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ORIGINAL ARTICLE

# Patient perceptions and understanding of treatment instructions for ovarian stimulation during infertility treatment

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**Abstract** The impact of patient–physician communication and levels of understanding of treatment on patient knowledge and compliance has been studied in patients undergoing their first cycle of infertility treatment. This observational, real-life, longitudinal study involved 488 patients from 28 infertility centres in France. Data on communication quality, understanding of treatment instructions, patient knowledge and compliance to treatment protocol were collected through questionnaires administered before treatment initiation (V1) and at oocyte retrieval (V2). At V1, patients were very satisfied with their levels of understanding of the injection and monitoring schedules, the information given by the medical team, and the way of receiving instructions, with average ratings on a scale of 0–100% of >75%. They rated their understanding of possible treatment side-effects as satisfactory (average score 71.1%). Gaps in patient knowledge about their treatment, revealed by discrepancies between physician and patient reports, were observed in 20.5% of patients ($n$=79/386), and most commonly resulted from confusion about the units and dose of gonadotropin. Anxiety about performing self-injections and a lack of confidence in their ability to self-inject correctly were each observed in approximately one-third of patients. Patient self-assessment of compliance at V2 revealed that 27% of patients ($n$=83/305) did not comply with or had doubts about the injection schedule or dose injected. Meanwhile physicians reported high levels of patient

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compliance (94.3%; $n=350/371$). In conclusion, even when patient–physician relationships appear to be satisfactory, patient miscomprehension and non-compliance during infertility treatment may be underestimated. Further interventions are required to improve these outcomes.



**KEYWORDS:** assisted reproductive technology, IVF, gonadotropins, errors, patient understanding

## Introduction

Assisted reproductive technology (ART) treatments are expensive (Cassettari et al., 2016; Chambers et al., 2013) and are associated with a considerable physical and psychological burden for patients (Boivin et al., 2012; Domar et al., 2012; Gameiro et al., 2012; Rich and Domar, 2016). The psychological burden of infertility treatment is commonly associated with stress caused by relationship strain, and with anxiety and depression resulting from unsuccessful treatment (Domar et al., 2010, 2018). Treatment administration adds to the psychological burden for female patients and has an impact on their everyday activities (Boivin et al., 2012; Huisman et al., 2009; Mamata et al., 2015). Moreover, the physical burden from injection pain or the occurrence of adverse events, such as breast tenderness or pain at oocyte retrieval, can be considerable (Van den Broeck et al., 2009). In addition to cost, these emotional and physical treatment burdens lead to a significant proportion of couples discontinuing fertility treatment before achieving a pregnancy (Domar et al., 2018; Gameiro et al., 2012; Olivius et al., 2004; Rajkhowa et al., 2006; Van den Broeck et al., 2009). In a large cohort of 1391 couples in the Netherlands, approximately half dropped out before receiving any fertility treatment, and one-third of patients withdrew after one cycle of in-vitro fertilization (IVF) (Brandes et al., 2009).

Patient-centred care, good communication and a strong patient–healthcare provider relationship are essential for effective management of patients with infertility. These measures may also improve patient adherence to treatment schedules, reduce the physical and emotional burdens associated with treatment, and decrease the rates of treatment discontinuation (Dancet et al., 2011; Gameiro et al., 2013a). A cross-sectional study has shown that patient-centred care promotes well-being during treatment (Gameiro et al., 2013b). However, physician–patient communication during ART treatment is complex (Leone et al., 2018). Poor relationships and negative interactions with healthcare providers, together with a lack of information provision, coordination and continuity of care at ART centres, have all been cited as sources of stress and patient dissatisfaction with their ART centre (Haagen et al., 2008; Malin et al., 2001; van Empel et al., 2010). These factors increase the likelihood of patient misunderstandings and non-adherence to therapeutic protocols, and can lead to treatment discontinuation (Boivin et al., 2012; Gameiro et al., 2012; Huisman et al., 2009; Olivius et al., 2004; Rajkhowa et al., 2006). Despite initiatives to improve patient-centredness in fertility care, levels of patient-centred care reported in some studies remain unsatisfactory and there is still room for improvement (Huppelschoten et al., 2013; Leone et al., 2018).

The aim of this study was to evaluate patient–infertility care provider relationships and communication in ART centres in France, and investigate whether the quality of the care provided had an impact on patient adherence to treatment and monitoring protocols. We conducted an observational study to assess how patients undergoing their first cycle of infertility treatment perceived the quality of communication and information provided by healthcare professionals prior to the start of treatment and at the end of their first cycle. We also evaluated patient knowledge of their treatment, and assessed adherence to therapeutic and monitoring schedules from both patient and physician reports. Risk factors for poor adherence to protocols were also evaluated.

## Patients and methods

### Study design and setting

This non-interventional, descriptive, longitudinal study involved 37 physicians from 28 ART centres in France and took place between August 2013 and October 2015. This observational study did not affect the physicians' usual management of their patients, and the study was conducted through visits scheduled as part of the patients' usual care.

In accordance with French law, approval for the processing of personal data was obtained from the French data protection agency (Commission Nationale de l'Informatique et des Libertés). The study methodology was approved by the French advisory committee on information processing in healthcare research (Comité Consultatif sur le Traitement de l'Information en matière de Recherche dans le domaine de la Santé).

### Study participants

From the 34 centers who agreed to participate, 28 were active in the study. Physicians were instructed to enrol up to 18 consecutive patients. All patients received a letter explaining the objectives and the requirements of the study from their participating physicians. Women undergoing their first IVF or intracytoplasmic sperm injection attempt at a participating ART centre, who were able to fill in a questionnaire unaided, who were not participating in any other clinical trial and who agreed to participate in the study were eligible for inclusion. Those who had already received injections for infertility (i.e. those who had been

treated previously with follicle-stimulating hormone) were not included.

## Study outcomes and assessments

The main study outcomes were the level of patient understanding of the therapeutic protocol prescribed by the physician, and the quality of communication with the medical team before the start of treatment. Other outcomes assessed before the start of treatment were patient preferences and concerns over administering their treatment, and patient knowledge of their treatment before initiation. Adherence to prescribed protocols, according to the patient and to the physician, was evaluated at the end of the treatment cycle. The final outcome was to identify risk factors for non-compliance with the treatment schedules.

## Data sources and assessment methods

All data were collected using anonymized self-administered patient-specific and physician-specific questionnaires provided to all participants at Visit 1 (V1) before treatment initiation and at Visit 2 (V2) at oocyte retrieval. Data on the demographic and infertility characteristics of the patient were collected through the V1 questionnaires.

Data on patient understanding of their treatment and levels of satisfaction with communication before initiation of treatment were collected using the V1 patient questionnaire. The questionnaire asked patients to grade their understanding of injection schedules, monitoring schedules, possible treatment-related side-effects and methods that would be used to communicate instructions. The questionnaire also asked for patient opinions on the clarity of terms used by the medical team, how well the team answered the patient's questions, and the degree to which the treatment schedule considered the patient's personal needs. Grading was conducted using a 10-cm visual analogue scale (VAS) from 0% to 100%. Scores were classed as follows: <25, very unsatisfactory; 25–50, unsatisfactory; 50–75, satisfactory; and >75, very satisfactory. Patients were also asked in the V1 questionnaire to indicate whether they had received a written and oral detailed description of their treatment schedule at V1, and whether they had been offered and attended a treatment information meeting at their ART centre.

Patient preferences and concerns over administering their treatment were assessed using the V1 patient questionnaire in which patients were asked to provide details of their plans for administering their injections [i.e. person(s) and reasons for this choice, and the location where injections were planned to be administered].

Patient knowledge of their treatment was assessed by identifying discrepancies between the responses to questions in the V1 patient questionnaire concerning details of the planned treatment (drug class, name and dose) and the therapeutic strategy outlined by the physician in the V1 physician questionnaire.

At the end of treatment, patients were asked to record who performed the injections, and provide details and opinions on how information was communicated during treatment (VAS from 0 to 100%: <25%, very unsatisfactory; 25–50%, unsatisfactory; 50–75%, satisfactory; and >75%, very satisfactory). Physicians were also asked at V2 to use the same VAS scale system to grade their impressions of the patient's understanding of the treatment schedule and their relationship with the patient.

Adherence to treatment and monitoring schedules was assessed by asking patients and physicians to report any deviations from the planned therapeutic schedule (alterations to treatment or monitoring schedules) in the V2 questionnaires. Poor compliance was determined by the physician as a patient who missed at least one treatment administration or follow-up examination, or who did not respect the treatment dose, or treatment or follow-up schedule on at least one occasion.

Risk factors for non-compliance were evaluated by comparing the following parameters between patients with poor compliance and those with good compliance: age, education level, number of children at home, socioprofessional category, professional activity, ovarian reserve, type of infertility, duration of infertility, indication for ART, detailed programme of treatment, briefing proposed by the centre, patient participation in briefing and pain at injection.

## Sample size

Sample size was calculated using the following formula:

$$n = \frac{p(1-p)\varepsilon^2}{i^2}$$

where $n$ was the number of subjects needed, $p$ was the expected percentage of the population with the parameters being assessed, $\varepsilon$ was equal to 1.96 for an $\alpha$ risk of 5%, and $i$ was the acceptable margin of error for the expected percentage.

Taking into account the multiplicity of the parameters studied, the value of $p$ differed for each of the study parameters and was fixed at 50% in order to obtain a maximum variance [$p$ x (1-$p$)]. A margin of error of 10% for $p$ was chosen, corresponding to an $i$ value of 5%. The number of patients required to confirm a value of $p$ equal to 50% with a 95% confidence interval (CI) and an accuracy of ±5% was 385, rounded up to 390.

## Statistical methods

Data are presented as the number and percentage of patients providing a response in the questionnaires, as the mean and standard deviation, or as the median and 95% CI. All statistical analyses were performed using SAS Version 9.1 (SAS Institute, Cary, NC, USA) at a confidence level of 95%.

All analyses were performed on the full analysis set (FAS) population. Univariate analysis was performed using Chi-squared test or Fisher's exact test for nominal qualitative variables; Wilcoxon test for ordinal variables; and an analysis of variance or Wilcoxon test for quantitative variables. Multivariate analysis was performed using all variables that were found to be significant at the 0.20 level in the univariate statistical test as potential exploratory variables. Variables were selected using a stepwise procedure with an entrance significance level of 20% and a removal significance level of 5%.

## Results

### Participants

Participant flow through the study is shown in Fig. 1. In total, 502 women were recruited, but eligibility criteria were not met in 14 patients. The remaining 488 patients were included in the study, forming the FAS population.

Physicians completed the questionnaire provided before the start of treatment (V1) for all patients in the FAS population, whereas the questionnaire provided at the oocyte retrieval visit (V2) or last control examination was completed for 451 patients (92%). In total, 386 patients (79%) completed the V1 patient questionnaire and 305 patients (63%) completed the V2 patient questionnaire. The V2 questionnaires were completed at the last monitoring visit, rather than at oocyte retrieval, for 73 patients due to cancellation of the cycle. Reasons for cancellation of the cycle were a lack of response to treatment ($n$=37), medication error ($n$=9), hyperstimulation ($n$=5), mistiming of the ovulatory peak ($n$=4), pregnancy ($n$=4) or other ($n$=14).

### Baseline characteristics

The demographic and infertility characteristics of the FAS population are shown in Table 1. Primary infertility was the most common type of infertility, present in 394 cases (80.7% of patients). Male factor infertility alone, reported in 51% of couples, was the most common cause of infertility.

The most frequent protocol prescribed by physicians was a gonadotropin antagonist with an oestrogen or combined oestrogen and progesterone pretreatment (44.9% of patients). All patients were prescribed gonadotrophin for ovarian stimulation, and 90.8% of patients were prescribed gonadotrophin for final oocyte maturation (Table 2). Planned monitoring examinations included hormone tests and pelvic scans (Table 2).

### Patient understanding of the treatment schedule and levels of satisfaction with communication at V1

The majority of patients (93.9%; $n$=351/374) reported that they had received a detailed description of the treatment schedule at V1, and 63.2% ($n$=122/193) of patients indicated that they had attended a treatment information briefing at

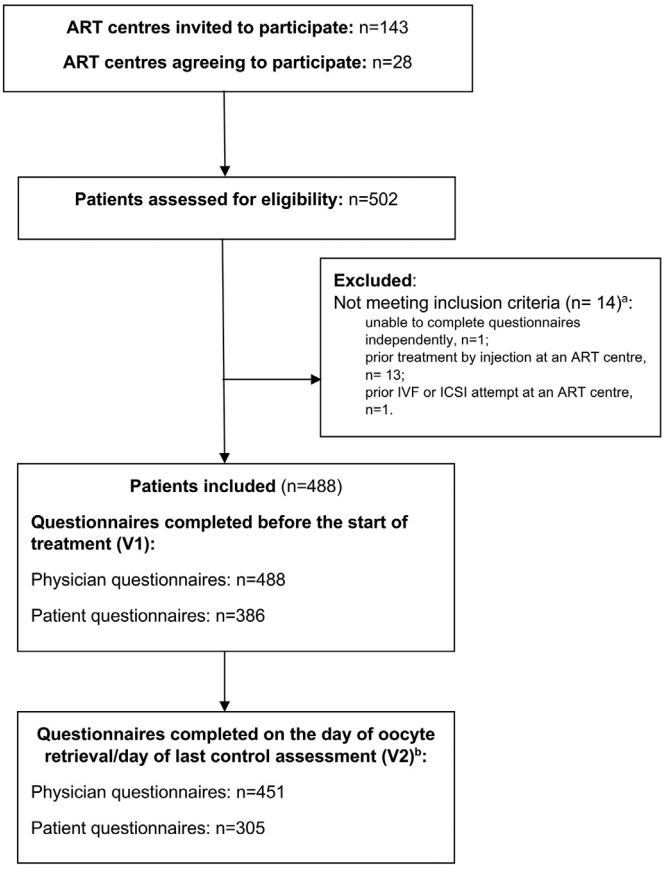


**Fig. 1** Participant flow through the study. Participants were asked to complete questionnaires before the start of treatment for their first in-vitro fertilization (IVF) cycle (V1) and on the day of oocyte retrieval (V2). [a]One patient had two reasons for being excluded. [b]If the cycle was cancelled, participants were asked to complete the questionnaires at the last control visit. ART, assisted reproductive technology; ICSI, intracytoplasmic sperm injection.

**Table 1** Patient demographics and infertility characteristics at baseline.

| Demographics | FAS |
|---|---|
| Age (years), | *n* = 488 |
| Mean ± SD | 32.1 (5.0) |
| Age group (years), *n* (%) | *n* = 488 |
| ≤ 30 | 197 (40.4) |
| 30–35 | 132 (27.0) |
| 35–40 | 116 (23.8) |
| ≥ 40 | 43 (8.8) |
| Education [a], *n* (%) | *n* = 383 |
| University degree or higher | 244 (63.7) |
| A levels | 84 (21.9) |
| National vocational qualification (BEP/CAP + college) | 41 (10.7) |
| Secondary education (GCSE) | 14 (3.7) |
| Employment, *n* (%) | *n* = 320 |
| Full time | 281 (87.8) |
| Part time | 39 (12.2) |
| Infertility characteristics | |
| Ovarian reserve estimated by the physician, *n* (%) | *n* = 485 |
| High | 104 (21.4) |
| Normal | 229 (47.2) |
| Low | 152 (31.3) |
| Type of infertility, *n* (%) | *n* = 488 |
| Primary | 394 (80.7) |
| Secondary | 94 (19.3) |
| Duration of infertility (years) | *n* = 488 |
| Mean ± SD | 2.9 ± 1.7 |
| Median [95% CI] | 2 [2.8–3.1] |
| Duration of infertility (years), *n* (%) | *n* = 488 |
| 1–2 | 263 (53.9) |
| 3–4 | 148 (30.3) |
| ≥ 5 | 77 (15.8) |
| Time from first consultation for infertility to inclusion (months) | *n* = 488 |
| Mean ± SD | 14.2 ± 16.5 |
| Median [95% CI] | 8.7 [12.7–15.7] |
| Indication for ART, *n* (%) | *n* = 488 |
| Male factor | 249 (51.0) |
| Endometriosis | 69 (14.1) |
| Tubal disorder | 73 (15.0) |
| Ovulatory disorder [b] | 46 (9.4) |
| Idiopathic | 31 (6.4) |
| PCOS | 7 (1.4) |
| Other | 6 (1.2) |
| Two indications or more [c] | 7 (1.4) |

ART, assisted reproductive technology; CI, confidence interval; FAS, full analysis set; SD, standard deviation; PCOS, polycystic ovarian syndrome, IVF, in-vitro fertilization, ICSI, intracytoplasmic sperm injection, *n*, number of patients for which data were available.

[a] Education levels are approximate equivalents between the French and British education systems: A levels equivalent to the French Bachelorette, national vocational qualifications equivalent to BEP/CAP, and GCSEs equivalent to a college diploma.

[b] Excluding PCOS.

[c] Patients with at least two indications for ART included those with a male factor and tubal disorder, a male factor and PCOS, and a male factor and an ovulatory disorder excluding PCOS.

their centre. Patients graded their understanding of the injection schedule, the examination schedule and the method of communicating instructions as very satisfactory, with mean VAS scores of >75% (Fig. 2). Patients felt that their understanding of any possible side-effects was satisfactory. Their understanding of the terms used by the

**Table 2** Prescribed therapeutic management strategies and patient plans for administering these treatments.

| Treatment prescribed by the physician at V1 | *N*=488<br>*n* (%) |
|---|---|
| ART type | *n*=488 |
| IVF | 196 (40.2) |
| IVF and ICSI | 38 (7.8) |
| ICSI | 254 (52) |
| Agonist/antagonist protocol | *n*=488 |
| Daily long-term GnRH agonist | 113 (23.2) |
| Long-term GnRH agonist with sustained release | 82 (16.8) |
| Daily short-term GnRH agonist without oestrogen or combined oestrogen and progesterone pretreatment | 7 (1.4) |
| Daily short-term GnRH agonist with oestrogen or combined oestrogen and progesterone pretreatment | 10 (2.0) |
| GnRH antagonist without oestrogen or combined oestrogen and progesterone pretreatment | 57 (11.7) |
| GnRH antagonist with oestrogen or combined oestrogen and progesterone pretreatment | 219 (44.9) |
| Method of agonist administration | *n*=186 |
| Intramuscular | 67 (36.0) |
| Subcutaneous | 57 (30.6) |
| Nasal | 62 (33.3) |
| Gonadotrophin for ovarian stimulation | 488 (100) |
| Method of administration | *n*=488 |
| Syringe | 93 (19.1) |
| Pen run | 395 (80.9) |
| Gonadotrophin for final oocyte maturation [a] | 442 (90.8) |
| Method of administration | *n*=441 |
| Syringe | 67 (15.2) |
| Pen run | 374 (84.8) |
| Prescribed monitoring examinations at V1 | *N*=488<br>Mean ± SD |
| Hormonal tests | |
| No. of days after the beginning of stimulation before first test | 5.3 ± 2.0 |
| No. of tests planned | 3.4 ± 1.1 |
| Pelvic scans | |
| No. of days after the beginning of stimulation before first scan | 5.75 ± 2.1 |
| No. of scans planned | 3.1 ± 1.0 |

V1, Visit 1 (before treatment initiation); GnRH, gonadotropin-releasing hormone; IVF, in-vitro fertilization; ICSI, intracytoplasmic sperm injection; FAS, full analysis set; SD, standard deviation; *N*, number of included patients; *n*, number of patients for whom data were recorded.

[a] Data were recorded for 487 patients.

physician and answers given by the medical team were considered very satisfactory (VAS scores >75%; Fig. 2).

## Patient preferences and concerns over administering their treatment at V1

At V1, the large majority of patients (92.7%; *n*=357/385) planned to administer their injections at home, and to either administer their injections themselves (39.2%, *n*=151/385) or have their injections administered by a nurse (33.5%, *n*=129/385). For almost half of the patients (43.5%; *n*=161/370), patient autonomy was cited as the reason given for the choice of person planned to perform the injections. Anxiety about performing a self-injection was frequently reported by patients (35.7%; *n*=132/370), as well as a lack of confidence in being able to self-inject correctly (27.3%; *n*=101/370).

## Discrepancies between prescribed and patient-reported treatments at V1

Discrepancies between the treatments prescribed by the physician and treatment information reported by the patient were observed for 20.5% of the patients who responded in the V1 patient questionnaire (*n*=79/386; Fig. 3). The most commonly observed discrepancies (38%; *n*=30/79) resulted from confusion about the units of the prescribed gonadotropin treatment (international units, milligrams or micrograms). Some patients also inaccurately reported the dose of gonadotrophin prescribed for stimulation and maturation,

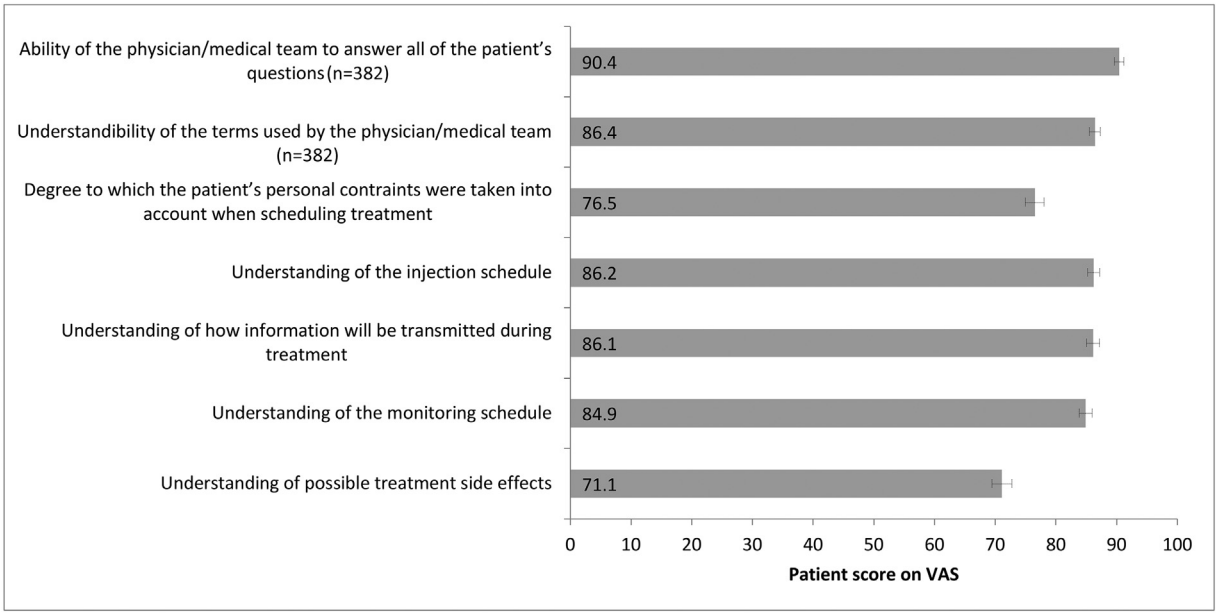


**Fig. 2** Patient understanding and perceptions of the quality of the physician–patient communications assessed at Visit 1 before the start of treatment. Grading was conducted using a visual analogue scale (VAS) from 0% (very unsatisfactory) to 100% (very satisfied). Data presented are the mean VAS scores, and bars represent the standard error.

and the names of the treatment they had been prescribed (Fig. 3).

## Physician-reported treatment and follow-up schedules at V2

The treatment and monitoring schedules reported by the physicians in the V2 questionnaire are provided as online supplementary information (Table A.1). The mean time between the two visits was 1.6 months. Compared with the planned treatment regimen, there was, on average, less than one change (0.8±1.2) in gonadotropin daily dose prescribed during the course of treatment. Additional hormonal tests were performed in 38.3% of cases and additional pelvic scans were performed in 30.5% of patients. Physicians rated patient understanding of their treatment and the quality of their relationship with the patient as very satisfactory, with mean VAS scores of 90.9±14.37 and 89.7±14.48, respectively.

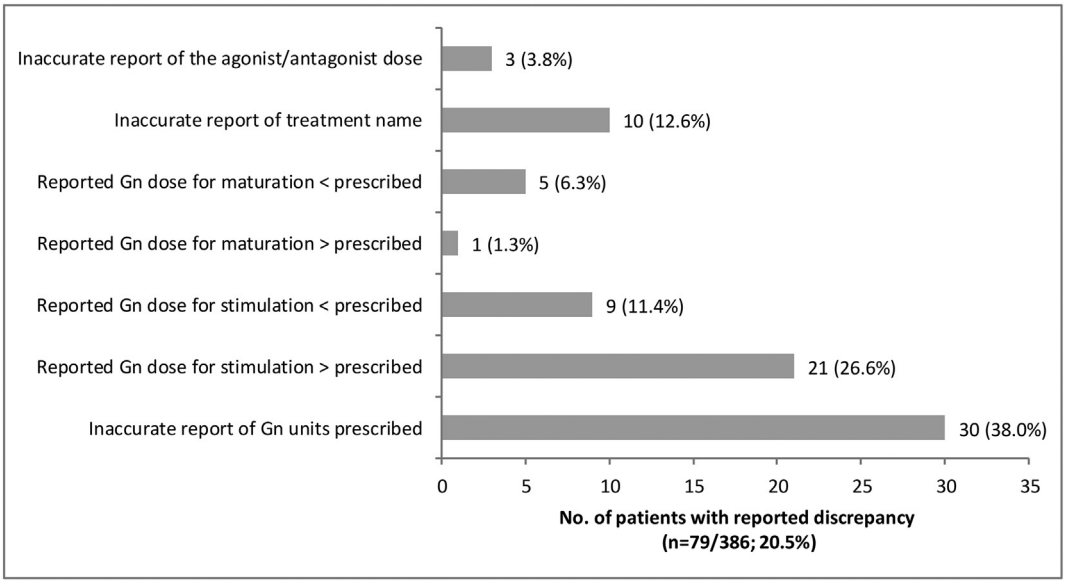


**Fig. 3** Discrepancies between physician-prescribed and patient-reported treatment information at Visit 1 before the start of treatment. Gn, gonadotropin.

**Table 3** Deviations from the treatment and monitoring schedules at Visit 2 (V2, oocyte retrieval).

| Patient doubts and deviations from the treatment schedule | *N* = 305<br>*n* (%) |
|---|---|
| Overall *n* (%) of patients with doubts and deviations from the treatment schedule | 83 (27.7) |
| Injection schedule oversights | *n* = 303 |
| Yes | 5 (1.7) |
| No | 298 (98.3) |
| Number of injections missed | *n* = 3 |
| 1 | 3 (100) |
| Injection schedule not respected | *n* = 299 |
| Yes | 34 (11.4) |
| No | 265 (88.6) |
| Number of injection schedule errors | *n* = 34 |
| 1 | 26 (76.4) |
| 2 | 6 (17.6) |
| 3 | 2 (5.9) |
| Doubts about the injection dose | *n* = 302 |
| Yes | 41 (13.6) |
| No | 261 (86.4) |
| Number of times patients had doubts about an injection dose | *n* = 38 |
| 1 | 29 (76.3) |
| 2 | 5 (13.2) |
| 3 | 2 (5.3) |
| 4 | 1 (2.6) |
| More than once | 1 (2.6) |
| Injection dose error | *n* = 300 |
| Yes | 3 (1.0) |
| No | 297 (99) |
| Patient-reported deviations from monitoring schedules | *N* = 305<br>*n* (%) |
| Overall *n* (%) of patients with deviations from monitoring schedules | 10 (3.3) |
| Monitoring examination oversights | *n* = 303 |
| Yes | 7 (2.3) |
| No | 296 (97.7) |
| Number of monitoring examinations missed | *n* = 4 |
| 1 | 4 (100) |
| Monitoring examination schedule not respected | *n* = 303 |
| Yes | 3 (1.0) |
| No | 300 (99) |
| Physician-reported deviations from treatment and monitoring schedules [a] | *N* = 371<br>*n* (%) |
| Overall *n* (%) of patients with physician-reported deviations from treatment and monitoring schedules [a] | 21 (5.7) |
| At least one treatment administration not performed | 3 (0.8) |
| Treatment schedule not respected on at least one occasion | 6 (1.6) |
| Treatment dose not respected on at least one occasion | 4 (1.1) |
| At least one monitoring examination not performed/not performed on schedule | 5 (1.3) |
| At least one request to alter the timing of a monitoring appointment | 10 (2.7) |

*N*, number of patients/physicians that returned the V2 questionnaire; *n*, number of patients for whom data were available.
[a] Physicians may have reported more than one type of deviation per patient.

### Patient-reported methods of treatment administration and communication at V2

When questioned about administration of their treatment, nearly half of the patients (43.9%; $n=133/303$) reported administering their injections themselves, and 70.1% of the patients ($n=211/301$) reported experiencing pain as a result of the injections.

Over the course of their treatment, patients reported that instructions about their treatment were most often transmitted by telephone by the physician (68%; $n=168/247$) or during a visit to the centre (51%; $n=126/247$). The average VAS score given for overall satisfaction with the way in which information was transmitted during treatment was 85.4 (±17.6), indicating that most patients were very satisfied with the mode of communication. Over half of the patients rated the information provided during treatment as totally comprehensible (57.8%; $n=175/303$).

### Patient-reported deviations from treatment and monitoring schedules at V2

Deviations from injection schedules reported by patients at V2 included non-compliance with the injection schedule in 11.4% of patients and injection schedule oversights in 1.7% of patients (Table 3). For patients who provided further information, the oversights involved missing a single injection (Table 3). In addition, 13.6% of patients reported having doubts about the dose of the treatment they were injecting (Table 3). Patient-reported deviations from the monitoring examination schedule were infrequent. Oversights and non-compliance with the examination schedule were reported in 2.3% and 1% of patients, respectively (Table 3). For patients who provided further information, the oversights involved forgetting a single monitoring examination (Table 3).

### Physician-reported deviations from treatment and monitoring schedules

At V2, physicians considered that adherence to treatment was good for 94.3% of patients. The schedule and dosage of administered treatments were not respected at least once in 1.6% and 1.1% of patients, respectively (Table 3).

### Risk factors for poor compliance

A univariate analysis showed that poor compliance with overall treatment and monitoring protocol was associated with poor understanding at V1 of the mode of communication of instructions that would be used by the medical team during treatment ($p=0.0326$). However, this was no longer significant after multivariate analysis.

## Discussion

This multicentre, longitudinal, observational study, conducted in 28 ART centres across France, provided new information about patient perceptions of communication, and patient understanding of and expectations about treatment instructions during their first IVF cycle. Communication and information have been identified by patients as priority dimensions for the provision of patient-centred care (Dancet et al., 2011), with poor communication being noted as a major cause of dissatisfaction amongst patients (Boivin et al., 2012; Gameiro et al., 2012; Leone et al., 2018). Better treatment-related information, improved communication, and establishing trustworthy and stable patient–fertility care provider relationships are key factors for optimizing infertility care and promoting patient well-being (Dancet et al., 2010; Gameiro et al., 2013a). Patients who returned the V1 and V2 questionnaires revealed high levels of satisfaction with communication methods, and the information provided before treatment initiation and during therapy. These patients also felt that they had a very satisfactory understanding of their treatment and monitoring schedules before the initiation of therapy. Although reported levels of satisfaction were still classed as high, the lowest score for understanding was attributed to information concerning treatment side-effects. Further improvements to the information provided on this issue are required. Side-effects of treatment are a major concern for patients, and questions related to the risk of side-effects have been reported to be the most common questions posed by patients regarding the use of infertility treatments (Domar et al., 2012; Huisman et al., 2009). Some previous studies have reported discrepancies between patient and physician evaluations of patient-centred infertility care (Aarts et al., 2011; van Empel et al., 2011). The physicians participating in this study also viewed patient understanding of treatment and the quality of the relationship with the patient to be very satisfactory.

Our evaluation of patient and physician reports of the planned therapeutic strategy before initiation uncovered significant gaps in patient knowledge about their treatment, and showed that the information provided failed to relieve concerns surrounding self-administration of injections in some patients. Around one-fifth of the patients in this study were unable to provide accurate details of their treatment, with misunderstandings concerning the units and dose of gonadotropin being particularly common. Around one-third of patients reported feeling anxious about performing injections, and were concerned about performing injections correctly. This study and previous reports indicate that self-injection is important for providing patients with a sense of autonomy during treatment (Sedbon et al., 2006). However, our findings also show that self-administered gonadotropin injections contribute to the psychological burden of treatment. These results are consistent with the observations of Huisman et al. (2009) from their multicentre interview-based study, in which 57% of patients reported being worried about the injection process despite receiving training and detailed explanations about the procedure (Huisman et al., 2009). Domar et al. (2012) revealed similar findings from their cross-sectional online quantitative study, where 44% of the participants reported being anxious about self-administering their injections or having their injections administered by a partner (Domar et al., 2012).

A lack of patient knowledge before the start of treatment likely contributed to the deviations from the injection schedule and doubts about the injection dose being reported

by 27.7% of patients during their treatment. In contrast, physician-reported deviations from the injection schedule were reported in only 3.5% of patients. Thus, our findings suggest that patient errors during treatment are more common than expected. Indeed, a previous study found that 45% of patients made or suspected making some form of error whilst self-administering their injections, and that 29% of these patients did not report their mistake to their healthcare provider (Huisman et al., 2009). Worries about having made a treatment error may also add to the psychological stress associated with treatment. In addition, the prevalence of patient errors during treatment is a major concern for healthcare providers. Huisman et al. (2009) found that 47% of fertility healthcare professionals were concerned about patients injecting themselves correctly and 26% had concerns about patient compliance (Huisman et al., 2009).

It is well known that clinical factors – including age, duration of infertility, and presence of ovarian and tubal issues – can predict treatment success (Zarinara et al., 2016). No clear sociodemographic predictive factors (e.g. age, level of education, socioprofessional category, number of children or type of infertility) were identified in our study as affecting adherence. However, our analysis was limited by the small number (<6%) of poorly adherent patients reported in our study, and further evaluation of these factors, on a significantly larger cohort of patients, will be required to confirm these results.

One of the main strengths of this study is that it provides some insight into how patients and physicians perceive fertility management to be carried out in real life. Also, the population evaluated was highly homogeneous in terms of the stage of infertility treatment being administered, with all patients included undergoing their first cycle of infertility treatment. However, this study has several limitations. Selection bias is a possible limitation of this study. Only 34 of the 143 centres contacted agreed to participate in the study. Thus the sample of physicians was not selected at random and only physicians volunteering to participate were included. These physicians may have had a particular interest in communication and forming good patient–healthcare provider relationships. The open and observational design could also have affected physician behaviour. In particular, physicians may have been more attentive to their patients' needs as they were aware they were being studied and that patients were expected to provide feedback about their care. In addition to self-reported perceptions by patients being inherently subjective, the findings of this study are also limited by the fact that only responses of patients that returned the questionnaires could be assessed. Although approximately 80% of patients returned the V1 questionnaire, only 63% of patients returned the V2 questionnaire. No comparative assessments of the characteristics of patients who failed to complete the questionnaires were conducted. Although high levels of satisfaction were reported by the patients who returned the questionnaires, patients who did not respond may have been less satisfied with their treatment experience. As suggested by Van den Broeck et al. (2009), the physiological burden of treatment may have been greater amongst the non-responders. The 37% of patients who did not complete the questionnaires in our study may also have been less satisfied with the quality of the patient–healthcare provider relationship, and actual levels of patient satisfaction may be lower than those reported. However, the response rate to the V2 questionnaire observed in our study was similar to that observed in a recent study on communication by Leone et al. (2018). Finally, it should be noted that this study was conducted from 2013 to 2015. Since the end of this study, several changes have been made to infertility treatment regimens and communication strategies, such as administration of a depot gonadotropin-releasing hormone agonist and the increased use of medication reminders and smartphone apps. These recent developments have likely led to improvements in patient comfort during treatment, and reduced, but not eliminated, the risk of treatment administration errors.

Despite these limitations, our results show that non-compliance with treatment schedules and stress caused by doubts over correct dosing and self-injecting occurred in the French ART centres included in our study and were underestimated by physicians. Our findings indicate that further measures are required to improve patient knowledge, and address the physical and psychological burdens associated with complex ART regimens. Further improvements in communication and the information provided are also required. Recent developments, such as using electronic reminders or smartphone medication adherence apps (Dayer et al., 2013; Vervloet et al., 2012), have likely helped improve communication but will not eliminate all potential mistakes. Individualizing treatment regimens (Nardo et al., 2011) and simplifying protocols by using long-acting treatments (Pouwer et al., 2016) may also facilitate reduction of the treatment burden and enhance adherence. Clinicians should improve patient care, beginning with communication to them.

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