

Title: Sexual function among distressed women struggling to conceive without medical intervention

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Abstract

Infertility is disproportionately associated with distress in women yet there has been limited research focusing on sexual function in this population. Two hundred and thirty women with infertility who were attempting to conceive without medical assistance were recruited via social media. Women completed the Fertility Quality of Life, Revised Dyadic Adjustment Scale, Female Sexual Functioning Index, State-Trait Anxiety Inventory, and Patient Health Questionnaire. Over half of the women with infertility met the clinical cut-off for sexual dysfunction. Sexual function was positively associated with relationship adjustment and infertility-related quality of life and negatively associated with anxiety and depression. Sexual function moderated the relationship between time trying to conceive and psychological outcomes. These findings highlight several domains of sexual functioning that could be manipulated via psychological interventions to potentially improve distress among women struggling to conceive.

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Sexual Function Among Distressed Women Struggling to Conceive Without Medical Intervention

Approximately one in six reproductive-aged couples will experience infertility in Canada, defined as an inability to conceive despite 12 or more months of focused attempts (Bushnik et al., 2012). Although male and female factor infertility¹ are equally prevalent, men and women have unique psychological experiences of infertility (El Kissi et al., 2013). For example, the onus is often on the woman to seek information, undergo fertility testing, and pursue treatment (Bunting et al., 2013). In couples using timed intercourse to conceive, the onus is also on the woman to monitor her fertility in order to identify her ‘fertile window’, which constitute the six days throughout the female menstrual cycle during which a woman is fertile and on which intercourse must take place for conception to occur (Dunson et al., 1999; Weinberg et al., 1998; Wilcox et al., 1995). This is often done through the use of ovulation predictor tests, cervical mucus monitoring, and basal body temperature checks (Chernoff et al., 2020).

It is therefore perhaps unsurprising that infertility has been shown to take a greater psychological toll on women (Galhardo, Cunha, & Pinto-Gouveia, 2011; Pasch & Sullivan, 2017; Sexton, Byrd, & von Kluge, 2010; Wiweko, Anggraheni, Elvira, & Lubis, 2017). Approximately one-third of women undergoing assisted reproductive technologies (ART) meet clinical criteria for an anxiety disorder or for major depressive disorder (Chen et al., 2004; Volgsten et al., 2008) with similar rates of psychopathology being observed for infertile individuals attempting to conceive without medical intervention (Balsom & Gordon, 2021; Chernoff et al., 2020). In fact, one study compared six groups of women struggling with chronic

¹Female factor infertility refers to instances when a couple or individual is experiencing difficulty conceiving due to a diagnosed or suspected biological anomaly in the female (e.g., endometriosis), male factor infertility refers to instances when there is a diagnosed or suspected biological anomaly in the male (e.g., low sperm count).

health conditions – infertility, chronic pain, cardiovascular disease, cancer, hypertension, and HIV – and found that quality of life among women with infertility was comparable to the levels of individuals with cancer, cardiovascular disease, and hypertension (Domar et al., 1993). The negative psychological impact of infertility has furthermore been shown to increase with advancing time spent trying to conceive (Domar et al., 1992; Yilmaz et al., 2020). Importantly, although infertility-related distress has traditionally been studied among women pursuing ART, our recent research suggests that levels of distress are also very high among women struggling with infertility but not pursuing medical intervention, whether for financial, religious, or other reasons (Chernoff et al., 2020). These findings are in line with previous research finding that in a random sample of 580 women living in the U.S., 27% of those self-reporting as having failed to achieve pregnancy despite having had unprotected intercourse for ≥ 12 months reported clinically significant depressed mood (Jacob et al., 2007).

In addition to infertility's effects on women's mental health, numerous qualitative investigations have identified a decline in relationship satisfaction as an important theme of infertility-related distress (Bokaie et al., 2015; Hasanpoor-Azghdy et al., 2014; Steuber & Haunani Solomon, 2008; Yao et al., 2018). For example, couples may have disagreements regarding next steps to take in their efforts to conceive, such as whether to continue attempting to pursue fertility treatments or whether they should continue attempting to conceive at all. Couples also report that differences in coping with stress or grief (e.g., seeking social support versus preferring isolation and privacy) can contribute to misunderstandings and increased distance between partners (Albuquerque et al., 2018; Scholtes & Browne, 2015). Quantitative investigations have been more mixed, however, in linking infertility with a decline in relationship satisfaction. While some research has indicated that infertility negatively impacts

relationship satisfaction (Benazon et al., 1992; Gana & Jakubowska, 2014; Monga et al., 2004; Samadaee-Gelehkolaee et al., 2015; Sun & Lee, 2000; Tao et al., 2012; Valsangkar et al., 2011) other studies have actually found higher satisfaction scores in infertile couples than healthy controls (Drosdzol & Skrzypulec, 2009; Onat & Beji, 2012). These findings may suggest that although an important subset of couples do find that their relationship suffers while struggling with infertility, others may actually thrive in the face of shared adversity.

One factor that may contribute to the fate of a couple's relationship as they struggle to conceive is infertility's effect on a couple's sexual relationship. One recent meta-analysis of 10 studies found that women with infertility are significantly more likely to suffer from sexual dysfunction, with the domains of lubrication, orgasm, and sexual satisfaction being particularly affected (Mendonça et al., 2017). In a cross-sectional study of women awaiting oocyte donation, it was found that many women experienced sexual dysfunction, with almost half meeting the clinical cut-off (Carter et al., 2011). Women in this sample also endorsed poor quality of life with 68% scoring below the cut-off. Furthermore, sexual function has been shown to decline among couples pursuing ART with increasing infertility duration (Facchin et al., 2019; Iris et al., 2013). These findings corroborate qualitative investigations highlighting reports that in the context of infertility, some women who are struggling to conceive find it difficult to view sexual intercourse as anything other than a means of conceiving a child (Onat & Beji, 2012). This decline in sexual functioning may have important implications for overall relationship satisfaction: indeed, numerous studies have identified a healthy sex life as being a key determinant of happiness within a marital relationship (Apt et al., 1996; Christopher & Sprecher, 2000; Fields, 1983; Young et al., 1998, 2000). The extent to which a couple's sexual relationship

is impacted by the struggle to conceive may therefore predict infertility's impact on the overall quality of the relationship.

One limitation of the existing literature examining the effect of infertility on sexual function and relationship satisfaction relates to the fact that it has primarily focused on women pursuing ART. This is an important limitation for a several reasons. First, only a small percentage (22%) of women with infertility actually undergo ART due to financial and other barriers to receiving such treatment (Boivin, Bunting, Collins, & Nygren, 2007). Second, the pursuit of ART is typically preceded by many months, if not years, of attempts to conceive through timed intercourse. Third, in considering the differences between the experience of trying to conceive through intercourse and the experience of pursuing ART, trying to conceive without the use of ART might have a stronger negative impact on a couple's sexual relationship than trying to conceive through a physician-directed procedure like in vitro fertilization because the pressure to time their acts of intercourse within the woman's 'fertile window' is high. Indeed, research suggests that 88% of women struggling to conceive without medical intervention use at least one method of identifying the 'fertile window' (Chernoff et al., 2020). Furthermore, the use of fertility monitoring techniques, such as daily cervical mucus checks to identify days accompanied by fertile mucus of egg-white consistency or the daily use of ovulation predictor tests, is associated with higher levels of anxiety (Balsom & Gordon, 2021). In contrast, intercourse is not part of the equation among couples pursuing ART. Research is therefore needed to examine the impact that struggling to conceive without ART has on a couple's sexual relationship. Further research is also needed to investigate how sexual function may be impacted by psychological factors, such as relationship quality and infertility-related distress in individuals experiencing infertility.

The current study, therefore, aimed to examine sexual function and related psychological factors among women struggling to conceive without medical intervention. Specifically, it aimed to answer the following questions: 1) How is sexual function related to other psychological outcomes, such as relationship satisfaction, infertility-related quality of life, anxiety, and depressed mood, in this population?, 2) How is the use of fertility monitoring techniques associated with sexual function?, 3) How are sexual function and other psychological outcomes associated with time spent trying to conceive?, 4) Does sexual function moderate the relationship between time spent trying to conceive and both relationship satisfaction and infertility-related quality of life? Therefore, we hypothesized that 1) women with worsened sexual function will have poorer outcome variables, 2) fertility monitoring technique use will be associated with worsened sexual function, 3) a longer duration of infertility will be associated with worsened sexual function, increased distressed, and less relationship satisfaction, and 4) Time trying to conceive would be more strongly negatively associated with relationship quality and infertility-quality of life among women reporting low sexual function.

Participants

Two hundred and thirty women of reproductive age (18 to 45-years-old) residing in the United States and Canada who had been actively attempting to conceive a child between 12 and 48 months were recruited to participate in this online study. As the focus of the study was on women attempting to conceive without medical intervention, eligible participants had to have the biological capacity to carry a child (i.e., have a uterus) and be in a mixed-sex relationship (i.e., the other partner produced sperm). Due to the ultimate purpose of informing clinical interventions for infertility-related distress, eligible women had to endorse at least a moderate level of distress about their inability to conceive, as evidenced by a score of 12 (50 on a scale

from 0-100) or less on the six-item emotional subscale of the Fertility Quality of Life Questionnaire (Boivin et al., 2011) indicating that, on average, the participant endorsed each of the subscale items at least “a moderate amount of time”. Participants were required to be actively attempting to conceive in the upcoming cycle and to experience menstruation at least every 60 days. The only exclusion criterion was the current use of any fertility treatment as the emphasis of this study was to increase knowledge about the struggle to conceive without medical assistance.

Procedure

Participants were recruited through a paid Facebook ad. Prospective participants who responded to the ad were invited to complete an online eligibility survey housed on Qualtrics. Those found to be eligible were then sent an email with a link to an online survey using Qualtrics (Provo, Utah), which began with an electronic consent form. Following the completion of the survey, participants were compensated \$10. The study was reviewed and approved by the University of Regina Research Ethics Board.

Baseline Questionnaires

Female Sexual Function Index (FSFI; Rosen, Brown, Heiman, Leiblum, & Ferguson, 2000). The FSFI is a 19-item questionnaire with a focus on women’s sexual function. Items focus on sexual function in the previous 4 weeks and are measured on a 5-point Likert scale. There are six domains for the FSFI including desire, subjective arousal, lubrication, orgasm, satisfaction, and pain. Each domain has a maximum score of 6 with the entire scale having a maximum score of 36. Test reliability for domains range between $r = 0.79$ to 0.86 . The internal consistency for the measure was also high (Cronbach’s $(\alpha) = 0.82$) (Rosen et al., 2000). In the current study, the internal consistency of the FSFI was good ($\alpha = 0.93$). The sexual

function domains had an internal consistency that ranged from acceptable to excellent (desire $\alpha = 0.88$, arousal $\alpha = 0.92$, lubrication $\alpha = 0.78$, orgasm $\alpha = 0.76$, satisfaction $\alpha = 0.87$, and pain $\alpha = 0.78$).

Fertility Quality of Life Questionnaire (FertiQoL; Boivin et al., 2011). The FertiQoL is a 36-item questionnaire. The FertiQoL is used to assess quality of life in individuals experiencing infertility. The FertiQoL has 4 subscales and an overall score (Core FertiQoL). The Emotional subscale measures individuals' negative emotions associated with their infertility, the Mind-Body subscale measures individuals physical (e.g., fatigue) and cognitive or behavioural (e.g., poor concentration) experiences due to their infertility, the Relational subscale measures facets of infertility that have influenced their relationships (e.g., communication), and the Social subscale measures how social interactions have been influenced by their experience of infertility (e.g., stigma). Items are on a 5-point Likert scale ranging from 0 (*Completely, Very Dissatisfied, Always, An Extreme Amount*) to 4 (*Not at all, Very Satisfied, Never, Not at All*). The questionnaire alternates between four patterns with different anchors for the Likert scale. Each subscale is scaled to range from 0 to 100. In the current study, the internal consistency of the FertiQoL was good ($\alpha = 0.78$). The subscale of Mind-Body fertility quality of life was good ($\alpha = 0.85$), while the other subscale's reliability was lower (emotional $\alpha = 0.71$, relational $\alpha = 0.68$, social $\alpha = 0.43$).

Revised Dyadic Adjustment Scale (RDAS; Russell Crane, Middleton, & Bean, 2000). The RDAS is a 14-item measure of quality and adjustment of a couple's relationship. The RDAS provides three subscales including the Dyadic Consensus Subscale, Dyadic Satisfaction Subscale, and Dyadic Cohesion Subscale. The Dyadic Consensus subscale measures the degree to which individuals agree with their partner, the Dyadic Satisfaction subscale measures the

degree to which individuals are satisfied with their partner, and the Dyadic Cohesion subscale measures the degree to which individuals participate in activities with their partner. The consensus sub-scale ranges from 0 to 30, satisfaction from 0 to 20, and cohesion from 0 to 19. The total score can range from 0 to 69. The RDAS has been found to have good construct validity with both distressed and non-distressed couples (Busby et al., 1995). In a community sample of couples, internal consistency was found to be, $\alpha = .80$ (Cuenca Montesino et al., 2013). In the current study, the internal consistency of the RDAS was good ($\alpha = 0.80$). The internal consistency of the subscales ranged from acceptable to excellent (cohesion $\alpha = 0.71$, consensus $\alpha = 0.95$, satisfaction $\alpha = 0.92$).

Patient Health Questionnaire-9 (PHQ-9; Spitzer et al., 1999). The PHQ-9 is a 9-item questionnaire based on DSM-IV criteria for depressive disorders. Items on the PHQ-9 are on a 4-point Likert scale ranging from 0 (*Not at all*) to 3 (*Nearly every day*). In the current study, the internal consistency of the PHQ-9 was strong ($\alpha = .86$).

State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). The Y-scale of the STAI, which is a 20-item measure of trait anxiety, was used in this study (Spielberger et al., 1983). Items on the STAI are on a 4-point Likert scale ranging from 0 (*Almost Never*) to 3 (*Almost Always*). In the current study, the internal consistency of the STAI was good ($\alpha = 0.84$).

Fertility Monitoring Techniques. Participants were asked to report which, if any, fertility monitoring techniques they were currently using: calendar/rhythm method, basal body temperature measurement, cervical mucus checking, or use of ovulation predictor tests.

Statistical Analysis

Main Analyses. Pearson correlations were used to examine the relationship between baseline characteristics and sexual function. However, multivariate multiple regression was used

to examine the influence of sexual function on psychological outcomes (i.e., fertility quality of life, relationship adjustment, anxiety, and depression) and fertility monitoring technique use as well as to explore the influence of time on sexual function. In cases where multiple subscales of a questionnaire were treated as independent variables (e.g., subscales of the FSFI), they were included all together in the same model. Conversely, in cases where multiple subscales of a questionnaire were treated as dependent variables (e.g., subscales of the FertiQoL), they were included all together in the same model using multivariate regression. Moderation analyses were completed to explore whether sexual function would moderate the relationship between psychological outcomes and time trying to conceive. Moderation analyses were calculated using PROCESS for SPSS v28 (Hayes, 2012). Where moderation was significant, follow-up analyses were completed to explore the conditional effects of the interaction on values of the moderator (sexual function). The effect was explored on standard deviation above the mean, at the mean, and one standard deviation below on the FSFI total score.

Power Calculations

The described study was powered to recruit a sufficient number of participants for the longitudinal portion of this project, which examined within-person relationships between coping strategies and mood across the menstrual cycle (Balsom & Gordon, 2021). Our aim was to recruit 50 participants for the longitudinal part of the study and the current sample is the number of total participants who completed the baseline survey, including those who did and did not go on to complete the longitudinal portion of the study. Although we did not complete a priori power analyses for the aims explored in this particular manuscript, we did complete a sensitivity analysis determining that with a sample size of 230, six predictors (i.e., in the case of the

subscales of the FSFI), alpha at 0.05, and power at 80% that the study was powered to detect a small effect ($f^2 = 0.06$).

Results

Participant Characteristics

A total of 306 women completed the questionnaire. After removal of duplicate responses and participants deemed eligible based on the eligibility questionnaire but later deemed ineligible (e.g., currently undergoing ART, attempting to conceive for more than 48 months, actively attempting to conceive), 230 women remained. As can be seen in Table 1, the mean age was 30.8, with the vast majority of participants being white and married or in a common-law relationship. Participants had been attempting to conceive for an average of nearly two years, with a range of 12-48 months. Most of the participants had not previously experienced pregnancy or miscarriage. A little over half of the participants met the clinical cut-off for sexual dysfunction and over 75% met the clinical cut-off for depression on the PHQ-9.

Sexual Function Associated with Demographic and Reproductive Characteristics

ANOVA and Pearson correlations were used to examine the relationship between sexual function and the baseline demographic and reproductive characteristics listed in Table 1. Sexual function was also positively related to yearly income ($r(226) = .63, p < .001$) and number of years of education ($r(228) = .33, p < .001$). Marital status also was associated with women's sexual function ($F(2,220) = 7.13, p < .001$). Women who were widowed ($M(SD) = 29.61 (5.39), p = .011$) and married or common law ($M(SD) = 27.01 (6.05), p = .001$) reported greater sexual function than those who were cohabiting but not married or common law ($M(SD) = 22.03 (3.79)$). There was not statistical difference between the sexual function of those who were widowed or married or common law ($p = .52$). There was also a positive relationship between

FSFI score and reported number of fertility monitoring techniques used ($r(228) = .37, p < .001$).

In other words, women who used more fertility monitoring techniques reported better sexual function. No other significant associations were seen ($ps > .05$).

Psychological Outcomes Associated With Time Spent Trying to Conceive

A negative relationship was found between months spent trying to conceive and overall FSFI score ($B(SE) = -0.31 (.04), p < .001$). In examining the individual subscales of the FSFI, time appeared to be negatively associated with desire ($B(SE) = -1.73 (.74), p = .021$) and orgasm ($B(SE) = -1.88 (.92), p = .043$). The other subscales of the FSFI, arousal ($B(SE) = -.11 (.92), p = .902$), lubrication ($B(SE) = -.62 (.96), p = .516$), satisfaction ($B(SE) = .52 (.82), p = .528$), and pain ($B(SE) = -.72 (.47), p = .130$), were not associated with time.

A negative relationship was found between months spent trying to conceive and overall fertility quality of life ($B(SE) = -.37 (.09), p < .001$). In examining the individual subscales of the FertiQoL, relational quality of life had the strongest negative association with time trying to conceive ($B(SE) = -.52 (.11), p < .001, \eta_p^2 = .10$), followed by mind-body quality of life ($B(SE) = -.46 (.12), p < .001, \eta_p^2 = .07$), emotional quality of life ($B(SE) = -.37 (.11), p < .001, \eta_p^2 = .06$), and social quality of life ($B(SE) = -.20 (.08), p < .001, \eta_p^2 = .03$).

A negative relationship was also found between months spent trying to conceive and overall relationship adjustment ($B(SE) = -.19 (.07), p = .011$). In examining the relationship between time spent trying to conceive and relationship adjustment, it was revealed that there was a negative relationship between time trying to conceive and relationship cohesion ($r(222) = -.29, p < .001$). Relationship satisfaction ($r(229) = -.13, p = .05$) and consensus ($r(220) = -.03, p = .66$) were not found to be significantly associated with time trying to conceive.

Sexual Function, Anxiety, and Depressed Mood

FSFI score was negatively associated with anxiety ($B(SE) = -.22 (.06)$, $p < .001$) and depressed mood ($B(SE) = -.25 (.11)$, $p = .028$). Time trying to conceive did not moderate the relationship between sexual function and anxiety ($p = .08$) nor depression ($p = .69$).

Sexual Function and Fertility-Related Quality of Life

Main Effect. A positive relationship was found between sexual function and fertility quality of life ($B(SE) = 0.93 (.14)$, $p < .001$). In order to examine which subscales of the FertiQoL were most strongly associated with sexual function, a multivariate regression was completed exploring total FSFI as a predictor of the subscales of the FertiQoL (relational, emotional, mind-body, and social). Results revealed that all four subscales of the FertiQoL had a significant association with total FSFI. The mind-body subscale ($B(SE) = 1.36 (.19)$, $p < .001$, $\eta_p^2 = .22$) was the factor most strongly associated with sexual function, followed by the relational subscale ($B(SE) = 1.15 (.16)$, $p < .001$, $\eta_p^2 = .21$). When the item “Are you satisfied with your sexual relationship even though you have fertility problems?” was removed from the relational subscale due to its potential to be a confounding factor artificially creating a relationship between this subscale and the FSFI, the association decreased but remained significant ($B(SE) = 1.07 (.19)$, $p < .001$, $\eta_p^2 = .15$). Emotional quality of life ($B(SE) = .76 (.17)$, $p < .001$, $\eta_p^2 = .09$) and social quality of life ($B(SE) = .47 (.14)$, $p < .001$, $\eta_p^2 = .06$) were also positively associated with sexual function.

Additional multivariate multiple regression analyses were conducted to examine which facets of sexual function were most strongly associated with the emotional, mind-body, social, and relational subscales of the FertiQoL. As shown in Table 2, emotional fertility quality of life was most strongly related to sexual arousal, orgasm, satisfaction and lubrication, while mind-body fertility quality of life was correlated with orgasm and pain. Relational quality of life (with

sexual satisfaction question removed) was most strongly associated with satisfaction, pain, and orgasm, while social quality of life was most strongly associated with pain, arousal, and lubrication.

Interaction with Time Spent Trying to Conceive. Sexual function was found to significantly moderate the relationship between time spent trying to conceive and emotional quality of life ($p = .006$). In order to interpret and depict the interaction, further analysis of the conditional effects of the interaction on values of the moderator were completed, comparing scores one standard deviation above the mean, at the mean, and one standard deviation below on the FSFI total score. As can be seen on Figure 1a, there was a significant negative relationship between time trying to conceive and emotional quality of life for those scoring one standard deviation above the mean on the FSFI ($B(SE) = -.69 (.21), p = .001$) and at the mean ($B(SE) = -.26 (.12), p = .033$) but none for those scoring one standard deviation below the mean ($B(SE) = .09 (.16), p = .56$). In other words, individuals scoring high in sexual function report higher emotional quality of life than those low in sexual function early in the journey to conceive; however, this advantage goes away with increased time.

Sexual function was also a significant moderator of the relationship between time trying to conceive and the mind-body subscale of the FertiQoL ($p < .001$). As can be seen on Figure 1b, there was a significant negative relationship between time trying to conceive and mind-body quality of life for one standard deviation above the mean on the FSFI ($B(SE) = -1.16 (.22), p < .001$) and at the mean ($B(SE) = -.33 (.13), p = .01$), while there was a positive relationship between time trying to conceive and mind-body quality of life for those scoring one standard deviation below the mean on the FSFI ($B(SE) = .38 (.17), p = .03$).

A similar finding occurred with relational quality of life as sexual function was found to be a significant moderator of the relationship between time trying to conceive and relational quality of life ($p = .004$). As can be seen on Figure 1c, there was a significant negative relationship between time trying to conceive and relational quality of life for one standard deviation above the mean on the FSFI ($B(SE) = -.90 (.23), p < .001$) and at the mean ($B(SE) = -.38 (.14), p = .006$), while the relationship between time trying to conceive and mind-body quality of life was not significant for those scoring one standard deviation below the mean on the FSFI ($B(SE) = .02 (.18), p = .93$).

Finally, sexual function was also a significant moderator of the relationship between time trying to conceive and quality of life for the social support subscale ($p = .002$). As can be seen on Figure 1d, there was a significant negative relationship between time trying to conceive and relational quality of life for one standard deviation above the mean on the FSFI mean ($B(SE) = -.49 (.15), p = .002$), but not for the mean ($B(SE) = -.13 (.09), p = .15$) or one standard deviation below the mean ($B(SE) = .15 (.11), p = .20$).

Sexual Function and Relationship Adjustment

Main Effect. A positive relationship was found between sexual function and Relationship Adjustment ($B(SE) = 0.75 (.11), p < .001$). In order to examine which subscales of the RDAS were most strongly predicted by sexual function, a multivariate regression was completed including all of the subscales of the RDAS (cohesion, consensus, and satisfaction) as dependent variables, predicted by FSFI total score. Results revealed that the cohesion subscale ($B(SE) = .35 (.04), p < .001, \eta_p^2 = .31$) is the factor most strongly associated with sexual function, followed by relationship consensus ($B(SE) = .24 (.09), p = .006, \eta_p^2 = .04$), and relationship satisfaction ($B(SE) = .16 (.06), p = .005, \eta_p^2 = .04$). Additional regression analyses

were conducted to examine which facets of sexual function were most strongly associated with the cohesion, satisfaction, and consensus subscales. As can be seen in Table 2, relationship satisfaction was associated with higher scores on the pain, desire, and lubrication subscales, relationship consensus was associated with the satisfaction and orgasm subscales, while relationship cohesion was most strongly associated with sexual satisfaction.

Interaction with Time Trying to Conceive. Sexual function was a significant moderator of the relationship between time trying to conceive and the relationship consensus subscale ($p < .001$). As can be seen on Figure 2a, there was a significant relationship between time trying to conceive and relationship consensus for those scoring one standard deviation above the mean on the FSFI ($B(SE) = .37 (.10)$, $p < .001$), but there was not a significant association at the mean ($B(SE) = .12 (.06)$, $p = .06$) or at one standard deviation below the mean ($B(SE) = -.11 (.08)$, $p = .17$).

Sexual function was also a moderator of time trying to conceive and relationship satisfaction ($p = .02$). As can be seen on Figure 2b, there was a significant negative relationship between time trying to conceive and relationship satisfaction for those scoring one standard deviation above the mean on FSFI ($B(SE) = -.14 (.07)$, $p = .04$), but there was not a significant association at the mean ($B(SE) = -.03 (.04)$, $p = .53$) or at one standard deviation below the mean ($B(SE) = .07 (.05)$, $p = .17$). Sexual function was not a significant moderator of the relationship between time trying to conceive and relationship adjustment for relationship cohesion subscale ($p = .28$).

Discussion

The current study was a cross-sectional investigation of sexual dysfunction and its relationship with infertility-related quality of life and relationship adjustment among distressed

women struggling to conceive without medical intervention. Furthermore, it aimed to examine whether sexual function might moderate the relationship between months spent trying to conceive and psychological outcomes. Findings revealed that sexual dysfunction is high among distressed women who are struggling to conceive, with a little less than half of the sample scoring within the clinical range of the FSFI, indicating the presence of sexual dysfunction. Second, perhaps unsurprisingly, sexual function was positively associated with fertility quality of life and relationship adjustment. These findings confirm previous research indicating that individuals with greater sexual function score more favourably on measures of psychological wellbeing (Luk & Loke, 2015; Nelson et al., 2008; Valsangkar et al., 2011). Furthermore, sexual function, infertility-related quality of life, and relationship quality were all negatively associated with the number of months spent trying to conceive, suggesting that these factors tend to deteriorate over the course of a couple's struggle with infertility, a finding that is also consistent with previous research (Iris et al., 2013).

This is the first study to explore the association between the use of fertility monitoring techniques and sexual function, an important area to investigate considering that fertility monitoring techniques are very commonly used among individuals attempting to conceive and have been associated with increased levels of anxiety (Balsom & Gordon, 2021). Interestingly, counter to our prediction, women reporting a higher number of fertility monitoring techniques also reported better sexual function. One possible explanation for this finding is that by carefully identifying the days during which intercourse is most likely to result in conception, the cognitive association between sex and conception may be reduced during the remainder of the cycle. Thus, the purpose of sex outside the fertile window may remain simply to enhance intimacy and pleasure. The pressure to have intercourse more frequently than usual, despite not feeling

sexually aroused, may also be lessened in couples that more carefully track the fertile window. In contrast, among couples who don't track the fertile window, every act of intercourse may be seen as having the potential to lead to conception, thus perhaps contributing to more frequent thoughts about conception before and during as well as less focus on intimacy and enjoyment.

The observed negative relationship between sexual function and depressed mood is in line with previous research revealing a bi-directional relationship between depressed mood and sexual function in the general population (Atlantis & Sullivan, 2012; Baldwin, 2001; Kennedy & Rizvi, 2009; Laurent & Simons, 2009). Anxiety has also been associated with sexual function, though not as robustly as depressive mood (Karlidere et al., 2007; Shahraki et al., 2019). Sexual function was not found to be a moderator of the relationship between time trying to conceive and depressed mood or anxiety. Thus, it appears that depressed and anxious moods tend to increase over time in the context of infertility, regardless of whether sexual dysfunction is present.

All domains of sexual function were associated with one or more aspects of fertility-related quality of life (mind-body, social, emotional, and relational). These findings are consistent with prior research linking sexual dysfunction with an increased risk of mental health problems (Drosdzol & Skrzypulec, 2008). However, in light of research suggesting that emotions such as sadness and disillusionment contribute to low sexual arousal in women (Nobre & Pinto-Gouveia, 2008) as well as research identifying depression as a strong risk factor for low sexual desire, contributing to sexual dysfunction (Basson & Gilks, 2018), it may also be that poor mental health related to the disappointment of failing to conceive may be impacting women's sexual function rather than the other way around.

Sexual function was most strongly positively associated with women's mind-body fertility quality of life, referring to the physical, cognitive, and behavioural effects of infertility.

In examining the specific domains of sexual function, both the orgasm and pain subscales appeared to be driving this relationship. As the mind-body subscale of the FertiQoL includes questions about the physical component of infertility (e.g., pain and discomfort associated with infertility), it seems logical that there would be a positive relationship with sexual function domains. Many physical aspects of sex (e.g., poor lubrication, pain) have been associated with other chronic health conditions associated with pain and bothersome physical symptoms. For example, compared to healthy controls, women with endometriosis experiencing chronic pelvic pain have been found to experience a reduction in quality of life and sexual satisfaction (Tripoli et al., 2011). Then again, the cognitive component of the mind-body subscale (e.g., attention and concentration impaired by thoughts of infertility) may also be of relevance to sexual function, with ruminative thoughts about infertility perhaps being a distraction during sex, perhaps explaining the relationship between the mind-body subscale of the FertiQoL and the orgasm subscale of the FSFI. Moderation analyses revealed that sexual function was a significant moderator of the relationship between time trying to conceive and all four subscales of the FertiQoL such that individuals with greater sexual function experience better quality of life earlier in their attempts to conceive relative to those with worse sexual function but that these differences largely disappear. As the months continue, the emotional challenges linked with infertility appear to increase regardless of one's level of sexual function.

All domains of sexual function, with the exception of arousal, were associated with overall relationship adjustment. In examining the individual subscales of the RDAS, relationship consensus (the degree to which partners agree on decisions) was associated with orgasm and sexual satisfaction while relationship satisfaction was related to desire, lubrication, and pain, relationship cohesion (the degree to which partners complete activities together) was associated

with satisfaction . These findings are consistent with previous research observing an association between sexual function and both relationship satisfaction (Byers, 2005; Fallis et al., 2016; Witting et al., 2008) and dyadic cohesion (Dundon & Rellini, 2010; Smith & Pukall, 2014) in other populations. There is also some evidence to suggest that the relationship between relationship adjustment and sexual function is likely to be bi-directional, with a decline in one contributing to difficulties in the other (Brotto et al., 2016; Nappi et al., 2016). Sexual function was a significant moderator of the relationship between time trying to conceive and relationship consensus such that consensus increases over time among couples with high sexual function. Despite this, though, individuals with greater sexual function exhibit a decline in relationship satisfaction with increasing time spent trying to conceive. One possible explanation may be that these couples may report an increase in consensus with regard to decisions related to trying to conceive (e.g., agreement in their desire to have a child, whether to continue to conceive without medical intervention) but that this agreement in the practical aspects of infertility does not entirely protect their relationship from other negative impacts, such as poorer mental health of the parties involved.

Clinical implications

The current findings have important implications for future clinical research. First, they highlight that sexual function suffers among women struggling to conceive without medical intervention and tends to worsen the longer a couple has been struggling with infertility. Poor sexual function is also associated with poorer relationship satisfaction and lower fertility-related quality of life. These findings highlight the importance of developing psychological resources for couples who are struggling to conceive that aims to address their emotional and sexual connection with their partner in addition to their individual mental health. On the one hand,

targeting women's emotional wellbeing may benefit sexual function. Indeed, the observed relationship between women's fertility quality of life and sexual function suggests that helping women better cope with infertility's emotional toll may allow women to experience greater arousal and to more fully enjoy sex without distracting thoughts of the struggle to conceive. Unfortunately, currently available psychotherapies have been found to be only modestly effective in reducing distress among women struggling with infertility (Frederiksen et al., 2015). Further research is therefore needed to more appropriately tailor current interventions, such as cognitive behavioural therapy and mindfulness-based interventions, to better address the psychological challenges that arise in infertility.

It is also possible that targeting women's sexual dysfunction may benefit their relationships and improve their overall psychological wellbeing. However, despite the association between sexual dysfunction and infertility, little research has examined the utility of interventions targeting sexual dysfunction among individuals with infertility. In the most recent meta-analysis of available interventions for sexual dysfunction, seven categories of psychological interventions for sexual dysfunction were identified, including sexual skills training, sex therapy, cognitive-behavioural therapy, marital therapy, systematic desensitization, educational interventions, and other psychotherapy interventions (e.g., psychodynamic, rational emotive therapy) (Frühauf et al., 2013). Psychotherapeutic interventions were found to be effective in women with hypoactive sexual desire disorder and orgasmic disorder. There were significant effects on sexual satisfaction for orgasmic disorder and individuals with mixed sexual dysfunctions. However, there are mixed results as to which interventions are most effective for improving sexual function or sexual satisfaction. Future interventions could explore the utility of various interventions for women with infertility.

One possibility that may be specifically beneficial among couples who are struggling to conceive, in light of the strong relationship between intercourse and the act of conception, could be to encourage more sexual activity and intimate touch that does not include intercourse. Doing so may allow the couple to experience mutual sexual enjoyment that is removed from the pursuit of pregnancy. Another option that is supported by our findings is the use of fertility-confirming methods, such as ovulation predictor tests or fertile mucus monitoring, to identify the fertile window. If the positive relationship between the use of fertility-confirming methods and sexual function is supported in future research, their use may perhaps allow couples to engage in sex that is unrelated to the pursuit of conception (i.e. outside the ‘fertile window’).

Limitations and Strengths

Although this research is valuable in helping to clarify the relationship between sexual function, quality of life, and relationship adjustment, it is limited for various reasons. First, it is a cross-sectional study, which provides only a snapshot of what women experience. Second, the use of retrospective self-report measures is not ideal as previous research has demonstrated underreporting of negative outcomes when comparing retrospective and prospective methods, this is especially important to consider when exploring a sensitive topic like infertility that continues to be taboo (Anestis et al., 2010; Poulton et al., 2018). Future research should aim to complete prospective longitudinal studies to explore how changes in sexual function may be impactful for quality of life and relationship adjustment. A third limitation of this study was the specific recruitment of a distressed population. We recruited a distressed population as we wanted to obtain information that would be relevant for informing a clinical intervention, that being said it is possible that these findings may not hold true for all women with infertility who do not find the distressing experience. It is important to note that most women experiencing

infertility do find it extremely burdensome and distressing. Fourth, our conclusions regarding sexual function and relationship satisfaction were purely based on the experiences of one partner rather than the dyad. Though our reasoning to focus on women was related to the increased distress reported by women struggling to conceive, assessing dyads would have enhanced our understanding of the relationship dynamic. Fifth, our sample is that the participants were quite homogenous with most participants being white, middle-class, educated, and in a committed relationship (i.e., married or common-law), potentially limiting the generalizability of our findings. Sixth, we did not specifically assess the gender or sexual orientation of our population. While our inclusion criteria included individuals identifying as women and possessing the biological capacity to conceive a child (i.e., uterus), it would be useful for future research to examine how gender identity may play a role.

Despite its limitations, the current study has many strengths. The current large sample size has allowed us to conduct analyses with adequate power to detect clinically important associations. The current study also improves our knowledge of the experiences of an understudied population: women experiencing infertility who are not using medical interventions. Finally, the research suggested several promising avenues of target for future interventions potentially improving the quality of life and experience of women with infertility.

Conclusions

The current study points to several domains of sexual function that are negatively impacted among distressed women who are struggling to conceive and that are associated with women's fertility quality of life and relationship satisfaction. Sexual function has been demonstrated to moderate the relationship between time trying to conceive and psychological outcomes, suggesting that improvements in sexual function may help dampen the temporal

impact of infertility on psychological outcomes. Psychological interventions aimed at improving sexual function may therefore have benefits for women's overall psychosocial wellbeing. Future psychological interventions aimed targeting infertility-related distress may benefit from the incorporation of techniques specifically aimed at improving the couple's sexual relation.

Table 1.

Sample characteristics.

Variable	Mean (SD) or % (n)
Mean age (SD)	30.8 (3.58)
Age range	20-41
Race/ethnicity	
White/Caucasian	87.4% (201)
Black/African American	10.4% (24)
Mean time trying (SD) in months	21.5 (9.69)
Marital Status	
Married/ Common law	86.1% (198)
Cohabiting but not married	8.7% (20)
Widowed	3.5% (9)
Previous pregnancy	9.6% (22)
Previous miscarriage	14.8% (34)
Endometriosis	6.1% (14)
Pelvic inflammatory disease	0.9% (2)
Polycystic ovarian syndrome (PCOS)	13.9% (32)
Mean FertiQoL Core	62.84 (12.78)
Below FertiQoL Clinical Cut-off (<52)	72.6% (167)
Mean RDAS Total	42.38 (10.36)
Mean STAI Total	49.67 (5.09)
Mean FSFI Total	26.73 (6.05)
Below FSFI Clinical Cut-off (<26.55)	49.1% (113)
Mean PHQ-9	14.74 (5.51)
Above PHQ-9 Clinical Cut-off (>10)	75.2% (173)

FertiQoL Fertility Quality of Life. RDAS Revised Dyadic Adjustment Scale. STAI State Trait Anxiety Inventory. FSFI Female Sexual Function Index. PHQ-9 Patient Health Questionnaire. For the FSFI and FertiQoL the clinical cut-off are below and for the PHQ-9 the clinical cut-off is above due to the scoring of the measures.

Table 2.

Relationships between individual domains of sexual function (FSFI), fertility quality of life (FertiQoL) and relationship adjustment (RDAS).

	FertiQoL Emotional		FertiQoL Mind-Body		FertiQoL Relational		FertiQoL Social		RDAS Satisfaction		RDAS Cohesion		RDAS Consensus	
	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>	<i>B(SE)</i>	<i>p</i>
Desire	-0.039 (1.32)	.976	-1.66 (1.45)	.255	2.38 (1.44)	.099	-1.05 (1.45)	.333	-1.21 (.43)	.005	.51 (.29)	.083	1.06 (.65)	.106
Arousal	6.02 (1.52)	<.001	1.37 (1.69)	.418	2.27 (1.67)	.175	3.01 (1.80)	.017	-.46 (.52)	.375	-.07 (.36)	.855	-1.05 (.80)	.193
Lubrication	-4.11 (1.62)	.012	-2.25 (1.79)	.212	-.25 (1.78)	.891	-2.79 (1.89)	.037	1.27 (.55)	.021	.39 (.38)	.297	.59 (.84)	.481
Orgasm	4.51 (1.58)	.005	5.62 (1.75)	.002	3.49 (1.73)	.045	2.34 (1.30)	.073	.10 (.53)	.849	.51 (.36)	.166	-2.40 (.81)	.003
Satisfaction	-3.68 (1.36)	.007	-2.01 (1.51)	.183	-4.88 (1.61)	.001	-.80 (1.12)	.477	.58 (.46)	.207	.84 (.32)	.008	4.41 (.71)	<.001
Pain	1.23 (.83)	.139	3.32 (.92)	<.001	2.82 (.91)	.002	2.13 (.68)	.002	.81 (.26)	.002	-.13 (.18)	.472	-.68 (.41)	.095

Figure 1

The moderating effect of sexual function in the relationship between time trying to conceive and subscales of the Fertility Quality of Life (FertiQoL) scale

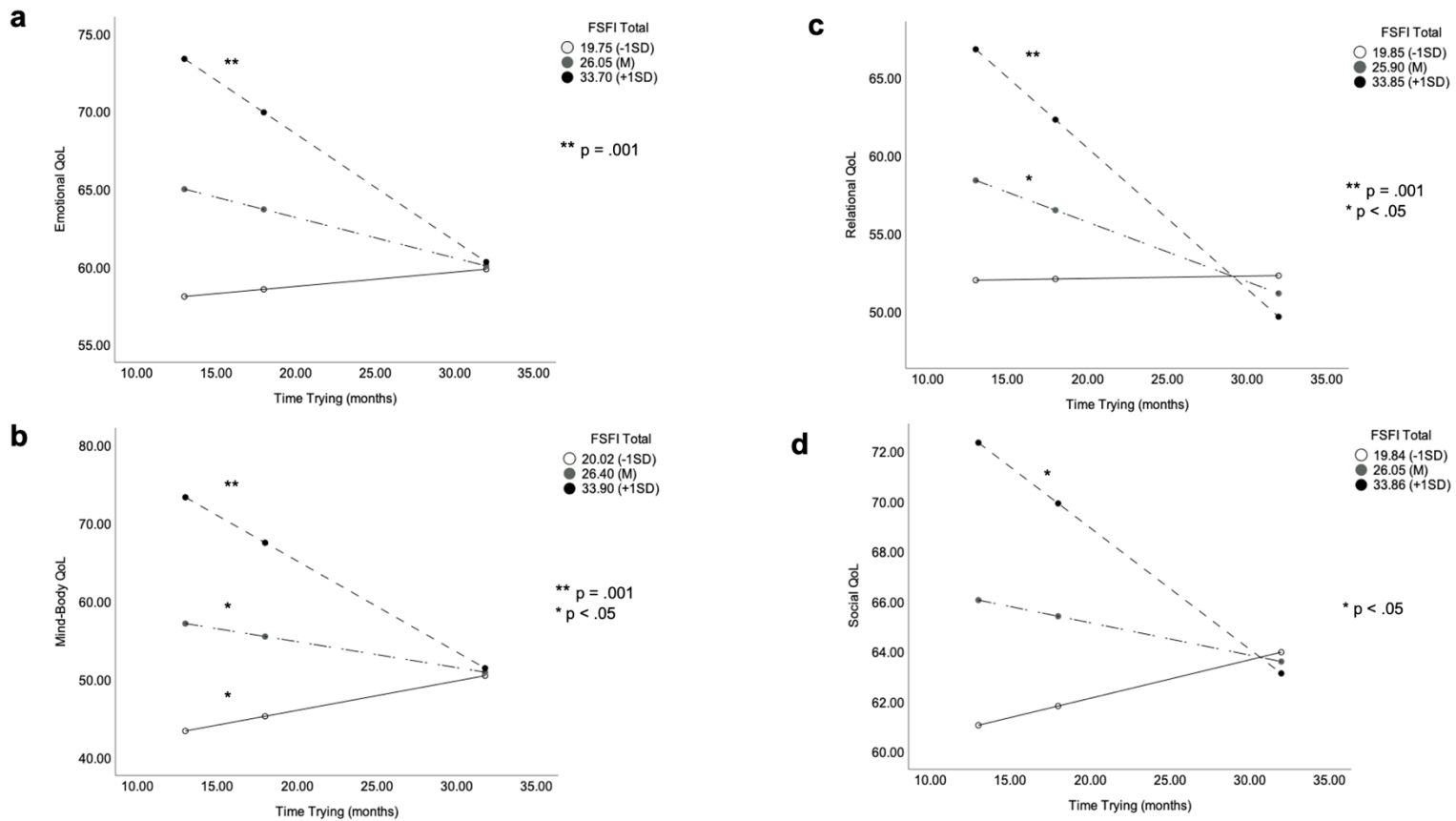
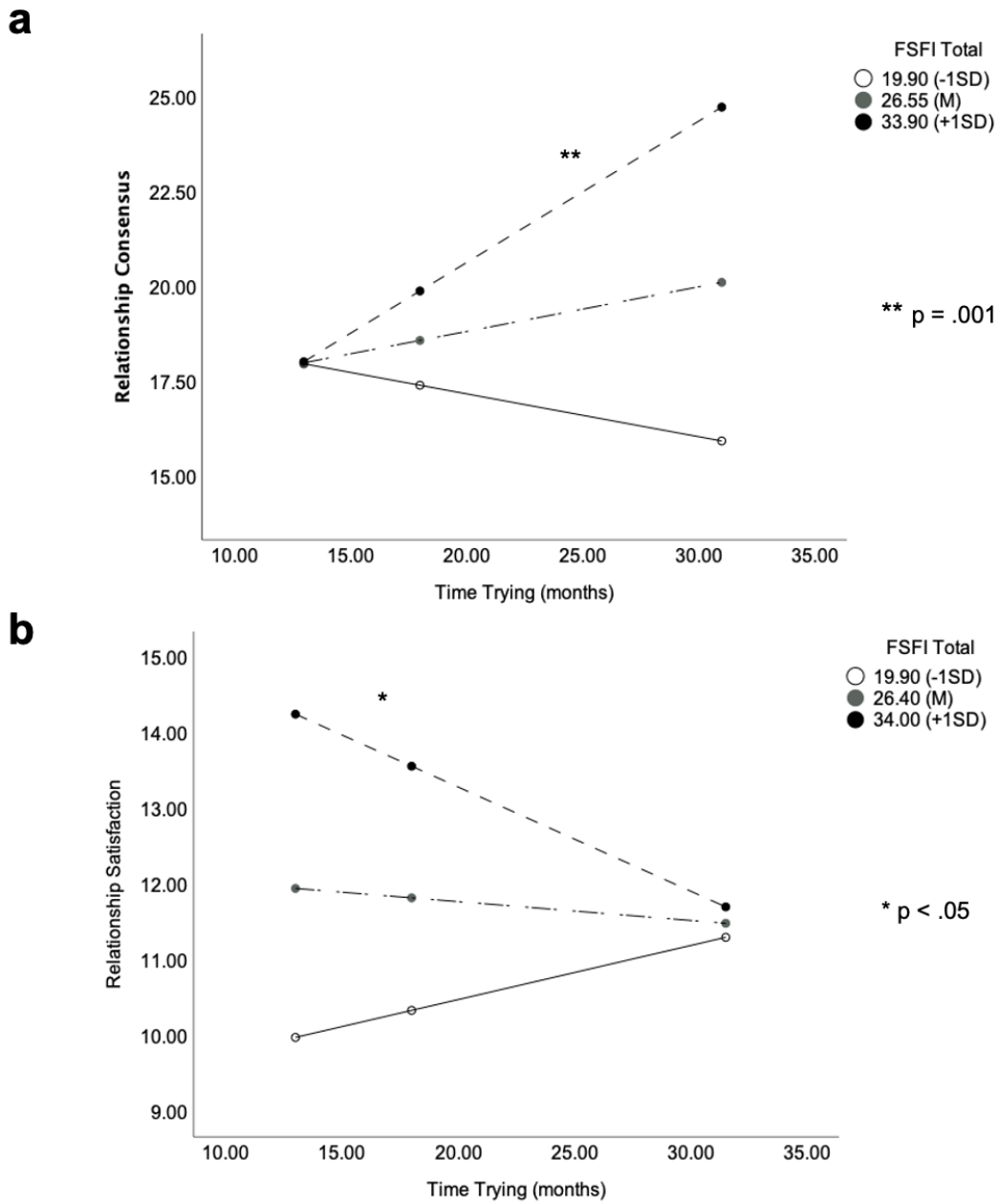


Figure 2

The moderating effect of sexual function in the relationship between time trying to conceive and subscales of the Revised Dyadic Adjustment Scale (RDAS)



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