Dispositional Optimism, Trait Anxiety, and Coping: Unique or Shared Effects on Biological Response to Fertility Treatment?

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The aim of this study was to examine the unique and shared predictive power of psychological variables on reproductive physical health. Three months before fertility treatment, 97 women completed measures of dispositional optimism, trait anxiety, and coping. Information about biological response to treatment (e.g., estradiol level) was collected from medical charts after treatment. Structural equation modeling showed that measured psychological variables were all significant indicators of a single latent construct and that this construct was a better predictor of biological response to treatment than was any individual predictor. This research contributes to evidence suggesting that the health benefits of dispositional optimism are due to its shared variance with neuroticism.

Keywords: dispositional optimism, neuroticism, coping, infertility, physical health

A main controversy in health psychology is whether dispositional optimism is related to health because of unique aspects of this personality trait or because it shares variance with an underlying personality constellation that itself relates to health. Scheier and Carver (1987) argued that dispositional optimism has direct physiological effects as well as indirect effects on health through coping. However, others have argued that optimism is strongly related to neuroticism or negative affectivity and that it is this trait complex that has direct effects on health (e.g., Smith, Pope, Rhodewalt, & Poulton, 1989). Moreover, any indirect effects of optimism through coping may also be linked to associations between coping and neuroticism. The main aim of this study was to examine the unique and shared predictive power of dispositional optimism, coping, and neuroticism on physical health.

Dispositional Optimism and Physical Health

Dispositional optimism (Scheier & Carver, 1985) is a stable personality characteristic comprising “expectations on the part of the person that good, as opposed to bad, outcomes will generally occur when confronting problems across important life domains” (Scheier et al., 1989, p. 1025). That dispositional optimism might have implications for physical health is suggested by studies showing that higher scores on the Life Orientation Test (LOT; Scheier & Carver, 1985) are related to more favorable health outcomes, such as fewer and less severe physical symptoms (e.g., Scheier & Carver, 1985, Study 3; Scheier, Carver, & Bridges, 1994; Tomakowsky, Lumley, Markowitz, & Frank, 2001), better response to coronary artery bypass surgery (Scheier et al., 1989), improved immune response (Segerstrom, Taylor, Kemeny, & Fahey, 1998), and better birth outcomes (Lobel, DeVincent, Kaminer, & Meyer, 2000). These findings provide some support for the proposal that dispositional optimism has physiological effects that may promote better health outcomes (Scheier & Carver, 1987).

Dispositional Optimism and Neuroticism

Neuroticism (Eysenck & Eysenck, 1975), also known as negative affectivity (Watson & Clark, 1984), is a stable personality characteristic that comprises a constellation of negative traits, mood states, and associated behaviors (Costa & McCrae, 1987). A central component of neuroticism is trait anxiety (Spielberger, Gorsuch, & Lushene, 1970), and this trait consistently shows high correlations with the LOT (range: −.40 to −.66) as well as significant associations with somatic or health complaints (e.g., Robbins, Spence, & Clark, 1991; Smith et al., 1989). In light of these findings, it has been proposed that the health effects of optimism may be due to shared variance with neuroticism and negative traits related to it rather than to unique aspects of optimi-

1 The terms negative affectivity, used by Watson and Clark (1984), and neuroticism, used by Costa and McCrae (1985, 1987), refer to stable, pervasive constellations of negative traits and emotional states. Both constructs are positively related to symptom self-reports, but neither is consistently related to organic disease. Thus, both negative affectivity and neuroticism may lead to exaggerated reports of physiological signs of ill health (Costa & McCrae, 1985, 1987; Watson & Pennebaker, 1989). Because of these similarities and to avoid the clumsiness of repeatedly referring to both terms, the term neuroticism is used to refer to both neuroticism and negative affectivity.
mism (e.g., Andersson, 1996; Smith et al., 1989). Several findings support such a neuroticism hypothesis. First, stronger correlations have been found between the LOT and indicators of neuroticism than between the LOT and other measures of dispositional optimism (Smith et al., 1989) or physical symptom reports (Andersson, 1996). In addition, controlling for indicators of neuroticism (e.g., trait anxiety) has reduced the relationship between optimism and physical health reports to nonsignificance (e.g., Scheier et al., 1994; Smith et al., 1989, Study 2).

However, although such findings suggest that optimism effects on physical health may be confounded by covariation with neuroticism, mediation analyses may lack explanatory power with respect to the impact of dispositional optimism on actual physical health for which symptom self-report measures are used. Symptom self-report reflects both true physical processes and subjective impressions of physical health (Watson & Pennebaker, 1989); thus, it would not be possible to ascertain whether the LOT remained significant because of its association with the subjective or objective component of self-report. The same can be said of neuroticism, as it has been argued that neuroticism is not related to actual physical health but merely contaminates symptom self-report (e.g., Costa & McCrae, 1987; Watson & Pennebaker, 1989). That different results might emerge if objective markers of health are assessed is suggested by recent work that showed that optimism but not prenatal maternal stress had a direct effect on birth outcomes (i.e., birth weight, gestational age; Lobel et al., 2000).

Dispositional Optimism and Coping

Carver, Scheier, and Weintraub (1989) suggested that certain personality characteristics may predispose individuals to “stable coping dispositions” (p. 270) that determine how they react to novel stressful situations (Carver & Scheier, 1994). Dispositionally optimistic individuals might use more problem-focused coping, whereas pessimists might employ more emotion-focused strategies to cope with the distress aroused by their negative expectations (Carver et al., 1989; Scheier & Carver, 1987). This difference in coping could influence health because optimists may be more likely to tackle health problems directly rather than avoid them as pessimists might. Research has supported these proposals insofar as optimism is associated with a greater use of problem-focused coping strategies (including better health behaviors) and a lesser use of emotion-focused coping strategies (e.g., Lobel et al., 2000; Scheier et al., 1989; Scheier, Weintraub, & Carver, 1986, Study 1). However, evidence that coping mediates the health effects of optimism is lacking, mainly because in these studies coping is not consistently correlated with markers of physical health (Scheier et al., 1989; Tomakowsky et al., 2001).

However, even if coping were shown to mediate optimism effects on health, this finding could also support the neuroticism hypothesis because coping may be a behavioral manifestation of this constellation of personality traits. That is, individuals who are prone to react to stressful situations with tension, worry, or nervousness may be less likely to contact health practitioners and more likely to avoid information related to their medical problems and so on. As such, associations between the LOT and coping may actually be due to associations between neuroticism and coping. Indeed, Smith et al. (1989) found that moderate correlations between the LOT and problem-focused coping or avoidance became nonsignificant after taking into account trait anxiety. However, as only symptom reports were used in this study, it is not known to what extent such findings apply to physical markers of health.

The Present Study

The main aim of this study was to determine whether dispositional optimism, trait anxiety, and coping had unique predictive power on physical health parameters or whether their effects were due to the fact that all were indicators of an underlying trait complex that itself was related to physical health. We examined this question in the context of a prospective study on predictors of women’s biological responses to in vitro fertilization (IVF) treatment.

IVF is a fertility treatment that helps couples with a range of fertility problems to achieve a pregnancy by means of a series of pharmacologic (i.e., hormonal) and physical interventions. During the normal menstrual cycle, the pulsatile release of gonadotrophin-releasing hormone (GnRH) to receptors in the pituitary stimulates the pituitary to produce luteinizing hormone (LH) and follicle-stimulating hormone (FSH). These hormones stimulate the growth of 15–20 follicles containing developing eggs (oocytes). As the oocytes mature, the ovaries secrete estrogen, which feeds back to the pituitary to decrease the production of FSH, resulting in sufficient FSH for only one follicle to mature fully. However, in IVF the effect of the GnRH pulse generator is suppressed and FSH is administered chronically. These pharmacologic interventions cause multiple follicles to mature and estradiol levels to remain high so that the number of oocytes that can be retrieved for treatment is maximized. (In women of reproductive age, estradiol is the principal hormone in the class of steroid hormones known as estrogens.) When follicles reach an optimal size, women receive an injection of human chorionic gonadotrophin to trigger ovulation and oocytes are retrieved within 36 hr. Oocytes are then placed in a culture dish and fertilized with the partner’s sperm. If fertilization is successful, a maximum of three embryos are transferred to the uterus, according to regulation in the United Kingdom (Human Fertilisation and Embryology Authority, 1995), and patients wait 14 days before taking a blood test to determine if pregnancy has been achieved.

The highest estradiol level reached (peak estradiol), the number of follicles, and the number of oocytes all therefore represent the functional capacity of the ovary. As women are born with all the oocytes they will ever produce, the number of oocytes additionally reflects the effect of factors that have impacted the ovary across the life span. These factors include biological events (e.g., aging), lifestyle factors (e.g., smoking, obesity; Cramer, Barbieri, Fraer, & Harlow, 2002), and, potentially, the effect of negative personality traits. These factors may degrade the quality of oocytes as well as reduce their numbers (Cramer et al., 2002) and may explain why not all follicles yield oocytes. In the present study, we examined the link between psychological factors and these indicators of biological response to treatment.

IVF is a good clinical model to test relations among psychological variables. Treatment is stressful, and converging evidence suggests that psychological characteristics measured prior to treatment predict the outcome of IVF. Anxiety (Sanders & Bruce, 1999) and depression (Smeenk et al., 2001) have been shown to correlate negatively with pregnancy, and chronic negative affect has been shown to be negatively related to the number of oocytes retrieved (Klonoff-Cohen, Chu, Natarajan, & Sieber, 2001). Also,
both emotion-focused coping (Demyttenaere et al., 1998) and problem-focused coping (Stoleru et al., 1997) have been associated with successful fertilization. Although these findings support psychosomatic effects on fertility, the methodology is problematic when pregnancy is used as an outcome measure. Although a viable pregnancy is dependent on the woman’s contribution to treatment (i.e., her ovarian response), it is also dependent on the man’s (i.e., his sperm quality). As spouse scores on psychological variables tend to be moderately correlated (Boivin et al., 1998), it would be impossible to know whether a psychological influence on pregnancy outcome was due to the psychological profile of the woman, the man, or both. In addition, once oocytes have been removed from the woman’s body, decisions by medical staff as to the quality of oocytes may impact the ultimate outcome of IVF. Thus, it is difficult to ascertain the extent to which pregnancy outcome is influenced by the psychological profile of the woman alone. Hence, the outcome variables used in the present study reflected only the woman’s biological or ovarian response to IVF.

We used a combination of regression and structural equation modeling (SEM) analyses to test whether optimism effects on reproductive health were due to unique aspects of optimism, to aspects shared with coping, or to shared variance with an underlying psychological dimension (i.e., neuroticism), which itself was related to physical health. If optimism health effects were due to unique aspects, then regression analyses should show that optimism remains significantly related to physical health after controlling for trait anxiety and coping (see Figures 1 and 2). Furthermore, if these potential causal variables can be considered as distinct elements in the causal pathway to health rather than as correlated indicators of a single underlying latent dimension (i.e., neuroticism), then indicator loadings and goodness-of-fit statistics should show that the proposed latent structure (see Figure 3) does not provide a good fit to the data (i.e., underlying variance–covariance/correlation matrix). The reverse would be expected if optimism effects were due to shared variance. That is, regression analyses should show reduced or nonsignificant path coefficients, and the structural equation model of an underlying latent psychological complex should be a good fit to the model predicting biological response to fertility treatment.

Method

Participants

The final sample included 97 women about to begin IVF treatment at the assisted reproduction unit of a large urban hospital. The selection criteria for the study were that women were accepted into the IVF program, had started the IVF cycle, spoke and understood English sufficiently to be interviewed, and had completed all study materials and that full information about the biological variables of interest was available from medical charts. The mean age of the women was 33.33 years (SD = 3.32), almost all (97.9%, n = 95) had completed at least some secondary education, and the majority (83.5%, n = 81) were employed. In terms of reproductive history, the women had been infertile for an average of 7.77 years (SD = 3.0). More than half (58.8%, n = 57) were experiencing primary infertility (i.e., had never had a pregnancy, whether it resulted in an ectopic pregnancy, abortion, miscarriage, or live birth), and around a third (35%, n = 34) had previously experienced one or more cycles of IVF treatment. IVF had previously been successful for 4 of these women (4.1%).

Women participating in this study were recruited from 287 women with scheduled appointments at the IVF clinic, 211 (75.3%) of whom attended their appointment and were interviewed as potential participants. Of these, 114 women were not included in the final sample because their IVF cycle was not scheduled during the study period (10.9%, n = 23), they did not meet medical requirements for IVF (18.0%, n = 38), they did not complete all study materials (10.4%, n = 22), or they were not invited into the study after interview (10.0%, n = 21). Of these 21 women, 8 could not understand the study materials, 8 were not interested in participating, and 5 had personal or marital issues. Ten women were not included in the final sample because full information about the biological variables of interest was not available. This was either because their treatment cycles were canceled before oocyte retrieval or because more than one value for the biological variables was missing from medical charts (n = 1).

Psychological and Biological Measures

Dispositional optimism. The original LOT (Schier & Carver, 1985) was used to assess dispositional optimism. The LOT contains eight items assessing generalized outcome expectancies (e.g., “In uncertain times, I usually expect the best”). Higher scores indicate greater optimism. The LOT has reasonable internal consistency (Cronbach’s α = .76), and the test–retest reliability of .79 reflects the dispositional quality of the con-
Coping. The coping inventory was adapted from the Ways of Coping Questionnaire (Folkman & Lazarus, 1988). The 66-item questionnaire was shortened to 23 items because of practical limitations (e.g., time taken to complete). Four subscales (Problem Management, Problem Appraisal, Expressing Emotions, and Escapist Coping) were created, on the basis of the approach described by Terry and Hynes (1998). Problem-management coping includes active efforts to solve a problem, whereas problem appraisal includes attempts to deal with the stressful nature of a situation by reappraising the problem. Expressing emotions refers to the expression of emotion engendered by the stressful situation, whereas escapism represents attempts to avoid the situation (e.g., daydreaming or fantasizing). Cronbach’s alpha was .62 for the resulting Problem Appraisal subscale, .65 for Problem Management, and .85 for Escapist Coping. Cronbach’s alpha for the Expressing Emotions subscale was unacceptably low (.35), so this scale was not used.

Biological response. Ovarian response to IVF was assessed with three variables: peak estradiol level, number of follicles, and number of oocytes retrieved. Peak estradiol level (ng/mL) was the highest blood estradiol level reached before ovulation was triggered (approximately 9–12 days after initiation of ovarian stimulation), number of follicles was the number of follicles observed by ultrasound scan at this time, and number of oocytes was the number of oocytes retrieved from follicles. Also recorded was the outcome of IVF, that is, whether treatment was canceled after oocytes were retrieved but before the pregnancy test (i.e., failed fertilization) or whether the result of the pregnancy test was positive or negative. Biological variables were converted to standard scores (z scores; Cohen & Cohen, 1983) and summed as a measure of ovarian response. Higher scores indicated better ovarian response. The mean numbers of follicles and oocytes for a sample of 254 women undergoing IVF was 9.56 (SD = 4.86) and 9.83 (SD = 5.14), respectively (Cramer et al., 1999). In the present study, the outcome of treatment was as follows: 13 women (13.40%) had a positive pregnancy test; 63 (64.95%) had a negative test; and for 21 women (21.64%), treatment was canceled after oocytes were retrieved but before the pregnancy test.

Procedure
Approximately 3 months before commencing IVF (M = 2.84 months, SD = 1.58), women attended an initial appointment with the medical consultant, at which time medical procedures for IVF were outlined and blood tests were carried out to assess suitability for treatment. At this time, women were provided with a complete description of the study and its requirements. Those interested in participating signed a consent form and were interviewed to obtain demographic and medical information. Women

Figure 2. Standardized beta weights and zero-order coefficients (in parentheses) for Model 3. This model shows trait anxiety and escapist coping as mediators. *p < .05. ***p < .001.

Figure 3. A structural equation model testing the role of a latent psychological complex in predicting biological response to fertility treatment. Scoring on the Life Orientation Test is reversed so that higher scores mean less optimism. y(8, N = 97) = 13.88; root-mean-square error of approximation = .089; goodness-of-fit index = .95; adjusted goodness-of-fit index = .88. *p < .05.
were then given a questionnaire pack to complete privately at home in the following week and return in the prepaid envelope provided. Women underwent the routine IVF treatment protocol for the clinic (as described in the introduction), and information about ovarian response (i.e., estradiol level, number of follicles and oocytes) was collected from medical records once treatment was finished. The study received ethical approval from the Bro Taf Local Health Authority (Cardiff, Wales), which receives applications for medical clinics governed by the National Health Service in the area in which participants were recruited.

**Data Analysis**

Data were examined to determine suitability for multivariate analyses. Missing values were identified on psychological predictors (trait anxiety; $n = 2$; dispositional optimism, $n = 1$; and coping, $n = 2$) and biological outcome variables (peak estradiol, $n = 1$; and number of oocytes, $n = 1$). As there were moderate to high intercorrelations among the psychological predictors and among the biological response variables (see Table 1), regression analyses were used to predict missing values. Missing values on psychological (biological) variables were predicted from the other psychological (biological) variables. Three outliers were found ($>3$ standard deviations from the mean of the outcome group, to which the case belonged). Outliers (peak estradiol, $n = 2$; oocytes, $n = 1$) were set equal to the next highest value in the distribution for that outcome group. To reduce extreme skewness ($>2.58$), peak estradiol and number of follicles were square-root transformed, improving normality (skewness, 0.53 and 1.84, respectively).

Zero-order correlations were computed to assess pairwise relationships among variables, and mediation was tested by using the method of Baron and Kenny (1986). According to this method, mediation is only possible if at the zero-order level the predictor (i.e., optimism) is significantly related to the mediator (e.g., trait anxiety or coping) and dependent (i.e., ovarian response) variables. It is important to note that the initial relationship between the predictor and the dependent variable must be significantly reduced when the mediator and predictor are included in the analyses, whereas the relationship between the mediator and dependent variable remains significant (Holmbeck, 1997, 2002) (see Figures 1 and 2). SEM with maximum likelihood estimation procedures (LISREL Version 7.20; Jöreskog & Sörbom, 1989) was used to test the hypothesis that dispositional optimism, trait anxiety, and coping, on the one hand, and estradiol level, number of follicles, and number of oocytes, on the other, represented two latent dimensions of psychological and biological constructs, respectively, that were significantly related (see Figure 3).³

**Results**

As 34 women had previous experience of IVF and treatment had been unsuccessful for all but 4, women with prior experience of IVF were compared with those without prior experience to establish whether these groups differed in their scores on psychological predictors or biological outcome variables. Using $t$ tests, we found no significant differences on predictors or outcome variables, whether or not treatment had been successful. Moreover, regression analyses (excluding those with previous IVF success) showed that previous experience did not interact with psychological predictors to predict response on any of the ovarian response variables. Therefore, all women were included in subsequent analyses.

Zero-order correlations between psychological variables and ovarian response showed that neither problem appraisal nor problem-management coping satisfied the basic requirements for mediational analyses (Baron & Kenny, 1986). Problem-appraisal coping was significantly related to the LOT, $r(95) = .17, p = .05$, but not to ovarian response, $r(95) = .15, p = .08$, and problem-management coping was not significantly related to either the LOT, $r(95) = -.11, p = .14$, or ovarian response, $r(95) = -.039, p = .35$. Consequently, these coping variables were not examined further. Table 1 shows zero-order correlations among remaining variables. Correlations among psychological variables were consistent with past research in showing that dispositional optimism was inversely related to trait anxiety and escapism whereas the latter two variables were positively associated with each other. Correlations between psychological and biological variables were also in the expected direction, though correlations with functional aspects of ovarian response (i.e., estradiol level, number of follicles) were not all significant. Correlations among standardized biological variables were also as expected.

Table 1: Zero-Order Correlations Among Psychological Variables and Ovarian Response Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>$M$</th>
<th>$SD$</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dispositional optimism</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>18.03</td>
<td>4.96</td>
<td>7–28</td>
</tr>
<tr>
<td>2. Trait anxiety</td>
<td>$-0.51^{**}$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>39.95</td>
<td>10.02</td>
<td>21–66</td>
</tr>
<tr>
<td>3. Escapism</td>
<td>$-0.38^{**}$</td>
<td>$-0.66^{**}$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>12.18</td>
<td>6.44</td>
<td>1–27</td>
</tr>
<tr>
<td>4. Peak estradiol level</td>
<td>0.10</td>
<td>$-0.11$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>5.50</td>
<td>3.44</td>
<td>0.27–16.00</td>
</tr>
<tr>
<td>5. Number of follicles</td>
<td>0.20</td>
<td>$-0.14^{†}$</td>
<td>$-0.11$</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>11.06</td>
<td>5.53</td>
<td>2–30</td>
</tr>
<tr>
<td>6. Number of oocytes</td>
<td>0.30</td>
<td>$-0.31^{**}$</td>
<td>$-0.31^{**}$</td>
<td>$-0.81^{***}$</td>
<td>—</td>
<td>—</td>
<td>8.10</td>
<td>4.65</td>
<td>1–19</td>
</tr>
<tr>
<td>7. Ovarian response</td>
<td>$0.22^{*}$</td>
<td>$-0.21^{*}$</td>
<td>$-0.20^{*}$</td>
<td>$0.86^{***}$</td>
<td>$0.91^{***}$</td>
<td>$0.93^{***}$</td>
<td>0.00</td>
<td>2.69</td>
<td>$-5.53–6.83$</td>
</tr>
</tbody>
</table>

Note. Means and standard deviations for peak estradiol and number of follicles are before variables were transformed.

³ Standardized variables. ² Ovarian response = peak estradiol + number of follicles + number of oocytes retrieved.

† $p < .10$.  * $p < .05$. ** $p < .01$. *** $p < .001$. ⁴ $p < .05$. ** $p < .01$. *** $p < .001$.
ian response was not significant after controlling for escapist coping. The link between escapist coping and ovarian response also became nonsignificant. As the relationships between trait anxiety or escapist coping and ovarian response were not significant when optimism was controlled, the conditions for demonstrating mediation (Holmbeck, 2002) were not met. Finally, when both trait anxiety and escapist coping were controlled in Model 3, the relationship between each predictor and ovarian response became nonsignificant and the equation was marginally significant, $F(3, 93) = 2.22, \text{MSE} = 6.97, p < .091$. Together these models show that there was sufficient covariation among the psychological variables to inhibit the unique prediction of any one variable.

To examine shared variance among psychological variables and their ability to predict physical health, we carried out a full-measurement structural equation model as described previously. In this model, the three indicators for the underlying latent psychological dimension were dispositional optimism, trait anxiety, and escapist coping. The three indicators for the ovarian response dimension were peak estradiol level, number of follicles, and number of oocytes. In order to make the interpretation of path coefficients unambiguous, scoring on the LOT was reversed so that higher scores meant less optimism. Figure 3 contains the results for the test of the overall model of the latent psychological construct predicting the biological dimension. The standardized coefficients showed that all indicators were significant predictors of their proposed latent constructs. Lambda values for the psychological construct ranged from .57 to .89, whereas lambda values for biological variables ranged from .70 to .98. Of the psychological indicators, trait anxiety had the highest loading with the latent psychological construct; of the biological variables, the number of oocytes showed the highest loading with the latent biological construct. The psychological dimension significantly predicted the biological dimension ($\beta = -.36, p < .05$). Derived goodness-of-fit statistics were within the range considered acceptable: goodness-of-fit index $= .95$; adjusted goodness-of-fit index $= .88$; root-mean-square error of approximation $= .098$; $\chi^2(8, N = 97) = 13.88, p < .10$. Thirteen percent of the variance in ovarian response to IVF was associated with psychological characteristics.  

**Discussion**

It is commonly believed that patients with a positive outlook fare better during difficult health ordeals, which reflects an assumption that positive expectancies have beneficial health effects. We showed that dispositional optimism was significantly related to several aspects of reproductive health, which together indicated a more favorable biological response to fertility treatment. A significant link between optimism and health was expected and is in line with numerous other findings showing a clear association between dispositional optimism and aspects of physical health, such as fewer HIV symptoms (Tomakowsky et al., 2001), improved immune function (Segerstrom et al., 1998), better perinatal outcomes (Lobel et al., 2000), and lower likelihood of myocardial infarction during surgery (Scheier et al., 1989).

What is not yet clear is how positive expectancies promote positive health. One hypothesis is that they motivate people to engage in behaviors that promote good health, for example, by using coping strategies that aid recovery (e.g., planful problem solving; Folkman & Lazarus, 1988) rather than strategies that cause or exacerbate physical health problems (e.g., alcohol use, ignoring physical symptoms; Scheier & Carver, 1987). An alternative explanation to account for direct and indirect effects (via coping) is that both optimism and coping are facets of a broader and more complex personality constellation, which itself relates to physical health (e.g., Smith et al., 1989). According to this proposal, people who are prone to react to situations with tension, anxiety, or worry are also less likely to be optimistic and more likely to use coping strategies like wishful thinking or avoidance. The results of this study would support the second explanation for health effects of dispositional optimism, that is, that the health benefits of dispositional optimism are due to its shared variance with a broader psychological dimension.

This conclusion is based on one key finding supported by two types of statistical analyses. First, neither optimism, escapist coping, nor trait anxiety predicted reproductive health when the other variables were included in the mediational analyses. Second, each variable was a significant indicator of an underlying latent psychological dimension, which was more correlated to reproductive health than any variable on its own. Together, these findings provide strong evidence for shared variance among optimism, escapist coping, and trait anxiety and for an underlying psychological dimension linking all three variables. We can only speculate as to the nature of this underlying dimension; however, we propose it to be closely linked to neuroticism, as trait anxiety, which loaded highest on the dimension, is a core aspect of this personality constellation.

There is some debate as to the effects of neuroticism on physical health. Some consider this trait complex a “nuisance” (Watson & Pennebaker, 1989, p. 234) variable that contaminates reports of physical symptoms but does not generally lead to poorer physical health. Others suggest that facets of this dimension are indicative of a disease-prone personality, which has significant implications for people’s physical well-being (Friedman & Booth-Kewley, 1987). Our findings support the latter contention and extend the scope of influence to reproductive functioning. Our findings may be more in line with those of Friedman and Booth-Kewley (1987) because our sample (i.e., patients) and outcome variable (i.e., biological indicator) were more similar to those included in their meta-analysis than those included in the Watson and Pennebaker (1989) review, which included mainly a healthy population and distal disease indicators (e.g., blood pressure).

The pathways by which personality variables could impact reproductive health include indirect effects via lifestyle (e.g., smoking) or reproductive behavior (e.g., intercourse frequency). Additionally, personality could exert direct biological effects. As the biological end-points examined in this study were assessed prior to implantation, personality effects would need to be exerted on processes that occur prior to this stage of reproduction, namely follicular maturation and ovulation. It seems reasonable to propose that personality would influence reproductive health via the pathways that mediate the effects of stress, namely via activation of the

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4 In light of arguments that the LOT consists of separate Optimism and Pessimism subscales, we summed the positively and negatively worded items separately and recomputed the structural equation model, including these separate scores. The results showed that optimism and pessimism were significant indicators of the underlying construct. The magnitude of relationships between the underlying construct and biological response remained more or less as presented in Figure 3.
hypothalamic–pituitary–adrenal (HPA) axis that regulates the stress response.

It is generally agreed that the final neuroendocrine event causing stress-induced disruptions to reproductive function in untreated women is inhibition of the GnRH pulse generator and the slowing of the LH pulse frequency (Ferrin, 1999). Inhibition of GnRH is ultimately caused by an increase in corticotrophin-releasing hormone, which reflects the increased activity of the HPA axis during stress (Sapolsky, Romero, & Munck, 2000). However, stress effects in IVF are unlikely to occur through this functional pathway because pharmacological interventions used during treatment already inhibit GnRH receptors and chronic FSH administration overrides the negative feedback mechanism to the pituitary, thus allowing multiple follicles to mature and estradiol to reach supraphysiologic levels even though GnRH is inhibited.

However, two alternative routes may mediate stress effects on reproduction. Research suggests that in the presence of a highly estrogenized environment, as would be the case in IVF, HPA activation may cause a premature release of LH (Xiao, Xia-Zhang, Barth, Zhu, & Ferin, 1998), which may damage or degenerate the oocyte contained within the follicle (Ferrin, 1999) and account for fewer oocytes being observed in more trait-anxious women. Such events have been reported in IVF treatment cycles (Pepperell, 1994). Our findings would be in line with this explanation, as we found that psychological variables correlated more strongly with number of oocytes than with functional indices (i.e., estradiol). Second, release of the corticotrophin-releasing hormone would cause an increase in cortisol, and cortisol inhibits estradiol production (Chrousos, Torpy, & Gold, 1998). One would therefore expect stress to be associated with lower estradiol levels even if levels of this hormone remained in the supraphysiologic range because of chronic FSH administration. This proposal is consistent with our finding of a negative correlation between negative personality traits and estradiol level. Although IVF is a useful clinical model to examine stress effects on gross reproductive end-points (e.g., ovarian response, pregnancy), its pharmacological interventions may make it too complex to study more basic interactions between the HPA and hypothalamic–pituitary–gonadal axes. Future research aimed at identifying these basic processes may be more productive if targeted at the normal menstrual cycle and/or at treatments that do not require as much pharmacological intervention (e.g., artificial insemination).

A key purpose of the present study was to determine whether dispositional optimism has a direct effect on physical response to fertility treatment. The results suggest that this is not the case. Instead, the results of this study and others (e.g., Smith et al., 1989) suggest that neuroticism is the key trait influence on physical health. Therefore, it seems pertinent to consider whether the construct of dispositional optimism is redundant in health research. We believe, in line with Scheier et al. (1994), that it remains valid to continue to decompose neuroticism into its constituent facets because too little is yet known about the nature of relationships among different manifestations of this trait complex and how these relationships impact physical health. For example, it is possible that cognitive (e.g., expectancies), affective (e.g., depression), behavioral (e.g., poor health habits), and physiological (e.g., anxiety) manifestations of neuroticism are synergistic, moderate each other’s influence, and/or differentially impact other variables in affecting physical health.

If neuroticism is conceptualized as such an interactive system, then this has implications for interventions to remedy the effects of a disease-prone personality. Although personality is conventionally viewed as resistant to change, intervening to ameliorate any manifestations of neuroticism, whether to modify expectations, encourage more adaptive health behaviors, or lessen depression, should, in principle, feed back into the neuroticism system. In this way, intervention on one facet of neuroticism may serve to lessen the effect of the whole complex on health. Indeed, a recent study showed that cognitive behavior therapy, aimed at altering distorted cognitions, in combination with relaxation training, improved pregnancy rates in infertile women (Domar et al., 2000).

Although these results seem promising, a recent review of psychological interventions in infertility found that there was scant evidence that psychosocial interventions that reduced negative affect increased pregnancy rates (Boivin, 2003). On the basis of such findings, it might be worthwhile to aim interventions at reducing negative health behaviors that may be associated with neuroticism and that also affect reproduction (e.g., smoking). Overall, future research should focus on the interactive and moderated effects of different facets of the neuroticism complex on specific health outcomes. Such work would serve to untangle the effects of dispositional optimism, neuroticism, and associated behaviors on physical health.

References


