Infertility stigma and openness with others are related to depressive symptoms and meaning in life in men and women diagnosed with infertility

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Abstract

Background Stigma is the experience of feeling different from socially accepted norms which can lead to personal devaluation or fear of disapproval from others. For men and women experiencing infertility, stigma has been associated with psychological distress, feelings of otherness in relation to people with children, and selective disclosure with others about their infertility challenges. However, there are few studies which examine how infertility stigma and being open with others are related to depressive symptoms and meaning in life for men and women diagnosed with infertility.

Methods Participants experiencing infertility were recruited for this cross-sectional study during November 2023-January 2024 via announcements on infertility discussion listservs and social media accounts. Four-hundred fifty-eight women and 89 men completed an online survey. Participants were primarily from the United States (81%), followed by Europe, Canada, and Australia/New Zealand. Participants completed validated and reliable measures of infertility stigma, openness with others, depressive symptoms and meaning in life.

Results Hierarchical regression models explained substantial variance (*adjusted R-squared*) for depressive symptoms (41% men; 27% women), search for meaning in life (12% men; 14% women), and presence of meaning in life (19% men; 25% women). For both men and women, higher personal infertility stigma was significantly related with higher depressive symptoms and search for meaning. For both men and women, higher openness with others about infertility was significantly associated with lower levels of depressive symptoms and greater presence of meaning.

Conclusions The current findings support prior research indicating a significant association between infertility stigma and depressive symptoms and adds to the infertility literature by offering new insights into the relationships between stigma, openness with others, and meaning in life. Health care providers can use these findings to assist individuals and couples in reducing infertility stigma through collaborative conversations that reduce feelings of personal failure. Providers can also help those with infertility challenges to reduce psychological distress and increase meaning in life through accessing existing social networks and expanding social connections with others in ways that facilitate support.

Keywords Infertility, Stigma, Openness, Depression, Meaning, Men, Women

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Plain Language Summary

An infertility diagnosis can lead to feelings of inadequacy, loss, and difficulty being open with family and friends. It can also affect how people view the meaning and purpose of their life. This study explores how infertility stigma and being open with others relates to depressive symptoms and meaning in life for men and women experiencing infertility. When someone feels infertility stigma, they feel different from others and may question the fairness of life. When someone is open about infertility, they are likely to share their struggles with others. This study found that men and women who felt higher levels of infertility stigma had more depressive symptoms and were more likely to question the meaning of their lives. On the other hand, men and women who were more open with others had fewer depressive symptoms and sensed more meaning in their lives. The researchers encourage health care providers to help patients reduce infertility stigma, while helping them be open in ways that lead to positive support and increased opportunities to create new meaning.

Background

Stigma occurs when an individual or a group with certain characteristics that differentiate them from other members of society, sense public disapproval or personal devaluation [1, 2]. For men and women with infertility, they may experience stigma as a negative feeling of being socially different from others that can lead to psychological distress, fears of undesirable judgments, and selective disclosures with others [3, 4]. "We keep the fact that we are undergoing assisted reproduction very secret, we don't tell. Our family does not know. Very few friends know" (Klaus et al., [1]).

Infertility is defined as a disease of the male or female reproductive system resulting in the inability to conceive a pregnancy after 12 months or more of regular unprotected intercourse [5]. People with infertility commonly internalize negative societal or cultural attitudes about the failure to have a child, leading to feelings of inferiority, a sense of otherness compared to people with children, social isolation, and internalized shame [1, 6–8]. Furthermore, infertility can be experienced as a developmental interruption in a couple's expected life course, leading one or both partners to question their identity, views about parenthood, and beliefs about life's meaning [9]. This is particularly true in pronatalist countries where infertility is associated with increased stigma, less happiness, and lower life satisfaction [3, 10, 11].

Couples with infertility are more likely to experience depressive symptoms compared to fertile couples [12, 13], and depressive symptoms in one partner can impact the level of distress in the other [14]. A systematic review of 17 quantitative studies from 13 countries found strong evidence of a significant positive association between infertility stigma and depressive symptoms in women [15]. Qualitative studies have found that stigma and depression are commonly reported by men experiencing infertility [16, 17], however, there are few studies that directly examine how stigma is related to depression in men [18].

In addition to increased psychological distress, infertility can also lead men and women to reconsider meaning in their lives as they question assumptions about life's fairness, identity, and parenthood [9]. Meaning in life consists of two components: the search for meaning and the presence of meaning [19]. Search for meaning is defined as ongoing efforts to discover and make sense of one's meaning and purpose in life. Presence of meaning, on the other hand, is defined as having a clear sense that one's aim and purpose in life is meaningful [19]. In a study of women trying to conceive, the presence of meaning was related to the use of adaptive coping strategies, whereas the search for meaning predicted increased ruminations about getting pregnant, increased suppression of emotions and thoughts, and decreased sharing with others about their attempts at pregnancy [20].

The unexpected and stressful nature of the infertility experience can lead couples to feel uncertain about what challenges to share and with whom. This is particularly true for men who are less open than women about infertility, even when they report less stigma [4]. A global study of 1,171 men with infertility in five geographic regions through the world found that 73% were not very likely to talk about their infertility with others [21]. Men also commonly report being less open with their partner about infertility stress to support and protect their partner from burdening them with their own personal struggles [22]. Men's reluctance to disclose their infertility struggles with others may also be related to the amount of infertility stigma they feel, which is embedded in social and cultural norms of masculinity and shame [4, 16, 17]. However, if men are more open about infertility, there may be potential benefits. A study of 170 Italian men found that men who shared their infertility struggles with others reported significantly fewer depressive symptoms compared to men who did not [23].

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Despite the risk of experiencing infertility stigma, more depressive symptoms, less meaning, and greater challenges to being open with others about infertility, there have been few studies examining the specific relationships between these variables [15, 23] Because infertility has a lifetime prevalence of 17.5% globally, it is vital to study these factors as they are deeply embedded in the personal and social experience of infertility among men and women around the world [24]. The current study examined how depressive symptoms and meaning in life are related to men and women's internalized infertility stigma and levels of openness with others. A greater understanding of how these variables impact each other can offer people coping with infertility, counselors, and healthcare providers additional support and resources to better manage the infertility experience.

Our study was guided by two primary hypotheses. First, that greater infertility self-stigma would be associated with greater depressive symptoms, more search for meaning, and less presence of meaning in life. Second, that higher openness with others would be related with lower depressive symptoms, lower search for meaning, and higher presence of meaning in life.

Methods
Study design and participants
The study used a cross-sectional design where data were collected once at a single point in time [25]. Participants completed an online survey from November 2023 to January 2024 and were recruited via listservs and social media sites of Uniquely Knitted – a U.S. based non-profit organization that provides information and low-cost therapist-led process groups for the infertility community throughout the world. A total of $N=1030$ people clicked on the survey and completed at least one item; of them, 682 completed the survey. Several attention checks were used to ensure data quality questions (e.g., repeating items that has been previously asked, asking participants to 'click strongly agree' as an item response), thereby increasing the trustworthiness of responses by eliminating those who may have sped through the survey without carefully reading many of the questions. This led to a final sample of 547 participants (458 women and 89 men).

Ethical approval and study procedure
The study was approved by the first author's university institutional review board (IRB). The survey was advertised as an "infertility study" focused on people's experiences with infertility. The survey was estimated to take 15–20 min to complete. After clicking on the study link, participants read a consent form providing more details about the study's content. They were then given the option to continue with the survey or stop participation.

Participants who provided informed consent completed demographic questions, followed by questions about their infertility history, and questions from validated psychological measures. Participants who completed the full survey were entered into a random drawing of five $100 gift cards for Amazon.com, which were selected in the Spring of 2024.

Infertility-related measures
Infertility self-stigma
Participants completed the 7-item Self-Devaluation subscale of the Infertility Stigma Scale [26]. This measure is used to assess internalized stigma and negative feelings about the self because of one's infertility. Participants were asked how much they agreed with each statement. Three example items were "I am ashamed of being infertile," "I look down on myself because of my infertility," and "I feel inferior to others because of my infertility." Participants answered on a 5-point response scale (1 = Totally disagree, 5 = Totally agree). The items were averaged, with higher scores indicating greater self-devaluation. McDonald's Omega showed high internal consistency among the items for men ($\Omega=0.90$) and for women ($\Omega=0.86$).

Infertility diagnosis and treatment
We created several items to assess experiences with infertility. Participants were asked for their infertility diagnosis (male-factor, female-factor, combine-factor, or unexplained factor) or if they had not been diagnosed with infertility. Participants who had not been diagnosed with infertility were excluded from this sample. Participants were also asked for the length of time since diagnosis, infertility treatment history, and whether or not they had a child with their current or a former partner.

General psychological measures
Depressive symptoms
Participants completed the 10-item Center for Epidemiologic Studies Short Depression Scale (CES-D-10 [27]). This measure is used to assess depressive symptomatology in the general population. Participants were asked how often they were experiencing the issues described by each item. Three example items were "I felt depressed," "I felt lonely," and "I felt hopeful about the future (reverse coded)." Participants answered on a 4-point response scale (0 = Rarely or none of the time (less than 1 day); 3 = All of the time (Every day or almost every day). The items were summed and reverse coded when indicated, and higher scores indicated greater depressive symptoms. McDonald's Omega showed high internal consistency among the items for men ($\Omega=0.83$) and for women ($\Omega=0.87$).

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Search for meaning and presence of meaning

Participants completed the 10-item Meaning in Life Questionnaire [19]. This measure contains two subscales assessing the search for and presence of meaning, each containing five items each. Two examples of search for meaning were "I am always looking to find my life's purpose" and "I am searching for meaning in my life." Two examples of presence of meaning were "I understand my life's meaning" and "my life has a clear sense of purpose." Participants responded on a 7-point response scale (1 = Absolutely untrue, 7 = Absolutely true). The items in each sub-scale were averaged with higher total scores indicating higher levels of either presence or search for meaning. McDonald's Omega showed high internal consistency among the presence and searching items for men ($\Omega = 91$. and 0.93) and for women ($\Omega = 0.87$ and 0.91), respectively.

Openness to others

Participants completed the 8-item Openness to Others—Revised Questionnaire [23]. This measure is used to assess the extent to which people rely on their partners, friends, family, and others as confidants. Participants were asked how much they agreed with statements about how open they are with others using a 4-point response scale (1 = Strongly disagree, 4 = Strongly agree) with higher scores indicating greater openness. We assessed openness by creating two subscales: *openness to partner* (2 items) and general *openness to others* (4 items). The openness to partners items were both reverse coded: "There are some concerns I prefer to keep to myself in order not to burden my partner," and "I think that if I say how I really feel, I could demoralize my partner." The general openness items were "Beyond my partner, there are other people that I feel close to and with whom I am open with," "I share all my problems with my family," "There is a person who is a true source of support for me," and "I have no difficulty sharing all my problems with my friends."

We then omitted the two additional items from the general openness subscale. The first item was omitted because it overlapped conceptually with depression: "Sometimes I feel so down I think that nobody could help me." We were concerned that the inclusion of this item assessing how "down" they feel would artificially bias the results in favor of our hypothesis when predicting our primary outcome measure of depression. The second item that we omitted was "I'd like to open up more with others." This item was distinct from the other general openness items in that it measured a hypothetical (e.g., an attitude about wanting to open up) as opposed to a tangible relationship or behavior (e.g., sharing problems with family and opening up to people besides a partner).

An exploratory factor analysis (principal axis factoring with promax rotation) supported this two-subscale approach. The factor analysis revealed one general openness to others factor with the four aforementioned items (29.56% of variance; Eigenvalue = 2.37) and one partner openness factor with the two aforementioned items (16.71% of variance; Eigenvalue = 1.34). All factor loadings for these items on their primary factors exceeded 0.40. The factor analysis also hinted at a third potential factor with just a single item (13.52% of variance; Eigenvalue = 1.08), containing the hypothetical opening up item (factor loading = 0.45). The depression item did not load on any factor (all < 0.40).

We therefore proceeded with creating the openness to partner and general openness to others subscales. Cronbach's alpha was calculated for the openness to partner subscale because there were only two items, and it showed high internal consistency between the items for men ($\alpha = 0.71$) and for women ($\alpha = 0.73$). McDonald's Omega showed moderate internal consistency among the general openness items for men ($\Omega = 0.59$) and for women ($\Omega = 0.66$).

Overview of data analytic approach
Statistical analyses

Correlations among key variables, along with a series of hierarchical regressions, were conducted separately for men and women. Because over half of the 89 men had a partner who also participated in the study, we ran separate regressions for men and women to avoid violating the assumption of independence of observations. All continuous predictor and outcome measures were z-scored separately by gender so that the z-scores were centered around the means for each gender. These variables included age, time since diagnosis, education, infertility self-devaluation, openness to partner, general openness, and depressive symptoms. Categorical variables were dummy coded using 0 and 1. All regression analyses were conducted hierarchically. The steps were ordered to identify the amount of explained variance that was added to the model for each variable beginning with more internally focused and intrapersonal variables and moving to more externally focused and interpersonal variables. Step 1 included demographics (age, education), Step 2 added infertility factors (time since diagnosis, diagnosis type, trying to have first child, and current treatment status), Step 3 added infertility self-stigma, and Step 4 added openness to partner and openness to others. Parallel analyses were conducted for men and women for each outcome variable.

We highlight the total *adjusted R^2* and the change in *adjusted R^2* for each step of the model to demonstrate the extent to which infertility factors (Step 2) added

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predictive value above and beyond demographics (Step 1), how infertility stigma added predictive value above and beyond demographics and infertility factors (Step 3), and how openness to others and partners added predictive value above and beyond these variables (Step 4). Age was chosen as a predictor because age is related to infertility, and education level is related to access to resources and treatment options. Key experiences related to infertility diagnoses and treatment, such as time since diagnoses and history of receiving treatment, were entered in case these factors affect depressive symptoms and meaning. We split the psychological measures into ones assessing negative psychological experiences (internalized stigma) and hypothesized protective factors (openness to partners and others) to establish whether the presence of protective factors explained variance in depressive symptoms and meaning above and beyond the demographic, infertility factors, and stigma. For our key hypotheses, we report and focus our attention on the regression coefficients generated for each predictor in the fourth and final step rather than the individual coefficient values in the previous steps.

Interpreting effect sizes

Cohen [28] suggested effect size *d* can be interpreted as small (0.20), moderate (0.50), or large (0.80), which correspond to Pearson's *r* correlations of 0.10, 0.24, and 0.37, respectively. Ferguson ([29] p. 533) recommended higher thresholds for what constitutes a "'practically' significant effect for social science data" ($d = 0.41$; β or $r = 0.20$). To strike a balance between Type I versus Type II errors, we focused on associations that were (a) statistically significant at the $p < 0.05$ level, but only if (b) the associations were $r > |.09|$, or $\beta > |.09|$. We then gave special attention to statistically significant findings with effect sizes of r or $\beta > |.19|$. Furthermore, in the tables, we noted whether associations were significant at $p < 0.05$, 0.01, or 0.001 threshold, with smaller *p* values indicating greater confidence in rejecting the null hypothesis. All results reported in the results section were statistically significant at least at the $p = 0.05$ level, unless otherwise noted.

Results

Sample characteristics

Participants included 458 women and 89 men who reported that they, their partners, or both had received an infertility diagnosis. The mean age for the sample was 34.0 ($SD = 5.4$) for men and 32.9 ($SD = 4.5$) for women. Of the participants, 39.2% were currently undergoing treatment, 36.9% had received treatment in the past, and 23.9% had never undergone treatment. Female-factor infertility was reported as the most common diagnosis (37.8%), followed by unexplained (33.8%),

combined-factor (15.9%), and male-factor (12.4%). Eighty-nine percent of participants had a college (50.1%) or advanced degree (38.6). Eighty-five percent of the sample identified as White, followed by Hispanic (5.3%), Biracial (4.7%), and Asian (4.0%). Participants were primarily from the United States (81.2%), followed by Europe (7.3%), Canada (7.3%), and Australia/New Zealand (2.4%). Additional demographic details of the final sample can be found in Table 1.

Zero-order correlations among key variables

The zero-order correlations among variables are shown in Table 2. Consistent with the hypotheses, for both men and women, greater infertility self-stigma was significantly associated with greater depressive symptoms and greater search for meaning. Partially consistent with the hypothesis, greater infertility stigma was associated with lower presence of meaning for women, and was in this predicted direction for men, but the association for men was not statistically significant. Consistent with the hypotheses, for both men and women, greater openness to others was associated with lower depressive symptoms, less search for meaning, and greater presence of meaning. Also consistent with the hypotheses, for women, higher openness with their partners was associated with lower depressive symptoms and lower search for meaning. Partially consistent with the hypotheses, for men, greater openness to partner was only associated with lower depressive symptoms, but not with search or presence of meaning. Although it was not the primary focus of our analyses, we also noted that infertility stigma was associated with less openness to others for men ($r = -0.51$, $p < 0.001$) and for women ($r = -0.43$, $p < 0.001$), and to less openness with partners for women, ($r = -0.26$, $p < 0.001$), but not for men ($r = -0.18$, $p > 0.05$).

Depressive symptoms

The multiple regression analyses were conducted to isolate the strength of each predictor variable when controlling for the others. Table 3 presents the results of the hierarchical regression for depressive symptoms showing that the variables explained 41% of the variance for men and 27% of the variance for women. In Step 1, demographic variables did not contribute any explained variance for men and contributed only 1% in women, without any specific variable significantly contributing to depressive symptoms. In Step 2, infertility variables contributed an insignificant 4% to the explained variance for men and contributed 3% of the variance for women showing that currently being in treatments was associated with higher depressive symptoms in women. In Step 3, infertility stigma contributed an additional 19% of the explained variance for men and 15% for women. In Step 4, openness

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Table 1 Demographics and infertility factors

Demographics	Overall	Men	Women	Demographics	Overall	Men	Women
Age M (SD)	33.1 (4.8)	34.0 (5.4)	32.9 (4.5)	Currently in ART? % (N)			
Sex % (N)				Yes	39.2 (215)	39.3 (35)	39.3 (180)
Male	16.3 (89)	100 (89)	0 (0)	No, but received in past	36.9 (202)	41.6 (37)	36.0 (165)
Female	83.7 (458)	0 (0)	100 (458)	No, and never received	23.9 (130)	19.1 (17)	24.7 (113)
Race (%, N)				Infertility diagnosis % (N)			
White	84.8 (464)	91.0 (81)	83.6 (383)	Male-factor	12.4 (68)	16.9 (15)	11.6 (53)
Hispanic	5.3 (29)	4.5 (4)	5.5 (25)	Female-factor	37.8 (207)	38.2 (34)	37.8 (173)
Black	0.7 (4)	1.1 (1)	0.7 (3)	Combined-factor	15.9 (87)	19.1 (17)	15.3 (70)
Asian	4.0 (22)	1.1 (1)	4.6 (21)	Unexplained	33.8 (185)	25.8 (23)	35.4 (162)
Biracial or other	4.7 (28)	2.2(2)	5.6 (16)				
Education (%, N)				Where live % (N)			
Some high school	0.7 (4)	0.0 (0)	0.9 (4)	United States	81.2 (444)	88.8 (79)	79.7 (365)
High school degree	10.6 (58)	12.4 (11)	10.3 (47)	Canada	7.3 (40)	2.2 (2)	8.3 (38)
College degree	50.1 (274)	56.2 (50)	48.9 (224)	Europe	7.3 (40)	5.6 (6)	7.6 (35)
Advanced degree	38.6 (211)	31.5 (28)	40.0 (183)	Australia or New Zealand	2.4 (13)	2.2 (2)	2.4 (11)
				Other	1.9 (10)	1.1 (1)	2.0 (9)
Income M (SD)	96 K (62 K)	122 K (71 K)	91 K (59 K)				
Trying to have first child with partner? % (N)							
Yes	70.9 (392)	69.7 (62)	72.1 (330)				

Table 2 Correlations among key variables among men and women reporting an infertility diagnosis

	Outcomes			Predictors					
	Depression	Search for Meaning	Presence of Meaning	Age	Education	Time Since Diagnosis	Infertility self-stigma	Openness to partner	Openness to others
	r	r	r	r	r	r	r	r	r
Depression	-	0.33***	−0.51***	−0.12*	−0.08	−0.11*	0.42***	−0.20***	−0.44***
Search for Meaning	0.14	–	−0.42***	−0.12*	−0.13**	−0.11*	0.30***	−0.13**	−0.23***
Presence of Meaning	−0.45***	−0.05	–	0.08	0.09	0.15**	−0.38***	−0.17***	0.35***
Age	−0.12	−0.06	0.00	–	0.29***	0.27***	−0.13**	−0.07	0.09
Education	−0.03	0.20	0.31**	0.11	–	−0.05	−0.15**	−0.02	−0.06
Time Since Diagnosis	−0.25*	0.20	0.14	0.43***	−0.03	–	−0.01	−0.01	0.05
Infertility Self-Stigma	0.39***	0.31**	−0.19	−0.13	0.10	−0.01	–	−0.26***	−0.43***
Openness to Partner	−0.23*	−0.06	0.09	0.07	−0.01	0.07	−0.18	–	0.25***
Openness to Others	−0.58***	−0.21*	0.33**	−0.09	−0.02	−0.01	−0.51***	0.37***	–

* *p* < .05, ** *p* < .01, *** *p* < .001. Results for men are shown below the diagonal and results for women are shown above the diagonal

with others and partner contributed an additional 18% of the explained variance for depressive symptoms in men, and an additional 9% in women. Consistent with the hypotheses, in the final model (Step 4), greater infertility stigma for both men and women was associated with higher depressive symptoms (men β=0.23; women β=0.24), and more openness to others was related to lower depressive symptoms (men β=−0.51; women β=−0.32). In contrast to the hypotheses, openness to partner was not associated with depressive symptoms.

Search for meaning

Table 3 shows that regression variables explained 12% of the variance in search for meaning for men, and 14% of the variance for women. The demographic variables in Step 1 accounted for an insignificant 2% to the explained variance for men and 2% for women, showing that lower education in women was associated with higher search for meaning. The infertility variables in Step 2 accounted for an insignificant 4% to the explained variance for men and 4% for women, showing that having had treatment in

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Table 3 Hierarchical linear regressions predicting depressive symptoms, search for meaning, and presence of meaning among men and women experiencing infertility

	Depression		Searching for Meaning		Presence of Meaning	
	Men	**Women**	**Men**	**Women**	**Men**	**Women**
	β	β	β	β	β	β
Step 1: Demographics						
Age	−0.02	−0.02	−0.19	0.01	−0.09	-0.06
Education	−0.06	-0.07	0.19	−0.12[*]	0.34[***]	0.10[*]
Step 2: Infertility factors						
Time since diagnosis	−0.30[**]	−0.08	0.24	−0.06	0.14	0.08[*]
Self sole-factor infertility (1) vs. other causes (0)	−0.68[**]	0.06	−0.33	0.00	0.04	0.02
Not trying to have first child (1) vs. trying to have first child (0)	0.01	−0.04	0.07	−0.21†	0.17	0.53[***]
Never received ART treatment (1) vs. currently in treatment (0)	0.15	−0.25[*]	0.04	0.09	0.45	0.10
Received past ART treatment (1) vs. currently in treatment (0)	0.22	−0.24[*]	0.28	−0.22[*]	0.17	0.02
Step 3: Stigma						
Infertility Self-Stigma	0.23[*]	0.24[***]	0.26†	0.20[***]	−0.04	−0.23[***]
Step 4: Openness						
Openness to Partner	0.05	−0.06	0.04	−0.10	−0.04	0.05
Openness to Others	−0.51[***]	−0.32[***]	-0.11	−0.13[*]	0.29[*]	0.22[***]
Step 1 *Adjusted R^2*	0.00	0.01[*]	0.02	0.02[**]	0.08[*]	0.01
Step 2 *Adjusted R^2*	0.04	0.04[***]	0.06	0.06[***]	0.13[*]	0.10[***]
Step 3 *Adjusted R^2*	0.23[***]	0.19[***]	0.14[*]	0.13[***]	0.15[**]	0.21[***]
Step 4 *Adjusted R^2*	0.41[***]	0.27[***]	0.12[*]	0.14[***]	0.19[**]	0.25[***]
Step 1 to 2 **Δ** *Adjusted R^2*	+0.04	+0.03[**]	+0.04	+0.04[***]	+0.05	+0.09[***]
Step 2 to 3 **Δ** *Adjusted R^2*	+0.19[***]	+0.15[***]	+0.08[**]	+0.07[***]	+0.02	+0.11[***]
Step 3 to 4 **Δ** *Adjusted R^2*	+0.18[***]	+0.09[***]	-0.02	+0.01[*]	+0.04	+0.04[***]
Final Model **Δ** *Adjusted R^2*	0.41[***]	0.27[***]	0.12[*]	0.14[*]	0.19[**]	0.25[***]
Final Model *F*	7.07	18.02	2.22	8.18	3.01	16.18
Final Model *df*	(10, 78)	(10, 447)	(10, 78)	(10, 447)	(10, 78)	(10, 447)

[*] $p < .05$, [**] $p < .01$, [***] $p < .001$, † $p < .06$. Hierarchical regression analyses were conducted to identify the roles of demographic (Step 1), infertility factors (Step 2), stigma (Step 3), and openness (Step 4) in predicting the outcomes of interest. The Beta (β) values displayed in the table represent those identified in the fourth and final step. The *Adjusted. R^2* is shown in each step. The * next to these values indicate if there was significant increase in percentage of variance explained over the previous step. For example, adding Step 3 predictors (.23) explained more variance in depression among men than the predictors included in Step 2 (.04). As shown in the bottom row, all final models after Step 4 was added were statistically significant predictors of the outcomes

the past was associated with lower search for meaning in women. In Step 3, infertility stigma contributed an additional 8% of the explained variance for men, and 7% for women, indicating that higher infertility stigma was associated with higher search for meaning. In Step 4, openness with others did not add any additional explained variance in search for meaning among men and only an increase of 1% for women. Consistent with the hypotheses, in the final model (Step 4), greater infertility stigma for both men and women was associated with higher search for meaning (men $\beta = 0.26$; women $\beta = 0.20$), however the association for men was only marginally significant ($p = 0.06$). Also consistent with the hypothesis, more

openness to others among women was related to lower search for meaning ($\beta = −0.13$), whereas openness to partner was not related to search for meaning in men or women.

Presence of meaning
Table 3 shows that the variables in the regression model for presence of meaning explained 19% of the variance for men, and 25% of the variance for women. The demographic variables in Step 1 accounted for 8% of the explained variance for men and an insignificant 1% of the explained variance for women, showing that higher education in men was associated with higher presence

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of meaning. In Step 2, the infertility variables contributed an insignificant 5% to the explained variance for men and 9% of the explained variance for women, showing that already having a child was associated with higher presence of meaning in women. In Step 3, infertility stigma contributed an insignificant 2% to the explained variance for men, and 11% for women. In Step 4, openness with others contributed an insignificant 4% of the explained variance for presence of meaning for men, and 4% for women. In partial support of the hypotheses, in the final model (Step 4), greater infertility stigma among women was associated with lower presence of meaning (β = −0.23), but this association was not significant for men (β = −0.04). In support of the hypotheses, greater openness to others was associated for both men and women with higher presence of meaning (men β = 0.29; women β = 0.22). In contrast to the hypotheses, openness to partner was not associated with presence of meaning for men or women.

Exploratory analyses of note

We also took the opportunity to examine any other large associations that were statistically significant that might be of interest (βs > 0.19 and p < 0.05). Although it was not an a priori hypothesis, we noted a strong association between trying to have a child and women's presence of meaning. Women who were not currently trying to have a child were much more likely to report presence of meaning in their lives (β = 0.53), or viewed another way, women who were currently trying to have a child reported less presence of meaning in their lives. Similarly, we noted that men with higher levels of education reported greater presence of meaning, and that men had fewer depressive symptoms the more time had passed since they were informed about an infertility diagnosis. Finally, there was an unusually large association between fertility diagnosis and depressive symptoms among men, with men who reported a male-factor diagnosis exhibiting notably lower depressive symptoms than men with female-factor, combined, or unknown-factor diagnoses. Given the small sample of men in the male-factor group, however, this is not a finding we emphasize.

Discussion

The findings from this study provide support for our two research hypotheses. First, consistent with Hypothesis 1, greater infertility stigma (e.g., they experienced attitudes such as "I am ashamed of being infertile") was related for men and women to greater depressive symptoms and search for meaning. Partially in support of Hypothesis 1, greater infertility stigma was associated with lower presence of meaning for women, but not men. Consistent with Hypothesis 2, greater openness with others was associated with lower depressive symptoms and greater presence of meaning for men and women. Partially in support of Hypothesis 2, greater openness with others was related to lower search for meaning for women, but not men.

Infertility self-stigma was consistently related with higher depressive symptoms and search for meaning

Experiencing stigma is known to have negative associations with mental and physical health, making it imperative to understand and address in the context of infertility [30]. Infertility stigma is reported by men and women throughout the world and is embedded in cultural and personal beliefs about parenthood, femininity, and masculinity [7, 21, 31–33],). When personal infertility stigma was included in our regression model, it explained substantially greater variance in depressive symptoms for men and women compared to models only including demographic and infertility variables. These findings build on the existing literature identifying infertility stigma as a correlate of psychological distress in women [7, 30] and adds to the limited emerging evidence of a potential relationship between infertility stigma and depressive symptoms in men [16, 18, 34].

It is possible that the relationship between personal stigma and depressive symptoms in men and women in our study can be explained by the emotional consequences of self-criticism, self-judgment, and feelings of inferiority compared to people with children [1, 4, 7, 8]. The role of internalized shame may also play an important role, which occurs when a person believes they are viewed negatively in the minds of others (external shame) and internalizes these beliefs as truths about the inadequacy and defectiveness of the self (internal shame). A previous study of couples pursuing infertility treatment found that shame and self-judgment were significantly associated with depressive symptoms [8].

The association between stigma and increased search for meaning was also consistent with our hypothesis. Search for meaning is reported when people feel a lack of clear purpose in their lives and are continually searching for something that makes life feel significant. For men and women, infertility is an unexpected life stressor that can disrupt identity and dismantle previously cherished beliefs about meaning, fairness, and purpose in life. Although the search for meaning has rarely been explored in men and women experiencing infertility, a study of women trying to conceive found the search for meaning predicted increased ruminations, emotional suppression, and decreased sharing with others about trying to become pregnant [20]. While we hypothesized this relationship would be present in the current study, it is also possible that the search for meaning may

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contribute to future psychological adjustment if it aids in the process of meaning creation and acceptance which has been associated with long-term adjustment to unmet parenting goals following infertility treatments [35].

Cultural and social beliefs play a key role in the search for meaning and its relationship to psychological well-being [36]. A cross-national study found that the search for meaning was positively associated with happiness and life satisfaction in collectivist societies, but was not associated with well-being in individualistic societies where questioning one's belief systems conflicts with the need to maintain positive self-regard and self-image [37]. Our study primarily consisted of participants from Western societies and lends support to these findings. However, because infertility is associated with the difficult task of reconstructing altered belief systems about identity and future life goals [35], additional studies exploring how stigma and the search for meaning vary across cultures are needed.

Openness with others was significantly related with lower depressive symptoms and higher presence of meaning

Consistent with our second hypothesis, openness with others was associated with lower depressive symptoms in men and women. To our knowledge, there is only one other study that has examined the relationship between openness with others and depressive symptoms during infertility [23]. In that study, Italian men undergoing assisted reproductive treatment (ART) were divided into two groups: men who shared their infertility experience with others, and men who did not share their experience. Men who shared their experience with others reported significantly lower depressive symptoms, and less openness with others also predicted higher depression [23]. Our study supports this finding as the relationship between openness and depressive symptoms in men had a large effect size. Our findings also add to the existing literature by showing this association was found among women. Those who limit openness and sharing with others may feel a sense of hopelessness about the future as they face the emotional burdens and challenges of infertility alone. In contrast, greater openness with others may be a way to receive social support which is a key protective factor in reducing isolation and psychological distress in couples experiencing infertility [1].

Increased openness with others was also associated with greater presence of meaning in men and women. Presence of meaning occurs when people have clear beliefs about life's purpose and significance and is associated with increased well-being, mental health, and adaptive coping strategies [38]. Despite its critical importance, we know very little about the relationship between the presence of meaning in life and being open with others

about infertility. In the current study, it is possible that a strong presence of meaning existed before infertility and helped men and women be open with others about the stress of the experience. A second explanation may be that increased openness with others aids in the process of storytelling, an essential component of meaning-making [39]. Storytelling is also a foundational component of talk therapy and there is strong evidence to support that talking with an empathic, attuned therapist is associated with meaning creation [40]. Those more open with others about infertility may benefit from a similar process of sharing with a trusted other. Finally, greater openness with others might assist in the cognitive process of meaning creation through acceptance, which is an adaptive response to stressful life events and has been reported when infertility patients redefine their life's priorities and have new beliefs about the world [35]

While increased openness was associated with lower depressive symptoms and increased presence of meaning, it is important to note that not all openness leads to positive outcomes [1]. Thus, caution needs to be taken in assuming the directionality and causal relationship between openness, depressive symptoms, and meaning. A study on infertility in Brazilian couples found that while open disclosure with others produced positive benefits such as increased emotional intimacy, demonstrations of affection, and supportive conversations with others, it also was associated with perceived judgment, lack of understanding, and strained relationships [1]. Because of this possibility, some couples choose to actively keep their infertility a secret from close friends and family. A lack of openness in this form might prove to be a protective factor for couples as opposed to a negative barrier to support. Future studies are needed to better understand the complex relationship between openness and psychological distress during infertility by differentiating a protective lack of openness that shields individuals from harmful judgment, from a lack of openness that prevents them from gaining helpful support from others.

It is worth noting that a lack of openness with a partner was not related to depressive symptoms or any of the outcomes measured. One possible explanation is that the depth of measurement on openness to partner (two items) was not sufficient to identify the variability in how people relate to their partner in ways that are relevant to depressive symptoms and meaning. Another possibility is that most participants were above the threshold of openness needed to maintain a positive and healthy level of communication with their partners. This might be especially likely due to how the sample was recruited: from an organization that is geared towards helping people and couples discuss and manage infertility, with many of the men in the sample also coming via referrals

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communicated to them by their partners. Therefore, the key variability in levels of openness that could contribute to mental health and meaning was coming from external sources like family and friends.

Implications for mental health & health care providers

Because there is evidence that psychosocial interventions benefit both men and women experiencing infertility [41], we propose that mental health and health care professionals use the findings from this study to reduce the negative impact of stigma and encourage openness that facilitates positive support and meaning creation. Empirically-supported interventions such as cognitive restructuring can be used to reduce self-criticism and increase acceptance which has been associated to lower depressive symptoms in women after unsuccessful infertility treatments [42]. Fertility counselors can also help men and women challenge unhelpful cultural scripts related to identity, masculinity, femininity, and parenthood that are linked with feelings of shame and secret keeping. Doctors, nurses, and health providers who interact directly with patients can reduce stigma through collaborative patient conversations that ease feelings of personal failure and isolation. Finally, researchers, policymakers, and health professionals can work to reduce infertility stigma for men and women at the community level through public programs and education that increase social awareness of the physical and emotional burdens of infertility [18, 43].

Fertility patients can also be encouraged to access their existing social networks through increased openness, as well as expand their networks by connecting with others experiencing infertility. By directly connecting with the infertility community, men and women are likely to receive support that is characterized by greater understanding and non-judgmental acceptance that comes from those sharing a similar challenge. Joining online communities with anonymous discussion boards can offer valuable support, particularly for men who are less likely to access in-person social support [44, 45]. For men, online platforms appear to be important because they provide a 'safe space' to share their emotional struggles, combat isolation, and offer empathy and support to others undergoing similar challenges [46]. For men and women who express difficulty accessing and relying on social networks, counselors can use empirically supported interventions such as expressive writing that reduces depressive symptoms and can assist in meaning creation [47].

Lastly, counselors and health professionals should bear in mind that these considerations should only be applied to individuals and couples experiencing infertility. Throughout the world, an increasing number of adults are choosing not to become parents, and this can be associated with high life satisfaction [48]. Thus, differentiating between childlessness due to infertility and choosing to live childfree is an important distinction.

Limitations and strengths

The findings from the current study should be noted in the context of its limitations. First, the study used a cross-sectional design which does not allow for inferences of causality. Second, participants were recruited through an organization dedicated to support coping with infertility, thus those not related to this organization may not have had the same opportunity to participate. Third, the main outcome measures were assessed by self-report, which can be limited by bias and socially desirable responses. Fourth, participation in the study itself is a form of openness about infertility, thus men and women who chose to participate in the study may be more inclined to share information about their infertility than those who did not participate. Fifth, the generalizability of findings are limited by our use of a primarily Western sample. While geographic comparisons are vital in highlighting unique cultural differences in the experience of infertility, such comparisons were beyond the scope of the current study and would not have been possible given the limited sample size. Finally, the findings about men are limited due to the small sample, as well as an underrepresentation of men with a male-factor infertility diagnosis (11% compared to global estimates of 20–30%; [49]), making it difficult to understand the impact of infertility diagnosis on the outcome variables.

A strength of our study is we measured openness in men and women which has been less examined in populations dealing with infertility. We also expanded beyond the usual focus on depressive symptoms as a negative mental health variable by exploring meaning which offers a broader and more positive perspective. Finally, although the number of men in the study is limited, it is a comparatively large sample when viewed in the context of infertility studies. It is well documented that men are underrepresented in social science and infertility research [50, 51], and new recruitment methods have been proposed to increase men's participation [52]. Despite using targeted strategies such as partner recruitment, male-specific social media recruitment requests, and direct contact with men using the Uniquely Knitted alumni database, these efforts proved challenging. Future studies that explore ways to increase men's engagement and participation in infertility research are needed so we can advance our knowledge about the impact of key psychological variables that relate to men's adjustment and well-being during the infertility experience.

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Conclusion

This study highlights the vital relationships between personal infertility stigma, openness with others, depressive symptoms, and meaning in life in men and women experiencing infertility. Counselors and health care providers can work to reduce infertility stigma through collaborative patient conversations and education that reduce feelings of personal failure and isolation. In addition, fertility patients can be encouraged to find ways to express openness with others that leads to positive support and increased opportunities to engage in meaning making.

Author contributions
BP led the study and participated in the study design, recruitment strategies, measurement selection, study hypotheses, implementation, analysis, and manuscript preparation. OT–B-A participated in the study design, measurement selection, study hypotheses, implementation, analysis, and manuscript preparation. BC participated in the study design, recruitment strategies, measurement selection, study hypotheses, implementation, analysis, and manuscript preparation. DB participated in the study design, recruitment strategies, analysis, and manuscript preparation. DF participated in the study design, recruitment strategies, measurement selection, study hypotheses, implementation, analysis, and manuscript preparation. All authors read and approved the final manuscript.

Availability of Data and Materials
The datasets used and/or analyzed during the current study may be available from the corresponding author on reasonable request.

Declarations

Ethical approval and consent to participate
The study was approved by the Chapman University Institutional Review Board (IRB-23–312) October 30, 2023.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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