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ASSISTED REPRODUCTION TECHNOLOGIES

# Perceptions among infertile couples of lifestyle behaviors and in vitro fertilization (IVF) success

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**Abstract**
*Purpose* To assess how patients perceive various lifestyle behaviors impact IVF success.
*Methods* Cross-sectional study of heterosexual, English-speaking couples ($n$=138) who completed web-based surveys during IVF treatment cycle. Perceived impact of lifestyle choices assessed by multivariable logistic regression and p-value tests for linear trend ($P_t$).
*Result(s)* During the IVF cycle, most patients consider it helpful for women to exercise (76 %), avoid stress (87 %) and limit activity after embryo transfer (92 %). The majority of patients (62 %) consider rigorous exercise (4+ h/week) helpful and nearly one-third (32 %) perceive benefit to complete bed rest after transfer. Overall, couples with a sex-specific infertility diagnosis are more likely to consider partner's lifestyle choices impactful: male-factor couples are more likely to consider it helpful for men to limit cellular phone use (OR:2.73,CI:1.06–7.04) and diminished ovarian reserve couples are more likely to consider it helpful for women to limit exposure to plastics (OR:2.38,CI:1.03–5.51). Patients at higher levels of education ($P_t$<0.01) and income ($P_t$<0.01) are less likely to consider lifestyle impactful.
*Conclusion(s)* Patient perceptions of the impact of lifestyle factors on IVF success vary by sex, infertility diagnosis and socioeconomic factors. Despite counseling to the contrary, many patients perceive benefit to rigorous exercise during the IVF cycle and complete bedrest following transfer. Results provide insight into patient beliefs and highlight opportunities to improve patient education, alleviate patient anxieties and potentially improve IVF outcomes.

**Keywords** Infertility · Bedrest · Lifestyle · Assisted reproductive technology (ART) · In vitro fertilization (IVF)

*Capsule* Patient perceptions of lifestyle factors are associated with sex, infertility diagnosis and education and demonstrate that most patients consider bedrest and exercise influential.

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## Introduction

In vitro fertilization (IVF) and assisted reproductive technologies (ART) are resource-intensive treatments such that any contributions to success, including lifestyle modifications, are important [1]. Studies suggest certain lifestyle behaviors and patient characteristics such as being underweight or obese adversely affect cycle success [2, 3], while stress-reducing behaviors are generally thought to be beneficial [4, 5]. Meanwhile, some popularly supported behaviors, such as complete bed rest after embryo transfer, have not been shown to improve outcomes [6, 7].

Patient understanding of the effect of lifestyle behaviors on IVF success has not been extensively studied. Existing literature demonstrates gaps in patient knowledge and resulting behaviors range from unnecessary to harmful [8, 9]. Alternatively, reinforcement of healthy behaviors may improve IVF

outcomes: IVF patients who stopped consuming caffeine and alcohol prior to their IVF cycle experienced higher clinical pregnancy and live birth rates than current users [10]. Patient perception of the influence of behaviors for which the impact on cycle success has not been robustly demonstrated (e.g. acupuncture, exercise, and bed rest after embryo transfer) has not been previously evaluated. A university-affiliated clinic in an insurance mandate state with favorable fertility treatment coverage provides a model population in whom to address this question.

The aim of this study was to characterize patient perceptions of how lifestyle behaviors impact IVF outcome. Assessing patient perceptions of the impact of lifestyle behaviors on reproduction may provide opportunities to identify deficiencies in patient knowledge and modify them through directed counseling. Improved education about lifestyle choices, to which many patients invest substantial resources, could relieve anxiety and expense spent on unrelated factors while contributing to the adoption of healthy behaviors that might improve outcomes.

## Methods

Couples presenting to the Center for Infertility and Reproductive Surgery at Brigham and Women's Hospital for fresh IVF cycle between July 2011 and January 2012 were screened for inclusion in this cross-sectional study. English-speaking, heterosexual infertile couples with internet access who presented for egg retrieval prior to fresh, autologous IVF cycle with Day 3 embryo transfer were eligible. Third party reproduction cycles (donor oocyte, donor sperm and gestational carrier) were excluded due to inability to assess partners' lifestyle behaviors. The research protocol was approved by the Partners Human Research Committees. All patients were provided information on the study and consented prior to beginning the survey.

Couples were screened for eligibility at the time of oocyte retrieval. Clinical and research staff provided an information packet including a one-page summary of the study and a separate document for interested patients to supply their and their partners' email addresses. Patients who provided an email address(es) were emailed a link to the online survey and a confidential login with a blinded, unique identifier. This link directed participants to supply their login and a password to confirm eligibility. Couples were not excluded if only one partner provided his or her email address. Participants were considered enrolled after accessing the on-line study, with consent posted at the beginning of the survey.

To ensure survey completion after embryo transfer but before serum pregnancy test, participants were allowed access to the survey within a strict 11-day time window beginning 3 days after and ending 14 days after egg retrieval (i.e. after embryo transfer but before serum pregnancy testing). Only Day 3 embryo transfers, the most common embryo transfers performed at our institution over this study period, were included to standardize this time window. To maximize response, reminder emails were sent to participants at 3 days and 1 day prior to link expiration.

Participants were asked for demographic information and medical history [11]. The remainder of the survey involved questions regarding participants' perceived impact of various lifestyle behaviors, such as 'How do you think stress affects the success (getting pregnant and having a baby) of your IVF cycle?'. Questions were presented with a Likert-type rating scale (very harmful, harmful, no effect, helpful, very helpful) and respondents were also provided the option of answering 'I don't know/no opinion.' Lifestyle behaviors assessed included exercise frequency (no exercise; <1 h/week; 1–3 h/week, "moderate"; 4+ h/week, "rigorous"), yoga practice (once a week, 2–6 times a week, 7 days a week), degree of rest after embryo transfer (normal activity, limiting strenuous activity and exercise, complete bed rest), acupuncture (receiving acupuncture or not), weight (underweight, normal weight, overweight, obese), stress (avoiding stress, having stress), attitude (positive attitude, negative attitude), prayer (no prayer, prayer), cellular phone use (limited use, typical use), and environment (limiting exposure to plastics, typical exposure to plastics) (Table 1). In addition to these behaviors, perceptions of the impact of various lifestyle choices, including smoking, alcohol use, medications, herbs and diet were also assessed and will be presented elsewhere.

After answering questions regarding the perceived impact of their behavior, participants were asked questions with regard to the perceived impact of their partner's behavior (e.g. 'How do you think your partner's stress affects the success (getting pregnant and having a baby) of your IVF cycle?'). Lastly, participants were asked about sources of information (physician, nurse, book, internet, friends, family, partner) that contributed to their beliefs.

SAS 9.2 (SAS Institute Inc., Cary, NC) was used for all data analyses. Multivariable logistic regression analyses adjusting for sex, age and education were performed to estimate the effects of explanatory variables such as sex, infertility diagnosis and duration of infertility on perceptions about lifestyle behaviors. For the purposes of statistical analyses, the two positive Likert scale categories were collapsed to represent "helpful" and the two negative categories were collapsed to represent "harmful". Results are presented as adjusted odds ratios (OR) with 95 % confidence intervals (CI) and Wald p-value tests for linear trend (for which statistical significance was assumed for $p<0.05$).

A total of 376 individuals were emailed a link to complete the survey and 360 individuals, (96 %) enrolled in the study by clicking the link to complete the questionnaire. Of those enrolled, 264 (73 %) provided responses. Completed surveys

containing insufficient demographic information were excluded due to the critical importance of accounting for the impact of patient characteristics on health perceptions for a total number of 208 surveys (79 % of all completed surveys) included in the final analysis.

## Results

The 208 participants, 138 (66 %) women and 70 (34 %) men, were mostly age 35 or older and well-educated, with a range of infertility diagnoses (Table 2). For most of the questions, less than 10 % of participants answered 'I don't know/no opinion'. Questions assessing the perceived impact of acupuncture and yoga on cycle outcomes had the highest proportion of participants stating 'I don't know/no opinion' (26 % and 23 %) while questions regarding the impact of stress had the lowest proportion (0 %).

Overall, most respondents considered it helpful for women to limit strenuous activities after embryo transfer (92 %), avoid stress (87 %), have a positive attitude (85 %), exercise for 1–3 h/week (moderate exercise)(76 %) or for 4+ h/week (rigorous exercise)(62 %), have acupuncture (63 %), practice yoga (58 %) and pray (57 %). Nearly one-third (32 %) of participants considered it beneficial for women to practice complete bed rest after embryo transfer; participants with less formal education were more likely to hold this belief ($P_t$=0.03). Most patients considered it detrimental for women to have a negative attitude (80 %) or be underweight (88 %), overweight (80 %) or obese (97 %). The majority of respondents believed that a woman's typical cellular phone use (92 %) and exposure to plastics (81 %) had no effect on IVF outcome. When asked about the impact of men's behavior, both sexes considered a positive attitude (80 %), moderate exercise (69 %) and rigorous exercise (63 %) beneficial and reported believing that a negative attitude (77 %) or being underweight (54 %), overweight (61 %) or obese (82 %) was harmful.

Couples with male factor infertility, a male-specific infertility diagnosis, were nearly three times as likely to believe it beneficial for men to be normal weight (OR:2.98, CI:1.30–6.83) and limit cellular phone use (OR:2.73, CI:1.06–7.04). In contrast, couples with diminished ovarian reserve, a female-specific infertility diagnosis, were less than half as likely to consider men's exercise (OR:0.43, CI:0.20–0.89) or yoga practice beneficial (OR:0.35, CI:0.13–0.97) yet more than twice as likely to consider women limiting exposure to plastics helpful (OR:2.38, CI:1.03–5.51).

When comparing perceptions between male and female participants, both sexes considered the impact of their behavior to be of greater consequence than their opposite-sex partners did (Figs. 1 and 2). Compared to women, men were less likely to believe it helpful for women to avoid stress (OR:0.24, CI:0.09–0.62), practice yoga (OR:0.40, CI:0.18–0.91) and be of normal weight (OR:0.29. CI:0.14–0.59) (Fig. 1). In contrast, men were more likely than women to consider it helpful for men to avoid stress (OR:2.08, CI:0.94–4.59), receive acupuncture (OR:2.91, CI:1.36–6.24), and be of normal weight (OR:2.27, CI:1.18–4.36)(Fig. 2). When asked which sources contributed to beliefs about lifestyle, most patients considered physicians (84 %) and nurses (83 %) influential or very influential. Patients also considered the internet (71 %), books (65 %), and, to a lesser magnitude,

**Table 1** Patient perceptions of the impact of lifestyle behaviors on IVF outcome assessed in an online survey

| Perceptions of lifestyle behaviors |
|---|
| Exercise |
| No exercise |
| <1 h/week |
| 1–3 h/week |
| 4+ h/week |
| Yoga |
| Once a week |
| 2–6 times a week |
| 7 days a week |
| Rest after embryo transfer |
| Normal activity |
| Limiting strenuous activity and exercise |
| Complete bed rest |
| Acupuncture |
| Receiving acupuncture |
| Not receiving acupuncture |
| Weight |
| Underweight |
| Normal weight |
| Overweight |
| Obese |
| Stress |
| Avoiding stress |
| Having stress |
| Attitude |
| Positive attitude |
| Negative attitude |
| Prayer |
| Engaging in prayer |
| Not engaging in prayer |
| Cellular phone use |
| Limited use |
| Typical use |
| Environment |
| Limiting exposure to plastics |
| Typical exposure to plastics |

**Table 2** Demographic characteristics of 208 survey participants undergoing in vitro fertilization (IVF) treatment at a university-affiliated clinic

| Characteristic | Women N (%) | Men N (%) |
|---|---|---|
| N (%) | 138 (66.3) | 70 (33.7) |
| Age | | |
| <=34 | 48 (34.8 %) | 20 (28.6 %) |
| 35–37 | 37 (26.8 %) | 14 (20.0 %) |
| 38–40 | 31 (22.5 %) | 16 (22.9 %) |
| 41–42 | 16 (11.6 %) | 7 (10.0 %) |
| 43+ | 6 (4.3 %) | 13 (18.6 %) |
| Education | | |
| High school or 2-year college | 17 (12.3 %) | 9 (12.8 %) |
| 4-year college | 40 (29.0 %) | 21 (30.0 %) |
| Master's degree | 44 (31.9 %) | 26 (37.1 %) |
| MD/PhD/JD | 37 (26.8 %) | 14 (20.0 %) |
| Annual household income | | |
| <$100,000 | 25 (18.3 %) | 17 (24.3 %) |
| $100,001–$150,000 | 43 (31.4 %) | 20 (28.6 %) |
| 150,001–$200,000 | 27 (19.7 %) | 13 (18.6 %) |
| >$200,001 | 42 (30.6 %) | 20 (28.5 %) |
| Race/Ethnicity (all that apply) | | |
| Asian | 15 (11.1 %) | 9 (12.8 %) |
| Caucasian | 107 (78.7 %) | 48 (68.6 %) |
| Other | 13 (12.5 %) | 13 (18.6 %) |
| Number of months trying to get pregnant | | |
| <6 months | 2 (1.5 %) | 8 (11.4 %) |
| 6–12 | 20 (14.6 %) | 9 (12.9 %) |
| 13–24 | 46 (33.6 %) | 28 (40.0 %) |
| >24 months | 69 (50.4 %) | 25 (35.7 %) |
| Primary infertility diagnosis (all that apply) | | |
| Ovulation | 14 (10.1 %) | 6 (8.6 %) |
| Blocked tubes | 23 (16.7 %) | 4 (5.7 %) |
| Uterine factor | 2 (1.4 %) | 0 (0 %) |
| Endometriosis | 10 (7.2 %) | 5 (7.1 %) |
| Male factor | 29 (21.0 %) | 13 (18.6 %) |
| DOR | 35 (25.4 %) | 15 (21.4 %) |
| Unexplained | 51 (37.0 %) | 24 (34.3 %) |
| Don't know | 4 (2.9 %) | 5 (7.1 %) |
| Other etiology | 10 (7.2 %) | 10 (14.3 %) |

family (53 %) influential or very influential. Overall, women reported considering more sources influential than men.

Lifestyle beliefs did not vary by age (all $P_t>0.05$). There were no consistent trends with regard to self-reported ethnicity, religion, or history of prior live birth. However, participants at higher levels of income and education were less likely to consider lifestyle behaviors influential. For example, those at higher income levels were less likely to consider attitude influential ($P_t<0.01$). Similar trends were observed with respect to education whereby respondents at higher levels of education were less likely to consider any lifestyle behavior influential when compared to patients with less education.

## Discussion

This cross-sectional study in couples undergoing IVF at a university-affiliated clinic demonstrates that patient perceptions about lifestyle vary by sex, infertility diagnosis and socioeconomic status. Major findings demonstrate that most patients considered exercise, stress avoidance and maintenance of a normal weight beneficial. Surprisingly, many patients perceived benefit to rigorous exercise prior to transfer and complete bedrest following transfer. Additional key findings include the observation that patients with sex-specific infertility diagnoses were more likely to consider lifestyle choices by that partner impactful. Results provide insight into patient beliefs and highlight opportunities to improve patient education.

The observation that over 90 % of participants considered it helpful for women to restrict strenuous activity after embryo transfer calls attention to the high level of patient concern surrounding acceptable activity at this point in the treatment cycle. At our institution, IVF education nurses discuss limiting strenuous activity that may increase the risk of ovarian torsion but do not specifically address limiting activity following transfer. A surprisingly high percentage (32 %) of patients perceived benefit to complete bed rest. This perspective was more common among less educated patients such that this finding may be explained by the association between less education and an increased likelihood of considering any lifestyle choice impactful. Notwithstanding, both findings demonstrate that despite insufficient evidence to support its use [6, 7, 12], bed rest remains a topic of concern for many IVF patients.

The finding that couples with a sex-specific infertility diagnosis (e.g. male factor) were more likely to consider the infertile partner's lifestyle choices impactful (e.g. couples with male factor infertility were more likely to consider numerous male lifestyle behaviors influential compared to couples with other infertility diagnoses) suggests there may be merit to tailoring education. If couples concentrate on the choices made by the "pathologic" partner [13], they may de-emphasize lifestyle choices made by the healthy partner or even permit poor choices such that additional education on the importance of lifestyle behaviors of the "healthy" partner might contribute to success in these couples.

Patient concern that being overweight or obese is detrimental to IVF success may contribute to the finding that over 60 % of survey respondents considered it helpful for men and women to exercise rigorously during the IVF cycle [2, 3, 14].

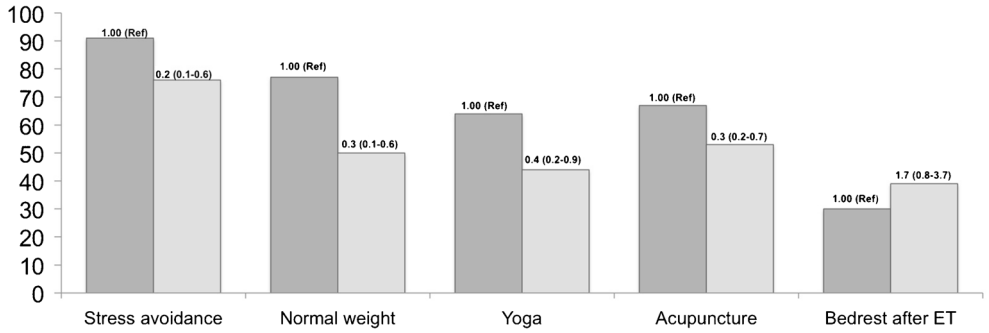


**Fig. 1** Percent of 138 female and 70 male participants who consider female behavior beneficial to IVF outcome

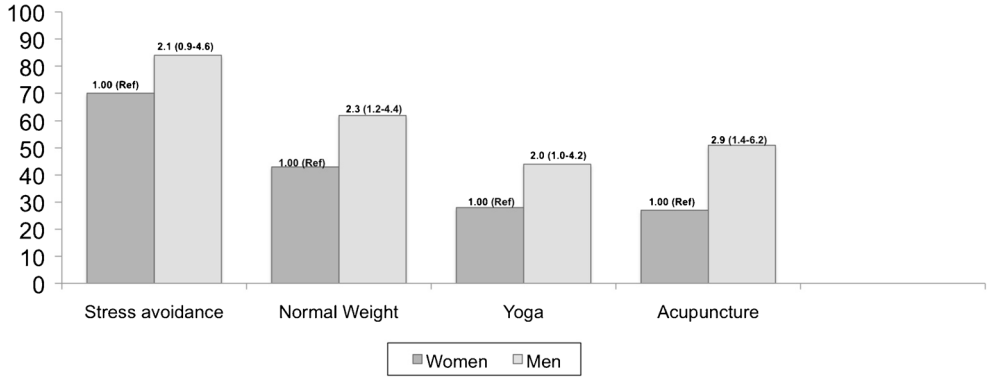


**Fig. 2** Percent of 138 female and 70 male participants who consider male behavior beneficial to IVF outcome

While the impact of rigorous exercise during the IVF cycle has not been completely characterized, existing literature suggests vigorous exercise, whether current or former, is associated with worse outcomes [15, 16].

The majority of patients considered participation in coping and relaxation behaviors, such as prayer, yoga, acupuncture and maintaining a positive attitude, beneficial. Overall, literature is sparse on these associations. Early research suggests that prayer [17], yoga [18], acupuncture [19], stress avoidance [20], and having a positive attitude [5], might positively impact success, though studies have not elucidated whether an effect is achieved through direct or indirect mechanism. Data exists to suggest acupuncture might improve outcomes through the mechanism of stress reduction [19], though a more substantial body of research does not support an independent relationship whereby acupuncture improves IVF outcomes [21–24].

Overall, an interesting phenomenon was observed whereby each sex considered the impact of their lifestyle choices to be of greater consequence than their partners did. The observation that women considered more sources influential than men may be related to women undergoing the majority of interventions in an IVF cycle and may also be related to women's assumption of the majority of the reproductive responsibility [25, 26].

Strengths of this investigation include a strict and limited time window for survey completion that captured responses when patients' degree of concern is expected to be highest yet uninfluenced by knowledge of cycle outcome (between embryo transfer and serum pregnancy test) [27]. An expansive survey assessing impact of varying levels of engagement in a range of behaviors allowed for thorough assessment. Questions regarding the perceived impact of a partner's behavior permitted comparisons by and between sexes. A study population drawn from all eligible patients at a university-affiliated clinic in an insurance mandate state allows for results that can be reasonably generalized among insurance mandate states and patients with insurance in clinics.

The exclusion of patients undergoing Day 2 or Day 5 transfers might introduce selection bias, though this was necessary to allow all participants equal time to enroll in and respond to the online survey. While participants were disallowed from submitting responses after they were eligible to complete a serum pregnancy test, it is possible participants took home pregnancy tests such that results unduly influenced responses. It is also possible the decision to take a home pregnancy test varies by socioeconomic status, infertility diagnosis and duration of infertility. Additionally, less attentive respondents might have answered questions with regard to the wrong partner, and this may vary by education level or age.

In summary, the major findings of this investigation demonstrate that patient perceptions of lifestyle varied by sex, infertility diagnosis and socioeconomic factors. Many patients perceived benefit to rigorous exercise during the cycle and complete bedrest after transfer. Patients with a sex-specific infertility diagnosis were more likely to consider the lifestyle choices of

that partner impactful. Results highlight areas to emphasize in patient education and identify opportunities to alleviate patient anxieties and potentially improve outcomes.

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