

Telemedicine for Preoperative Assessment, Surgical Appointments, and Preoperative Education in Gynecological Day Surgery: An Prospective Observational Analysis

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Background: This study investigates the differences in the cost, time, pre-operative education and patient satisfaction levels of patients requiring a second hysteroscopic surgery using a full-service model of remote preoperative assessment, surgical appointments, and preoperative education.

Methods: Forty-one patients who were proficient in the use of telemedicine platforms, planned to undergo a second hysteroscopic surgery, and selected either telemedicine (N=21) or face-to-face (N=20) models for their preoperative assessments, surgical appointments, and preoperative education were included. The data were analyzed using the Mann–Whitney *U*-test and Fisher's exact test.

Results: No significant demographic differences were observed between patients who used telemedicine and those who did not. The telemedicine group demonstrated significantly lower median travel time (40 min vs 205 min, $P < 0.01$), time spent in hospital (60 min vs 155 min, $P < 0.01$), meal time (0 min vs 60 min, $P < 0.01$), and total time spent (108 min vs 415 min, $P < 0.01$). Similarly, the telemedicine group had significantly lower median travel expenses (40 yuan vs 300 yuan, $P < 0.01$) and meal expenses (0 yuan vs 135 yuan, $P < 0.01$), and overall, total expenses (255 yuan vs 837 yuan, $P < 0.01$). 95.2% of the telemedicine group completely understood the preoperative education, compared to 100% who completely understood in the face-to-face group ($P = 1.00$). All patients in the telemedicine group were very satisfied compared to 80% in the face-to-face group ($P = 1.00$).

Conclusion: Telemedicine may be a feasible and advantageous method for preoperative assessment, surgical appointments, and preoperative education in gynecological day surgery. The application of telemedicine has demonstrated notable time and cost efficiency with high patient satisfaction levels. Future research should explore the full potential of telemedicine in this setting and for other surgical procedures.

Keywords: telemedicine, gynecological day surgery, patient satisfaction, cost and time efficiency

Introduction

Telemedicine refers to the practice of remote medicine that utilizes electronic information and telecommunications technology.¹ Telemedicine has emerged as a transformative approach in healthcare, offering remote medical consultation and treatment through digital platforms. On December 13, 2022, China completely relaxed its coronavirus 2019 (COVID-19) pandemic prevention policies, which may have exposed more people to the risk of SARS-CoV-2 infection. Hospitals are potential sources of cross-infection with this virus. To reduce the risk of face-to-face contact during the pandemic, some patients who feared infection avoided seeking medical care. This created an unprecedented challenge for Chinese healthcare institutions; however, the pandemic also spurred the rapid development of telemedicine. Telemedicine

allows patients to avoid face-to-face contact, reducing cross-infection and providing an effective means of communication between doctors and patients.² Telemedicine has been successfully applied in various medical fields.

In China, telemedicine has played a significant role in remote online consultations, minimizing the spread of the SARS-CoV-2 virus to the greatest extent and providing a solution for optimizing China's health services. Preoperative care, particularly in gynecological surgeries, is one area where telemedicine has shown promise in improving patient outcomes and operational efficiency. Previous studies have demonstrated the potential of telemedicine in various healthcare contexts. During the COVID-19 pandemic, telemedicine had been successfully applied for scheduling appointments at surgical clinics,³ preoperative assessments for surgeries,⁴ anesthetic preoperative consultations,⁵ post-dental surgery appointments,⁶ and follow-up care for patients undergoing orthopedic and trauma surgery patients.⁷

In preoperative assessment, several studies showed clinical outcomes and postoperative hospital utilization in the telemedicine group were found to be noninferior to those in the in-person group in various specialty, such as spine surgery {Greven, 2022 #3491}, pediatric surgery {Metzger, 2022 #3492}, bariatric surgery {Hlavin, 2023 #3493}, while patient maintain a high satisfaction {Geng-Ramos, 2022 #3494}.

Although previous studies investigated the use of telemedicine models within specific specialties, research specifically focused on preoperative telemedicine in gynecological surgery remains limited. Existing studies, such as the one by Davenport et al {Davenport, 2023 #3495}, primarily address patient satisfaction, leaving a gap in understanding its effectiveness in preoperative settings.

This study aims to fill this gap by evaluating the effectiveness of telemedicine for preoperative assessment, surgical appointments, and preoperative education in gynecological day surgery. By comparing telemedicine with traditional face-to-face consultations, we seek to determine its impact on cost, time efficiency, and patient satisfaction.

The theoretical framework underpinning this study is rooted in the potential of telemedicine to enhance healthcare delivery. Telemedicine is expected to reduce travel time and costs for patients, increase access to specialist consultations, and streamline preoperative procedures. Moreover, it aligns with the broader healthcare objective of leveraging technology to improve patient outcomes and operational efficiency.

In summary, this study aims to provide evidence on the viability and benefits of telemedicine in preoperative gynecological care, contributing to the growing body of literature on digital health interventions. By addressing the gaps identified in previous studies, we hope to inform future telemedicine policies and practices, ultimately enhancing patient care and resource utilization in healthcare.

Materials and Methods

We conducted this prospective observational study. The study protocol was approved by the Institutional Review Boards of the Women's Hospital, Zhejiang University School of Medicine with the IRB number IRB-20230252-R. All methods were carried out in accordance with relevant guidelines and regulations. Written informed consents were obtained from all participants. All patients were 18–60 years of age, planning to undergo their second hysteroscopic surgery at a day surgery center, and proficient in the use of telemedicine platforms with no cognitive or hearing impairments. Patients with language or hearing impairment and those who were unwilling to participate in the study were excluded. Following the preliminary screening of patients according to the inclusion and exclusion criteria, the patients were informed regarding the timing of the second hysteroscopic surgery after completion of the first hysteroscopic surgery. Patients were also informed that there were two models for preoperative assessment, surgical appointments, and preoperative education for the second surgery, including telemedicine and face-to-face models. Each patient chose their preferred model.

Forty-one patients who required a second hysteroscopic surgery at the day surgery center of the Women's Hospital, Zhejiang University School of Medicine between January 1 and March 31, 2023 were included in the study. Twenty patients chose face-to-face and twenty-one patients chose telemedicine for preoperative assessment. Most of the patients lived within a 150km radius of the hospital.

The patients in the telemedicine group underwent preoperative assessment, surgical appointments, and preoperative education via telemedicine. The telemedicine platform used in this study is integrated with the WeChat application, a widely used chatting app in China. Almost all Chinese people with smartphones are familiar with and regularly use WeChat. After the first hysteroscopic surgery, the research team ensured that patients followed the hospital's WeChat

public account and linked their medical record numbers to the platform. This step guaranteed that patients could proficiently use the telemedicine platform. The platform staff, including physicians and nurses, conducted online consultations through WeChat. They collected brief medical history information and reviewed preoperative examinations conducted either at our hospital or at other locations based on the patient's residence. The functionalities of the platform included real-time messaging, video calls, and document sharing, which facilitated comprehensive preoperative evaluations and consultations. The patients were provided with instructions on how to use these features, ensuring they were comfortable and confident in using the platform for their medical needs.

The patients in the face-to-face group visited the day surgery outpatient department for preoperative assessment, completion of preoperative examinations, and a review of the examination results. The patients then visited the day surgery center for face-to-face surgical appointment scheduling and preoperative education.

After completing the second hysteroscopic surgery, both groups of patients were administered a paper-based survey prior to discharge. The survey included items regarding the time required for preoperative assessment, preoperative examination, and successful surgical appointment scheduling; the monetary cost required from the preoperative assessment and preoperative examination to the successful surgical appointment scheduling; the degree of mastery of the preoperative education; and the overall satisfaction with the service. The survey response rate was 100%. Sample questionnaires are provided in the [Supplementary file 1](#). When presenting data, median refers to the middle value of a set of values, indicating that half of the observations fall below this value and half fall above. Total time the sum of travel time, in-hospital time, meal time, and accommodation time. Total expenses is the sum of travel expenses, in-hospital expenses, meal expenses, and accommodation expenses.

Data were collected through the WeChat telemedicine platform, where patients followed the hospital's public account and linked their medical records. Demographic information, medical history, and preoperative exam results were gathered through online forms and consultations, and patient satisfaction surveys were conducted. Data were securely entered into a password-protected, encrypted database with restricted access, and regular backups ensured data integrity. All data transmission was encrypted, and identifiable information was anonymized before analysis. Missing data were addressed using multiple imputation methods and sensitivity analysis to assess the impact of imputed data on study outcomes.

To minimize selection bias, we invited all eligible patients to participate in the study during the enrollment period, ensuring a representative sample of the population undergoing hysteroscopic surgery. To mitigate information bias, standardized procedures were used for data collection via the WeChat telemedicine platform. All consultations and data entries were conducted by trained healthcare professionals following a consistent protocol, which included real-time messaging, video calls, and secure document sharing. These measures ensured that data were collected uniformly and accurately. Additionally, patient satisfaction and understanding of preoperative education were assessed through validated surveys, enhancing the reliability and validity of our findings. Regular cross-checks and data audits were performed to maintain data integrity and prevent any inconsistencies.

Sample size calculation

The required number of patients was calculated using the online sample size calculator statulator.com, which predicts the sample size based on the time patients spend scheduling surgeries. The expected time required for the telemedicine appointment group was 75 minutes and that for the non-telemedicine appointment group was 120 minutes. The following parameters were used: Standard Deviation (SD)=50, power=90%, $\alpha=0.05$. It was determined that 20 patients were required in each group.

Statistical analysis

All statistical analyses were conducted using SPSS Statistics (version 22.0; IBM, TX, US). Continuous data are presented as mean (standard deviation) or median (5th, 95th percentiles), and categorical data are presented using percentages. The Mann-Whitney *U*-test and Fisher's exact test were used to compare continuous and categorical variables. Statistical significance was set at $P < 0.05$.

Results

The mean age of participants in both groups was 33 years (Table 1). The majority of participants lived in the same province, with approximately 20% residing in the same city. Most patients had at least a bachelor's degree and the predominant primary disease was intrauterine adhesion. There were no significant differences in the demographic variables or primary diseases between the face-to-face and telemedicine groups.

The telemedicine group spent significantly less time traveling (Median: 40 min vs 205 min; $P < 0.01$), in the hospital (Median: 60 min vs 155 min; $P < 0.01$), and eating meals (Median: 0 min vs 60 min; $P < 0.01$) than the face-to-face group (Table 2). The total time spent was significantly shorter in the telemedicine group (Median: 108 min vs 415 min; $P < 0.01$).

The median travel expenses for the telemedicine group were significantly lower (40 yuan) than those for the face-to-face group (300 yuan), with a statistically significant difference ($P < 0.01$) (Table 3). The median meal expenses for the telemedicine group were significantly lower (0 yuan) compared to the face-to-face group (135 yuan), and the difference was statistically significant ($P < 0.01$). The median in-hospital and accommodation expenses were not significantly different between the two groups ($P = 0.24$ and $P = 0.14$, respectively). The median total expenses were also significantly lower in the telemedicine group (255 yuan) compared to the face-to-face group (837 yuan), with a statistically significant difference ($P < 0.01$).

Table 1 Baseline Characteristics

	Face-to-face (N=20)	Telemedicine (N=21)	P
Age, years	32.9 (4.5)	33.8 (7.3)	0.65
Resident within the same city as the hospital			1.00
Yes	4 (20.0%)	5 (23.8%)	
No	16 (80.0%)	16 (76.2%)	
Resident within the same province as the hospital			1.00
Yes	19 (95.0%)	20 (95.2%)	
No	1 (5.0%)	1 (4.8%)	
Education level			0.71
Bachelor or higher	13 (65.0%)	13 (61.9%)	
Upper secondary education	6 (30.0%)	5 (23.8%)	
Lower secondary education	1 (5.0%)	2 (9.5%)	
Primary education	0 (0.0%)	1 (4.8%)	
Primary disease			0.11
Intrauterine adhesion	15 (75.0%)	13 (61.9%)	
Septate uterus	4 (20.0%)	2 (9.5%)	
Others	1 (5.0%)	6 (28.6%)	

Notes: Data are provided as mean (standard deviation) or number (percentage).

Table 2 Time Consumed by Patients

	Face-to-face (N=20)	Telemedicine (N=21)	P
Travel time, min	205 (120.5, 448.5)	40 (15.5, 117)	<0.01
Time in hospital, min	155 (60.75, 237)	60 (21,77.7)	<0.01
Meal time, min	60 (1.5,120)	0 (0,40)	<0.01
Accommodation time, min	0 (0,480)	0 (0,0)	0.142
Total time, min	415 (260.5,1118)	108 (51,205.5)	<0.01

Notes: Data are presented as median (5th, 95th percentile).

Table 3 Expenses of Patients

	Face-to-face (N=20)	Telemedicine (N=21)	P
Travel expenses, yuan	300 (101,985)	40 (5, 62)	<0.01
In-hospital expenses, yuan	210 (110, 312)	208 (123, 234)	0.24
Meal expenses, yuan	135 (4, 885)	0 (0, 96)	<0.01
Accommodation expenses, yuan	0 (0, 895)	0 (0, 0)	0.14
Total expenses, yuan	837 (314, 6415)	255 (132, 521)	<0.01

Notes: Data are presented as median (5th, 95th percentile).

Table 4 Patient Understanding of Preoperative Education

	Face-to-face (N=20)	Telemedicine (N=21)	P
Self-reported patient understanding of preoperative education			1.00
Complete understanding	20 (100.0%)	20 (95.2%)	
Mostly understood	0 (0.0%)	1 (4.8%)	
Not understanding	0 (0.0%)	0 (0.0%)	

All patients in the face-to-face group (100%) reported complete understanding of the preoperative education compared to 95.2% of patients in the telemedicine group ($P = 1.00$) (Table 4). In the telemedicine group, 4.8% of patients reported mostly understanding the education.

In the face-to-face group, 80% of patients were very satisfied and 20% were fairly satisfied with the service (Table 5). All patients in the telemedicine group (100%) were very satisfied. None of the patients in either group reported dissatisfaction. Patient satisfaction was not significantly different between the two groups ($P = 1.00$).

Discussion

Telemedicine has emerged as a significant component of modern medicine due to advances in information technology and the rise of the Internet. Telemedicine offers patients an accessible, safe, and efficient alternative to traditional healthcare practices in terms of cost and time.⁸ Its importance was highlighted during the COVID-19 pandemic, as the use of telemedicine mitigated infection risks by minimizing physical patient-doctor interactions and provided patients with essential social support.⁸⁻¹⁰ Despite the alleviation of the pandemic, telemedicine continues to play an integral role in healthcare delivery.

Table 5 Patient Satisfaction

	Face-to -face (N=20)	Telemedicine (N=21)	P
Satisfaction			1.00
Very satisfied	16 (80.0%)	21 (100.0%)	
Fairly satisfied	4 (20.0%)	0 (0.0%)	
Not satisfied	0 (0.0%)	0 (0.0%)	

Although telemedicine has gained popularity in the domain of gynecological surgery, its application remains relatively limited. It is typically used for postoperative care, as it is beneficial for evaluation and follow-up. Thompson et al¹¹ utilized telephonic follow-ups for postoperative care of pelvic floor surgeries in gynecology, leading to enhanced quality of care and ease of postoperative care for both patients and healthcare providers. Similarly, Radtke et al¹² conducted a randomized controlled trial that underscored the capacity of telemedicine to increase patient satisfaction after gynecological laparoscopic hysterectomy and laparoscopic endometriosis removal.

The use of telemedicine has been found to result in high patient satisfaction levels for follow-up visits after robotic gynecological surgery, and the safety and feasibility of telemedicine follow-up visits has been verified.¹³ Telemedicine has been used for gynecological disease management, and previous observational studies have reported high appointment resolution rates and overall patient satisfaction.¹⁴ In addition, telemedicine has been integrated into perioperative care in gynecology, encompassing elements such as preoperative evaluation consultations and surgical education.¹⁵

However, the application of telemedicine in gynecology has yet to be expanded to a full-service model comprising remote assessment, surgical appointments, and health education for gynecological day surgeries. The use of telemedicine for the preoperative assessment of major gynecological surgeries presents certain challenges. As doctors cannot physically examine patients using this model, there may be a potential bias in the evaluations. It has been reported that at least one in-person physical and pelvic examination should be conducted prior to major surgeries, highlighting the current limitations of telemedicine in the field of gynecological surgery.¹⁵

This study focused on patients undergoing a second hysteroscopic surgery, a group who were already familiar with the preoperative assessment, surgical appointment, and health education processes due to their prior surgical experience. The comprehensive nature of preoperative assessment for the second surgery was ensured based on the patient's recent experience. The remote surgical appointment phase included various elements, such as notifications, reminders, health education videos, and verbal instructions provided by a nurse. Thus, this structured approach is highly applicable to patients requiring a second surgery at a gynecological day surgery center.

This study examined the differences in time costs, monetary costs, and satisfaction with the full-service process of preoperative assessment, surgical appointment, and preoperative health education for a second hysteroscopic surgery at a gynecological day surgery center of a university-affiliated maternity hospital in China based on the patients' perspective. The use of telemedicine significantly reduced the total time for the entire second surgery appointment process, including travel time, time spent in the hospital, and mealtimes. However, the accommodation times of the two groups were similar. This may be due to the fact that the patients in this study primarily lived within Zhejiang Province and within a straight-line distance of 150 km from the hospital. Therefore, they did not require an overnight stay. The results suggest that the use of telemedicine saved 165 min in travel time, 95 min in hospital time, and 60 min in mealtime, for a total of 307 min saved. Moreover, patients in the telemedicine group, relying on the telemedicine platform, could use telemedicine anytime and anywhere. Patients with a smartphone and network coverage are able to use the telemedicine platform for surgery assessment, surgical appointments, and preoperative health education services, improving the convenience of seeking medical care.

In addition, most of the patients in the current study were of childbearing age and either employed or self-employed; therefore, the time saved could be translated into economic benefits. This is an important economic benefit of telemedicine and is consistent with the results of other studies.^{8,16,17}

The results of this study demonstrated higher satisfaction levels among patients in the telemedicine group, suggesting that telemedicine may enhance the quality of medical services and bolster patient trust in healthcare institutions. The application of telemedicine in gynecological surgery, with its patient-centric approach, ensures personalized, comfortable, and reassuring medical service.

In our study, we frequently report p-values of 1.00, which may imply non-significant differences. It is important to clarify that while some non-significant p-values can be attributed to our small sample size, leading to limited statistical power, a p-value of 1.00 typically indicates a true non-difference between the groups compared. This distinction is crucial for interpreting our results accurately. We have addressed this potential confusion by providing an explanation in the methods section, ensuring that readers understand the context of these p-values and the implications for our findings.

However, this study had several limitations. First the geographical restriction to a single region in China, which limits the generalizability of the results. Second the focus on patients undergoing a second hysteroscopic surgery may not reflect the experience of patients undergoing other types of surgeries. Third, technological issues such as unstable internet connections or lack of digital literacy among patients may have influenced the results, although these have not been extensively investigated. Fourth, our sample size is small. The pandemic restrictions and the nature of day surgery limited our recruitment. Fifth, Our study focused on quantitative measures, such as cost, time efficiency, and patient satisfaction, to evaluate the effectiveness of telemedicine in preoperative gynecological care. However, we recognize the potential benefits of incorporating qualitative methods to gain a deeper understanding of the factors influencing participants' preferences and experiences. Sixth, Regarding the theoretical contribution, while our study did not explicitly utilize or develop a theory, it offers empirical evidence that can inform the ongoing discourse on telemedicine in healthcare. Future research should consider using qualitative approaches, such as semi-structured interviews and focus groups, to explore the underlying motivations and perceptions of patients and healthcare providers regarding telemedicine. Future research should aim to address these issues by broadening the sample size and diversity, encompassing a wider range of surgical procedures, and investigating potential technological barriers, also should consider using qualitative approaches, such as semi-structured interviews and focus groups, to explore the underlying motivations and perceptions of patients and healthcare providers regarding telemedicine. Future research should aim to integrate theoretical frameworks to better understand and explain the mechanisms through which telemedicine impacts preoperative care and patient outcomes.

Our findings suggest several policy implications for integrating telemedicine into standard healthcare practice. Given its cost-effectiveness and high patient satisfaction, telemedicine should be more widely adopted, particularly where access to in-person care is limited. Policymakers should incentivize telemedicine through comparable reimbursement structures and support training programs to improve technological literacy among both patients and providers. Additionally, the effective use of platforms like WeChat highlights the need for secure, user-friendly technology in telemedicine programs. Our study highlights several technological challenges associated with telemedicine, such as software usability and data security, which are critical for ensuring a smooth user experience and protecting patient privacy. Ensuring that telemedicine platforms are user-friendly and secure is essential for their effectiveness and acceptance among patients. Additionally, comprehensive patient training is crucial to address technological literacy issues. From a patient-centric perspective, personal preferences significantly influence the adoption of telemedicine. While many patients appreciate the convenience and reduced costs, some prefer traditional face-to-face visits due to a perceived lack of personal interaction or discomfort with technology.

Conclusions

In conclusion, telemedicine has significant potential for the management of the full-service processes of preoperative assessment, surgical appointments, and preoperative health education for patients undergoing a second hysteroscopic surgery at a gynecological day surgery center. Despite certain challenges, telemedicine can significantly reduce the time and cost and enhance patient satisfaction. With appropriate policy support, telemedicine has the potential to revolutionize gynecological day surgery practices in China, improving patient experience and healthcare efficiency. This study has several limitations, including its geographical restriction to a single region in China, small sample size, focus on a specific surgery type, and lack of qualitative methods and theoretical frameworks. Future research should broaden the sample size and diversity, explore a wider range of surgical procedures, investigate potential technological barriers, and incorporate qualitative approaches and theoretical frameworks to deepen understanding of telemedicine's impact on preoperative care and patient outcomes.

Data Sharing Statement

Data are available upon reasonable request to Yue Wang by email.

Ethics Statement

The study protocol was approved by the Institutional Review Boards of the Women's Hospital, Zhejiang University School of Medicine with the IRB number IRB-20230252-R. All methods were carried out in accordance with relevant

guidelines and regulations. Written informed consents were obtained from all participants. This study complies with the Declaration of Helsinki.

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Disclosure

The authors report no conflicts of interest in this work.

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