporting that indices of distress and well-being or positive and negative affectivity are less related [66]. Notably, the present study and the one conducted by Wright et al. explored these associations in samples experiencing chronically stressful health conditions: pain and infertility.

The association between positive and negative affect changes during stress [67]. Under normal circumstances, individuals maintain the ability to simultaneously experience positive and negative affective states, thus preserving a two-dimensional representation of affect. However, the model postulates that stress may simplify affective processing such that the affects converge on a single bipolar dimension. The chronic nature of infertility-related demands along with the social, psychological, and identity sequelae of the condition may precipitate levels of stress sufficient to promote a more one-dimensional experience of affect. Indeed, for those coping with other major life stressors, there appears to be a strong association between indices of distress and those of well-being. For example, a comparison of conjugally bereaved older adults and disabled adults with age/gender-matched controls revealed that the association between positive and negative affect subscales was stronger for the former two groups ($r_s < -0.42$) than the controls ($r = -0.22$) [68]. Thus, individuals in the throes of managing significant stressors, including infertility, may be less emotionally differentiated than other individuals without similar burdens.

Adaptation to POI

Results from the present investigation revealed that the resilience resources factor was positively correlated with future well-being and negatively correlated with future distress. Likewise, the psychosocial vulnerability factor was positively correlated with distress and negatively correlated with well-being. However, with regard to coping, distinct associations with future adjustment were revealed. Specifically, letting go/moving on was correlated with well-being, but not distress, and avoidance was correlated with distress, but not well-being.

A prior cross-sectional investigation of definitively infertile adults also found that coping was differentially correlated with measures of adjustment [34]. Strategies believed to be adaptive across a variety of settings (e.g., goal reengagement, active coping, use of emotional support) were positively correlated with positive affect and unrelated to negative affect. Strategies considered maladaptive (e.g., self-blame, substance use, rumination, and catastrophizing) were correlated with

negative affect and unrelated to positive affect. Moreover, when adaptive coping strategies were considered together, only positive reappraisal emerged as a significant predictor of current positive affect. Similarly, when maladaptive coping strategies were considered together, only catastrophizing and self-blame emerged as predictors of current negative affect. Notably, though the present analysis modeled future and not current adjustment, the only strategies that emerged as significant predictors across the two investigations were cognitive. Indeed, in the present study, avoidance and letting go/moving on were comprised of strategies focused on mental circumvention and cognitive reorientation, respectively. These findings in combination with the present ones lend credibility to a two-dimensional model of mental health.

Although correlated with both resilience resources at baseline and well-being at 1 year, letting go/moving on coping did not mediate the resilience resources-well-being association. Notably, strategies comprising letting go/moving on have been acknowledged to be protective in cross-sectional investigations [12], but few studies have explored their future implications. Thus, the use of this group of strategies may be helpful in the short term but may not impart long-term benefit. On the other hand, avoidant coping did mediate the association between pre-existing vulnerability and future distress, and together, these variables accounted for a full 19 % of the variance in the criterion. This finding is consistent with those reported in an earlier cross-sectional investigation of adaptation to infertility [27], where avoidant coping mediated the association between attachment anxiety (a personal attribute) and infertility-related distress (an outcome). Thus, the present finding in a prospective study is particularly noteworthy, suggesting that avoidance can have a sustained impact on distress among women with infertility.

Limitations

The current investigation was subject to a number of limitations. First, the sample size was small, though characteristic of clinical samples with uncommon conditions. A second limitation was the wide variability in time since diagnosis. The average time since diagnosis was 3.5 years. Some women had received the POI diagnosis only months prior and others many years prior to study enrollment. In light of findings suggesting that distress and stress appraisals related to infertility vary as a function of time [69], a larger sample might have allowed for stratification by time since diagnosis to elucidate dispositional versus contextual coping patterns and adaptation. Moreover, although a 1-year time frame captures a significant segment of the coping process, evaluating coping over a longer time frame would add important information regarding adjustment to infertility. Additionally, because avoidance emerges as a salient factor in the process by which women with POI adapt, it is important to note the limitations of the current measure.

The Brief COPE includes only two questions about avoidance, and though they were modified to specify avoidant behavior in the context of POI, future investigations should consider a more reliable and robust measure of this construct. Finally, because the sample was highly educated, primarily white, and affluent, findings cannot be generalized to more diverse groups of infertile women.

Conclusion

For many women, infertility is a significant life challenge and the current findings have practical clinical utility. First, in a prospective longitudinal study, we demonstrate that avoidance can have a sustained impact on distress among women with POI. Avoidance is detrimental and thus represents a salient clinical target among those with POI that should not be ignored. Second, because well-being and distress are highly correlated in those with POI, encouraging a more differentiated emotional experience may prove to be clinically useful. For example, mindfulness-based interventions teach patients to attend to and differentiate emotional experiences. Moreover, they have demonstrated clinical utility in the form of improved outcomes with other populations characterized by undifferentiated emotional experiences (e.g., depression, pain) [70, 71].

Future investigations should include a larger sample of women from diverse backgrounds and in all stages of treatment to allow for more sophisticated modeling, along with stratification to explore momentary and longitudinal associations between coping and adaptation. Moreover, focus should expand to include additional variables of relevance to this population (e.g., support, stress appraisals) along with more varied assessments of personal attributes (e.g., pessimism, interpersonal sensitivity, extraversion) and coping. Finally, current models tend to focus solely on women's adjustment to their infertility. Yet because infertility occurs within a social context of family and friends, models that include the dynamic interplay among individuals over time would provide a richer understanding of the complex individual and social processes that contribute to adaptation.

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Compliance with Ethical Standards

Authors' Statement of Conflict of Interest and Adherence to Ethical Standards No conflicts of interest are reported for Drs. Driscoll, Davis, Aiken, Yeung, Sterling, Papat or Nelson. Additionally, no conflicts of interest are reported for Ms. Vanderhoof, Calis, or Covington. All procedures performed in the present investigation were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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