Identifying by means of coping typologies and primary appraisal the likelihood of positive β-hCG test results in women undergoing IVF treatment: a preliminary study

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**BACKGROUND:** At a psychological level, having to undergo IVF in order to be a mother may be appraised differently by women who start this treatment. These different forms of assessment can affect the pregnancy rates. The objective of this study was to determine whether psychological variables such as primary appraisal and coping typologies were associated with positive results in β-hCG pregnancy test after IVF.

**METHODS:** We performed a cross-sectional clinical study in a private infertility centre. We recruited women undergoing IVF treatment in the Assisted Reproduction Unit of the Hospital Clinic prior to treatment commencement. Women were asked to complete the Spanish adaptation of the Coping Responses Inventory-Adult Form, and coping typologies analysed in relation to pregnancy outcome of that round of treatment.

**RESULTS:** Women who face infertility and IVF with optimistic appraisal had a considerably increased likelihood of pregnancy compared with those with a pessimistic appraisal (odds ratio = 4.37; 95% confidence interval = 1.76–10.83). On the other hand, the pregnancy rate was significantly higher than the non-pregnancy rate among women who have a coping typology characterized by high use of approach strategies and with low use of avoidance strategies (Z-test = 4.34, P < 0.001).

**CONCLUSIONS:** Psychological variables such as positive appraisal and coping typologies were associated with increased pregnancy rates after IVF. The main limitations of this study were the size of the sample and in particular its cross-sectional design which only allows predictive associations to be made.

**Key words:** psychology / infertility / IVF/ICSI outcome / coping response inventory

**Introduction**

IVF techniques can trigger stress and affect the resulting conception rates and likelihood of positive outcomes (Thiering et al., 1993; Facchinetti et al., 1997; Eugster and Vingerhoets, 1999; Klonoff-Cohen, 2005). This finding has led to interest in identifying ways of reducing such psychological stress.

When faced with stressful events, people evaluate the strength of their impact (primary appraisal: e.g. threat or challenge) and then set in motion a series of coping mechanisms (coping strategies).

Coping strategies are behavioural or cognitive efforts used by people to remove or re-assess the stressful event (problem-focused coping or approach coping), or to regulate the emotional state that caused the stressful event (emotion-focused or avoidance coping) (Lazarus and Folkman, 1984; Lazarus, 1993; Moos, 1993). The literature on coping indicates that these strategies are neither good nor bad in themselves; rather, they will be adaptive to varying degrees depending on the characteristics of the situation and its appraisal (e.g. threat, challenge or controllability).
In the specific case of infertility, the way patients cope with this stressor is related to the rate of positive outcomes after IVF treatment. Demyttenaere et al. (1998) in their sample of 98 IVF patients at the Leuven University Center, University Hospital Gasthuisberg (Belgium), found that decreased expression of negative emotions and increased palliative coping predicted a higher pregnancy rate. Palliative coping is a way of modulating tension and making a situation more tolerable without directly addressing the problem (Jalowiec, 1988). In the context of infertility, Bar-Hava et al. (2001) in their sample of 96 IVF patients at the Lis Maternity Hospital-Tel Aviv Sourasky Medical Center stated that active coping strategies were positively associated with sexual functioning, and being sexually active during the IVF treatment period was found to be positively associated with the likelihood of conception and with adaptive coping strategies. Subsequent research by Panagopoulou et al. (2006) in their sample of 342 IVF patients at the General Clinic Fertility Centre of Thessaloniki (Greece) found that women were less likely to achieve a pregnancy if they displayed their emotions related with IVF treatment and infertility, whereas Rapoport-Hubschman et al. (2009) in their sample of 88 IVF patients at the Unit of the Rabin Medical Center in Petah-Tikva (Israel) observed that women who became pregnant had higher ‘letting go’ coping levels (originally named behavioural disengagement coping) at the beginning of IVF than did those who did not become pregnant. However, the use of problem-focused coping did not differentiate between those women who became pregnant and those who did not.

None of the studies of coping in IVF mentioned above take into account the fact that people generally use approach and avoidance strategies simultaneously. Therefore, the number of approach or avoidance strategies that people use when faced with a stressful event is not as important as the relative use of some strategies instead of others. Several authors (Herman-Stahl et al., 1995; Steiner et al., 2002; Kirchner et al., 2008a) have analysed both types of coping simultaneously by creating coping typologies (high approachers and avoiders, low approachers and avoiders, preferentially approachers and preferentially avoiders). However, none of these studies are related to infertility or IVF treatments. Indeed, to our knowledge, researchers have not yet linked these coping typologies at the beginning of IVF treatment with the pregnancy rate achieved subsequently. Furthermore, very few studies have focused on the association between the primary appraisal of stressing situations and post-IVF pregnancy rates (Demyttenaere et al., 1992; Hansell et al., 1998). The present study aims to fill this gap.

It should also be noted that a positive and optimistic appraisal of a stressful situation in areas other than infertility (chronic illness, migration, cancer) have been associated with better physical and mental health (Gordon et al., 2002; Franks and Roesch, 2006; Nes and Segerstrom, 2006; Kirchner and Patiño, 2010), which if extrapolated to infertility might translate into an effect on conception rates (Daniluk, 1988; Stoleru et al., 1993; Damti et al., 2008). Indeed, several studies have shown increased rates of pregnancy in women with infertility problems after psychological interventions (Tuschen-Caffier et al., 1999; Domar et al., 2000; Hosaka et al., 2002; De Liz and Strauss, 2005).

In light of the above, the aim of the present study was to determine, within the framework of stress and coping (Lazarus and Folkman, 1984; Moos, 1995), whether primary appraisal and coping typologies were associated with positive results on the β-hCG pregnancy test after IVF. Pregnancy was diagnosed by increasing serum concentrations of β-hCG in Weeks 2–3 after embryo transfer, and the subsequent demonstration of an intrauterine gestational sac by ultrasonography in Weeks 3–4 after embryo transfer.

The specific objectives were: (i) to analyse the association between coping typologies and positive results on the β-hCG test after IVF, and then to calculate the likelihood of obtaining positive outcomes; and (ii) to analyse the association between patients’ appraisal of having to undergo IVF treatment and positive β-hCG test results, and, once again, to calculate the likelihood of obtaining positive outcomes. Regarding the first objective, it was hypothesized that patients whose coping typology was characterized by comparatively greater use of approach rather than avoidance responses (preferentially approachers) would obtain a higher percentage of positive β-hCG test results than those who used the other coping typologies would. With respect to the second objective, we hypothesized that patients with an optimistic and non-threatening appraisal of the IVF situation would obtain a higher rate of positive β-hCG test results than those who appraised it negatively. The rationale for this study, based on previous research (Daniluk, 1988; Demyttenaere et al., 1992; Stoleru et al., 1993; Damti et al., 2008), is that the positive appraisal of IVF treatment and the use of effective coping strategies may reduce levels of stress and negative thoughts, thereby increasing the likelihood of a successful pregnancy. As stated by Verhaak et al. (2010), IVF is a stressful, emotional experience that could interfere in achieving pregnancy.

Materials and Methods

Participants

Participants were 92 women (mean age 34.07 years, SD = 2.82, range 25–41) undergoing IVF treatment in the Assisted Reproduction Unit of the Hospital Clinic in Barcelona (Spain). They were recruited through the consecutive case method. In 39.2% of the women, infertility was of unknown aetiology, related to female factors in 30.4% and to male factors in the remaining 30.4%. With respect to previous pregnancies, 90.2% of the women had never become pregnant by means of assisted reproduction techniques (ART), 4.3% had had a previous miscarriage, 1.1% had achieved a successful pregnancy before the present treatment and the remaining 4.3% had had a child with a previous partner. Therefore, 5.4% of the IVF participants had previously given birth, while the remaining 94.6% had never had children. This was the first IVF attempt for 39.1% of the women, the second for 32.6%, the third for 13% and the fourth for 15.2%.

Procedure

In accordance with the ethical standards of the Hospital Clinic, the purpose of the study was explained to each patient and their signed consent was requested. During the first visit at the start of the IVF procedure, participants were interviewed by a clinical psychologist who gave each patient a sealed envelope containing the psychological questionnaires to be completed at home before the beginning of pharmacological treatment. The women were asked to return the completed questionnaires in sealed envelopes during the next treatment appointment, which was on Day 10 after the start of treatment.
Measures

The Spanish adaptation (Kirchner et al., 2008b; Kirchner and Forns, 2010) of the Coping Responses Inventory-Adult Form (CRI-A; Moos, 1993) was employed to assess coping strategies. This test comprises three parts. In the first part, participants describe the most important problem that has occurred in the last 12 months. In the present study, the problem was contextualized as infertility and beginning IVF treatment. In the second part, the problem appraisal is assessed by means of 10 items with four response levels (Likert scale from 0 ‘Definitely no’ to 3 ‘Definitely yes’): (1) previous experience in this type of problem; (2) knowledge of possible occurrence; (3) time to confront the event; (4) consider the problem as a threat; (5) consider the problem as a challenge; (6) attribute responsibility for the problem to self; (7) attribute responsibility for the problem to others; (8) good outcome of dealing with the problem; (9) the problem was solved and (10) favourable outcome of the problem. The third part of the CRI-A considers eight coping strategies (Logical Analysis, Positive Reappraisal, Seeking Guidance and Support, Problem Solving, Cognitive Avoidance, Acceptance—Resignation, Seeking Alternative Rewards and Emotional Discharge) which may be employed to face the stressor, assessing them by means of 48 items rated on a four-point Likert scale from 0 (‘No, Not at all’) to 3 (‘Yes, Fairly often’). The first four scales assess approach coping and the last four avoidance coping. A study of the psychometric properties of the Spanish adaptation (Kirchner et al., 2008b; Kirchner and Forns, 2010) reported adequate reliability, with Cronbach’s α coefficients fluctuating between 0.81 for approach coping and 0.68 for avoidance coping.

Data analysis

Categorical variables were compared by means of χ², and the Mann–Whitney U-test and Student’s t-test were applied to test for differences in the means of non-parametric and parametric variables, respectively. Percentages were compared by means of the Z-test, while odds ratios (ORs) were calculated to determine the likelihood of pregnancy occurring.

Results

After undergoing IVF treatment, 52.2% of women obtained a positive pregnancy result on the β-hCG test (β+ women), versus 47.8% who tested negative (β− women). The first step of the analysis involved establishing the equivalence of the two groups with respect to a series of variables which could be acting as confounding factors (Table I).

No significant differences were observed between women who obtained positive results (β+) and those with negative results (β−) in regard to age, type of infertility, number of previous IVF attempts, having children or not prior to IVF treatment, or having been previously pregnant through ART.

Coping typologies and positive results on the β-hCG test

Using the mean values obtained from the total approach (mean = 38.98, SD = 9.46) and avoidance responses (mean = 22.79, SD = 9.47) on the CRI-A, women were classified into four coping typologies: Group 1: use of approach and avoidance coping responses above the mean (mean ≥ 39 and ≥ 23, respectively); Group 2: use of approach responses above the mean and use of avoidance below the mean (mean ≥ 39 and ≤ 22, respectively); Group 3: use of approach responses below the mean and use of avoidance above the mean (mean ≤ 38 and ≥ 23, respectively) and Group 4: use of approach and avoidance responses below the mean (mean ≤ 38 and ≤ 22, respectively). No association was found between coping typologies and the age of patients [F (3.81) = 2.38, P = 0.08], type of infertility (χ² = 4.93, df = 6, P = 0.55), number of previous attempts at IVF (χ² = 8.25, df = 9, P = 0.51), having children or not prior to IVF treatment (χ² = 3.41, df = 3, P = 0.33), or having been previously pregnant by means of ART (χ² = 9.04, df = 9, P = 0.43).

The percentage of positive and negative results on the β-hCG test was then computed according to different coping typologies. In Group 2, the percentage of women with positive results after IVF was significantly higher than the percentage with negative results. In the remaining groups, no significant differences were observed between the pregnancy and non-pregnancy rates. For each coping typology, the OR for pregnancy was also calculated. Each group was compared with Group 2, since it was this group that obtained the highest rate

<table>
<thead>
<tr>
<th>Variables</th>
<th>β-hCG outcome (n = 48)</th>
<th>β-hCG− (n = 44)</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success of IVF (rate)</td>
<td>52.2%</td>
<td>47.8%</td>
<td>Z test = 0.427, P = 0.61</td>
</tr>
<tr>
<td>Mean age (M, SD)</td>
<td>34.3 (2.63)</td>
<td>33.8 (3.0)</td>
<td>t = 0.880, P = 0.384</td>
</tr>
<tr>
<td>Type of infertility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown infertility (n, %)</td>
<td>20 (55.6)</td>
<td>16 (44.4)</td>
<td>χ² = 2.847, df = 2, P = 0.24</td>
</tr>
<tr>
<td>Female infertility (n, %)</td>
<td>11 (39.3)</td>
<td>17 (60.7)</td>
<td></td>
</tr>
<tr>
<td>Male infertility (n, %)</td>
<td>17 (60.7)</td>
<td>11 (39.3)</td>
<td></td>
</tr>
<tr>
<td>Mean number of previous IVF (M, SD)</td>
<td>2.04 (1.07)</td>
<td>2.05 (1.07)</td>
<td>t = 0.017, P = 0.987</td>
</tr>
<tr>
<td>Children prior to IVF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes (%)</td>
<td>8.3</td>
<td>2.3</td>
<td>χ² = 1.641, df = 1, P = 0.20</td>
</tr>
<tr>
<td>No (%)</td>
<td>91.7</td>
<td>97.7</td>
<td></td>
</tr>
<tr>
<td>Previous pregnancies with ART</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No (%)</td>
<td>87.5</td>
<td>93.2</td>
<td>χ² = 1.84, df = 3, P = 0.61</td>
</tr>
</tbody>
</table>
of positive results on the β-hCG test, and which can therefore be considered as the group with the greatest likelihood of pregnancy (Table II). The OR results failed to reach statistical significance.

**Infertility appraisal and positive results on the β-hCG test**

Significant differences on the appraisal items of the CRI-A with respect to undergoing IVF were found between women with positive and negative pregnancy results. The items that reached statistical significance were numbers 4 \((U = 771.00, P < 0.05)\) and 8 \((U = 654.00, P < 0.001)\). In other words, at the start of IVF, women who subsequently had a positive result on the β-hCG test experienced the problem of infertility in a less threatening and/or in a more positive and optimistic way than did those who obtained negative results.

Table III shows the association between type of appraisal and positive results on the β-hCG test. With regard to Item 4, women who experienced IVF in a non-threatening way were more likely to become pregnant (62.5 versus 37.5% who failed to become pregnant; \(Z\)-test = 2.22, \(P = 0.01\)). In contrast, women who experienced IVF as a threat, the rate of non-pregnancies was slightly higher than that of pregnancies (59.1 versus 40.9%; \(Z\)-test = 1.49, \(P = 0.06\)). The OR indicated that women with a non-threatening appraisal were more likely to obtain positive results on the β-hCG test than were those with a threatening appraisal.

Similarly, an association was also found on Item 8 between an optimistic appraisal at the start of IVF and a subsequent positive result on the pregnancy test: 73% of women who assessed the situation optimistically went on to obtain a positive outcome, versus 27% who obtained a negative result \((Z\)-test = 4.34, \(P < 0.001)\). In contrast, the pregnancy rate obtained by women with a non-optimistic appraisal of the situation (38.16%) was not statistically different from the corresponding non-pregnancy rate (61.82%) \((Z\)-test = 0.34, \(P = 0.37\)). The OR indicated that women with an optimistic appraisal were more likely to obtain positive results on the β-hCG test than were those with a pessimistic appraisal.

**Discussion**

The aim of this study was to establish whether primary appraisal and coping typologies were associated with positive results on the β-hCG pregnancy test in women undergoing IVF treatment. The most significant finding was that a positive appraisal at the beginning of treatment was associated with an increased likelihood of a successful outcome. Women who regarded IVF treatment as non-threatening were 2.41 times more likely to become pregnant than were those who appraised it as threatening. Furthermore, women who thought they could benefit by facing this situation with optimism increased their likelihood of pregnancy by 4.37 with respect to women who experienced IVF in a pessimistic way. This increase is non-negligible.

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Table II

**Frequencies and percentages of women with positive (β+) and negative (β−) results on the β-hCG test according to coping typologies.**

<table>
<thead>
<tr>
<th>Coping typologies</th>
<th>Group 1: approach and avoidance above mean, (n = 17^a)</th>
<th>Group 2: approach above mean and avoidance below mean, (n = 19)</th>
<th>Group 3: approach below mean and avoidance above mean, (n = 27)</th>
<th>Group 4: approach and avoidance below mean, (n = 22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>β-hCG test+ ((n = 45))</td>
<td>9 (52.9%)</td>
<td>13 (68.4%)</td>
<td>14 (51.9%)</td>
<td>9 (40.9%)</td>
</tr>
<tr>
<td>β-hCG test− ((n = 40))</td>
<td>8 (47.1%)</td>
<td>6 (31.6%)</td>
<td>13 (48.1%)</td>
<td>13 (59.1%)</td>
</tr>
<tr>
<td>Total</td>
<td>17 (100%)</td>
<td>19 (100%)</td>
<td>27 (100%)</td>
<td>22 (100%)</td>
</tr>
<tr>
<td>Z-test</td>
<td>n.s.</td>
<td>Z-test = 1.73, (P = 0.04)</td>
<td>n.s.</td>
<td>n.s.</td>
</tr>
<tr>
<td>OR: Group 2 versus the remaining groups</td>
<td>OR = 1.93 (CI 95% = 0.49–7.49)</td>
<td>OR = 2.01 (CI 95% = 0.38–6.86)</td>
<td>OR = 3.13 (CI 95% = 0.86–11.34)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a^\)The number of participants may vary due to missing values.

Table III

**Frequencies of women with positive and negative results on the β-hCG pregnancy test according to their appraisal.**

<table>
<thead>
<tr>
<th>Results on β-hCG test after IVF</th>
<th>β-hCG+</th>
<th>β-hCG−</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 4</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>Threatening</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Item 8</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>Optimistic appraisal</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>Non-optimistic appraisal</td>
<td>21</td>
<td>34</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Contrast</th>
<th>(\chi^2 = 4.289, df = 1, P = 0.038)</th>
<th>OR = 2.41 (CI 95% = 1.04–5.56)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 4</td>
<td>(\chi^2 = 10.730, df = 1, P = 0.001)</td>
<td>OR = 4.37 (CI 95% = 1.76–10.83)</td>
</tr>
</tbody>
</table>

\(\chi^2\)-test for comparison of non-pregnancy rate (61.82%) and positive pregnancy rate (73%) for Item 4: 4.34, \(P < 0.001\).
Another finding of note is that among women who reported an optimistic appraisal at the beginning of treatment, the rates of pregnancy were higher than those of non-pregnancy, whereas in women who viewed the situation negatively, the rates of pregnancy and non-pregnancy were statistically equivalent. These results are consistent with the findings of other authors who have highlighted the role of optimism and positive thinking with respect to fertility rates (Stoleru et al., 1993), as well as with the research showing that depression and anxiety may affect conception rates (Daniluk, 1988; Damti et al., 2008). Similarly, Gordon et al. (2002) and Nes and Segerstrom (2006) found that optimism, a positive view of life circumstances and the hope that things would go well were associated with better physical and mental health, and with lower levels of anxiety and depression.

In contrast to what was hypothesized, the coping typologies showed barely any association with the rate of successful pregnancy after IVF. The only important finding was that women with a coping style based on a high use of approach responses in conjunction with a low use of avoidance responses obtained higher pregnancy than non-pregnancy rates. In the remaining coping groups, the percentages of pregnancies and non-pregnancies were statistically equivalent.

Although, as far as we know, there are no studies relating coping typologies with the number of pregnancies after IVF, some research on coping and fertility (Demyttenaere et al., 1998; Bar-Hava et al., 2001; Panagopoulou et al., 2006; Rapoport-Hubschman et al., 2009) has stressed the positive role of active coping, palliative coping, ‘letting go’ coping and the reduction of the expression of negative emotions in the probability of getting pregnant. It is difficult to compare these findings with those of the present study because the authors did not simultaneously take into account the two broad dimensions of coping: approach and avoidance. Moreover, the different nomenclatures of coping strategies make comparisons difficult. Nevertheless, a literature review and the results of the present study stress three findings can be highlighted: first, the expression of negative emotions (which in part implies avoidance and emotion-focused coping) is associated with poorer pregnancy rates; secondly, active or approach coping is associated with increased pregnancy rates; and finally, the optimistic way in which women appraise and tackle infertility and IVF is associated with the increased pregnancy rates achieved.

The finding of an association between the psychological factors analysed and better outcomes after IVF suggests that assisted reproduction centres would do well to provide counselling services for women who begin treatment. Training in effective coping strategies and, especially, in a positive and non-threatening appraisal of the situation may lead not only to psychological benefits for patients (helping them towards a less traumatic experience of the long and invasive process to be undergone), but might also substantially increase the success rate of IVF, thereby optimizing both clinical and financial resources. The ability of psychological therapies to increase pregnancy rates among women with infertility problems has been noted by several studies (Tuschen-Caffier et al., 1999; Domar et al., 2000; Hosaka et al., 2002; De Liz and Strauss, 2005).

The current study has some limitations, the most significant being that the initial sample was reduced in size by dividing it into subcategories, which may affect the generalizability of the results obtained and increase type II error. The importance of the associations detected between positive appraisal and successful IVF treatment highlights the need for the study to be replicated with a larger sample. Likewise, it is now necessary to carry out further experimental studies with case-control designs that verify, not only in an associative way, whether pregnancy rates increase after psychological intervention. Another limitation is that it was impossible to analyse in depth the relationship between psychological variables and the bio-endocrine system of women undergoing IVF. This aspect requires further study.

Despite these limitations, the study has several strengths. The fact that the women’s appraisal and coping strategies were evaluated at the beginning of IVF, before knowing the results of the β-hCG test, makes the design of this study quasi-experimental and suggests predictive associations which merit further investigation using adequate statistical methods and sample sizes. The ease with which the appraisal of infertility and coping strategies can be detected, compared with the importance of being able to predict pregnancy outcomes, suggests that couples undergoing IVF should participate in brief psychological therapies to help them cope with the treatment and to optimize results.

Authors’ roles

All authors meet contributions: (i) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data, (ii) drafting the article or revising it critically for important intellectual content and (iii) final approval of the version to be published.

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