

A physician-nurse partnership *via* online healthcare platforms protects infertile women from anxiety and depression: A multi-center prospective study from Shanghai, China

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Abstract: Effective health interventions are a priority for future infertility research, and effective interventions in patient-centered care are still needed. A multi-center prospective study was conducted in order to investigate the effects of a physician-nurse partnership (patients receive guidance and health education *via* online healthcare platforms) on depression and anxiety disorders in infertile women. The women were randomly assigned to a physician-nurse partnership group ($n = 90$) or a routine treatment group ($n = 90$). The primary endpoints were self-rating anxiety scale and self-rating depression scale scores. This study also examined the waiting time as an outpatient and the frequency of using online medical platforms. Compared to the routine treatment group, scores on the self-rating anxiety scale (48.4) and the self-rating depression scale (48.0) were significantly lower in the physician-nurse partnership group ($p = 0.004$, $p = 0.001$). Moreover, the mean waiting time (3.4) was shorter and online platforms (6.1) were used more frequently in the physician-nurse partnership group than in the routine treatment group ($p < 0.001$, $p < 0.001$). These data suggest that a physician-nurse partnership could reduce patients' anxiety, depression, and their waiting time as an outpatient.

Keywords: physician-nurse partnership, infertility, depression, anxiety, waiting time

Introduction

A woman is considered infertile when she fails to conceive after at least 12 uninterrupted months of unprotected sexual activity (1). Research has increasingly indicated that the most common causes of infertility, such as polycystic ovary syndrome, endometriosis, fibroids, and diminished ovarian reserve, may lead to chronic morbidity later in life (2). These couples have been burdened with a heavy financial and mental toll, as well as a major expenditure of time spent on care, posing various challenges for the healthcare system (3).

Anxiety and depression are highly prevalent in infertile patients and their partners (4), and their distress could adversely impact themselves, their family, and their healthcare team. The specific impacts of anxiety and depression on infertile women are: *i*) symptoms of anxiety or depression are often characterized as the most upsetting experience in their lives (5); *ii*)

patients suffering from psychological distress are more likely to lose confidence and terminate treatment; *iii*) the prevalence of psychological distress may lead to lower pregnancy rates; and *iv*) they pose additional challenges for the healthcare team. As the demands on the healthcare system continue to grow, delayed access to treatment, increased healthcare costs, and poor clinical outcomes lead to patient dissatisfaction, misunderstanding, and anxiety (6).¹

The goal of infertility treatment is to maximize the chances of infertile women becoming mothers, and much needs to be done (7). A physician-nurse partnership is characterized by open communication, respect, and trust, as well as shared decision-making (8). An effective physician-nurse partnership can improve the quality of care, patient outcomes, and satisfaction among nurses and physicians and also decrease the cost of healthcare (9). Recent advances in information technology, such as the Internet, have revolutionized access to health information. Patients can use the

Internet to access a wide range of information and obtain support. Use of online systems also minimized face-to-face support during the COVID-19 pandemic (10).

The current study was designed as a multi-center prospective study to assess if a physician-nurse partnership benefits infertile patients who opted to receive assisted reproductive treatment. Scores on a self-rating anxiety scale (SAS) and a self-rating depression scale (SDS) were used as the primary endpoint to assess the patients' anxiety and depression. In addition, data on time spent as an outpatient and the frequency of using online platforms were collected in accordance with the hypothesis that a physician-nurse partnership could reduce patients' anxiety and depression and be associated with a favorable outcome.

Study design and data collection

Study design

This study was a multi-center prospective study conducted from January 2018 to December 2021 at the Obstetrics and Gynecology Hospital of Fudan University and Shanghai Ninth People's Hospital. Informed consent was obtained, and all patients agreed to participate in this study. The study subjects were married females (24-40 years of age) who failed to conceive regularly for more than one year during unprotected sexual intercourse and who opted to receive assisted reproductive treatment. Women who violated the protocol of this study or who refused to continue treatment were excluded. Male infertility was excluded from this study. This study was conducted in accordance with the Declaration of Helsinki, and it was approved by the Ethics Committee of Obstetrics and

Gynecology Hospital of Fudan University (2019-57).

Subjects

One hundred and eighty patients who had provided informed consent in writing were randomly assigned to a physician-nurse partnership group ($n = 90$) or a routine treatment group ($n = 90$) between January 1, 2018, and December 31, 2021. All of the subjects (180, 100%) completed the study, and no patients were excluded from the efficacy analysis. Patients' mean age, body mass index (BMI), duration of infertility, history of smoking, obstetric history, and one's reason for opting to receive assisted reproductive treatment were noted (Table 1).

Procedures

In the physician-nurse partnership group, patients received guidance and health education *via* online healthcare platforms (including the Haodf app, WeChat app, or Xingren doctor app). As part of the physician-nurse partnership: *i*) patients who opt to receive assisted reproductive treatment are required to register with at least one of the online healthcare apps and to upload their medical records, *ii*) a nurse creates medical records for the patient, *iii*) a physician makes an appointment with the patient after reviewing records uploaded to the online platform and the physician then conducts a further examination, he or she makes a diagnosis, and he or she prescribes medication, *iv*) the physician conducts an in-person assessment of follicular development *via* transvaginal ultrasonography in which the nurse participates, and *v*) the physician and nurse answer patients' questions weekly on the platform and provide education about common problems to enhance

Table 1. Baseline characteristics of infertile patients

Variables	Total ($n = 180$)	Routine treatment group ($n = 90$)	Physician-nurse partnership group ($n = 90$)	<i>p</i>
Age, years, mean (SD)	33.0 (4.2)	32.8 (4.3)	33.0 (4.0)	0.695
BMI, kg/m ² , mean (SD)	21.6 (2.4)	21.7 (2.4)	21.6 (2.5)	0.781
Duration of infertility, years, mean (SD)	2.8 (1.8)	2.7 (2.0)	3.0 (1.5)	0.198
History of smoking, <i>n</i> (%)	85 (47.2)	52 (57.8)	49 (54.4)	0.652
Prior pregnancy outcomes, <i>n</i> (%)	-	-	-	-
Full-term pregnancy	13 (7.2)	4 (4.4)	9 (10.0)	0.150
Preterm pregnancy	5 (2.8)	3 (3.3)	2 (2.2)	0.650
Biochemical pregnancy	20 (11.11)	13 (14.4)	7 (7.8)	0.155
Spontaneous abortion	27 (15.0)	16 (17.8)	11 (12.2)	0.297
No pregnancy	115 (63.8)	54 (60)	61 (67.7)	0.277
Reason for opting to receive assisted reproductive treatment, <i>n</i> (%)	-	-	-	-
Diminished ovarian reserve	37 (20.5)	18 (20.0)	19 (21.1)	0.854
Endometriosis	14 (7.8)	8 (8.9)	6 (6.7)	0.310
Polycystic ovary syndrome	14 (7.8)	5 (5.5)	9 (10.0)	1.239
Uterine leiomyoma	31 (17.2)	15 (16.7)	16 (17.8)	0.844
Unexplained infertility	84 (46.7)	44 (48.9)	40 (44.4)	0.357

BMI: body mass index.

Table 2. Comparison of anxiety and depression assessments, the waiting time as an outpatient, and the frequency of using online platforms

Variables	Total (n = 180)			Routine treatment group (n = 90)			Physician-nurse partnership group (n = 90)			p
	Before	After	p	Before	After	p	Before	After	p	
Anxiety and depression assessments										
SAS score [†]	54.1 (6.7)	50.6 (4.6)	< 0.001	54.0 (6.4)	52.7 (4.3)	0.307	54.1 (7.0)	48.4 (4.0)	< 0.001	0.004
SDS score [†]	54.9 (7.2)	50.8 (4.7)	< 0.001	54.9 (7.2)	53.7 (3.0)	0.047	54.8 (7.1)	48.0 (4.3)	< 0.001	0.001
The waiting time as an outpatient										
Waiting time	-	4.0 (1.1)	-	-	4.6 (1.1)	-	-	3.4 (0.9)	-	< 0.001
The frequency of using online platforms										
Times	-	4.2 (2.0)	-	-	2.5 (0.7)	-	-	6.1 (0.9)	-	< 0.001

Data are expressed as the mean (SD). SAS: self-rating anxiety scale; SDS: self-rating depression scale. [†]Scores range from 25 to 100, with higher scores indicating greater severity.

communication between patients and the physician and nurse.

In the routine treatment group, patients seek to receive treatment conventionally: *i*) a patient who opts to receive assisted reproductive treatment makes an appointment offline or online, *ii*) a nurse creates medical records for the patient, *iii*) a physician conducts a further examination, he or she makes a diagnosis, and he or she prescribes medication, *iv*) the physician conducts an in-person assessment of follicular development *via* transvaginal ultrasonography, and *v*) the patients is verbally instructed during the process.

Outcome measures

As per the study schedule, effectiveness outcomes were evaluated after two weeks. The primary outcomes were the SAS and SDS scores, which were used to assess anxiety and depression (11). Both the SAS and SDS have 20 items, each of which was scored on a scale of 1-4 points. The SAS and SDS scores are 1.25 times the total raw scores. The overall severity is assessed on a scale of 25 to 100, where higher scores indicate greater severity. Secondary outcomes were the waiting time as an outpatient and the frequency of using online platforms. All adverse events were recorded during the study. With the nurse's help, all of the patients completed visits in person or by telephone.

Statistical analysis

Data were expressed as the mean \pm standard deviation (SD). Statistical analyses were performed using the software SPSS 23.0. Differences between the two groups were compared using the Mann-Whitney *U* test. A paired *t*-test was used to compare the results in each group to the baseline indicators, including age, BMI, and duration of infertility. The chi-square test was used to compare the history of smoking. $P < 0.05$ was considered statistically significant.

Creation of a physician-nurse partnership *via* online healthcare platforms for infertile women

A physician-nurse partnership decreased anxiety and depression scores

There is increasing evidence that depression and anxiety are highly prevalent among infertile women (12). Thus, more attention needs to be paid to them and they need to be helped to overcome their psychological problems. Communication is essential in relationships and is highly correlated with better patient adherence to medical care. Patient-nurse, patient-physician, and physician-nurse communications are essential parts of the physician-nurse partnership and significantly impact patient outcomes (13). Since communication skills are one of the core requirements of doctors' and nurses' competency, practical strategies are highly recommended (14). Here, an effective physician-nurse partnership was put into practice and communication among patients, physicians, and nurses was enhanced, providing patients with a full understanding of their physical and mental condition. Results indicated that SAS and SDS scores for the physician-nurse partnership group decreased significantly compared to scores for the routine treatment group (Table 2), indicating that the physician-nurse partnership alleviated anxiety and depression in infertile patients.

A physician-nurse partnership reduced the waiting time as an outpatient and increased the frequency of using online platforms

Waiting time is a notable phenomenon in publicly funded healthcare systems (15). The process from registration, waiting, examination, and receiving a diagnosis to received medication usually takes several hours. Fertility is very time-sensitive because one of the most significant factors affecting the success of assisted reproductive treatment is a female's age. Time

spent waiting for treatment is detrimental for these patients. Reducing the waiting time as an outpatient may reduce the time required for treatment. Approaches can be adopted by clinical services to reduce patients' waiting time (16). Online resources are commonly used by patients to understand illnesses better and to obtain advice from physicians, thus improving the patient-physician relationship (17). In the current study, online healthcare platforms, including the Haodf app, WeChat app, and Xingren doctor app, were accessible to patients, allowing patients to register with these platforms and to understand their care. Patients can consult with medical personnel *via* these online healthcare platforms. The waiting time for healthcare was reduced, and patients chose to use the online healthcare platforms once they were informed of their benefits. The platforms helped to provide regular feedback to patients, physicians, and nurses. Use of online platforms, such as medical applications (apps) or WeChat, was recommended to patients, and the frequency of their use of online platforms during the study was determined. Online platforms were used more often by the physician-nurse partnership group than by the routine treatment group (Table 2).

Effective health interventions are a priority for future infertility research, and effective interventions in patient-centered care are still needed (18). In conclusion, an effective physician-nurse partnership was put into practice, *via* online platforms, and this approach helped to alleviate patient anxiety and depression, reduce their waiting time, and make are more efficient. The sincere hope is that this physician-nurse partnership will be embraced and used as a beneficial intervention.

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