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Original Article

Effect of Applying Telemedicine Follow-up versus Scheduled Clinic Follow-up on Renal-Transplanted Patients' Satisfaction

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ABSTRACT

Background: Kidney transplants are becoming common surgical procedures with high success rates. Although many specializations have effectively employed telemedicine, the practice -of kidney transplantation has lagged in its adoption. **Aim:** The present study's objective was to evaluate the effect of applying telemedicine follow-up versus scheduled clinic follow-up on renal-transplanted patients' satisfaction. **Design:** was quasi-experimental. **Setting:** The present study was conducted at the Menoufia University Hospital's Renal Surgeries follow-up outpatient clinic, Menoufia Governorate, Egypt. **Subjects:** A convenient sample of Forty-two adult renal-transplanted participants; half of them who underwent follow-up care via video and telephone calls interaction (telemedicine group) and the other half in scheduled follow-up clinic care (control group). **Methods**: patients who volunteered to participatewere evaluated for patients' satisfaction and healthcare use by employing the ***Kidney Transplant Understanding Tool (K-TUT)***, ***Telemedicine Satisfaction Questionnaire, and Health Utilization Questionnaire.*** Pairing by propensity was done through using one-way multiple regression of variances and one-way variation analysis to contrast the mean and SD of the ratings for the questionnaires. **Results:** In this investigation, there were 21 telemedicine participants that were confirmed and 21 other patients as the control group. The total average age (±SD) was 50 (±5.51) years for the telemedicine sample and 51 (±6.01) years for the control group, correspondingly. The two samples' levels of overall patients' satisfaction was comparable ($p = 0.78$). While telemedicine participants' satisfaction with social interactions and communication was comparable to that of clinic patient populations', they had much shorter commute ($p < 0.0001$) and waiting durations ($p < 0.0001$). 85.7% (18/21) of telemedicine participants choose to utilize the services again due to the convenience of using it without sacrificing patients-nursing engagement. **Conclusion**: The use of telemedicine seemed to be a more convenient and affordable option than scheduling follow-up meetings. Telemedicine offers the potential to increase clinic efficiency, shorten patient wait durations, and lower expenses for those undergoing kidney transplants. **Recommendations:** To maximize healthcare use in our nation, greater research into the application of telemedicine in a wide range of clinical environments is therefore necessary**.** To shorten waiting lists and give patients more flexibility planning, crowded facilities across the country should seriously explore offering telemedicine services.

Keywords: Renal Transplanted patients' Satisfaction; Scheduled Clinic Follow-up; Telemedicine.

Introduction:

The kidneys function as the body's natural blood filter by filtering waste material through metabolism. If any health problem damaged the person's kidneys and led to a decreased Glomerular Filtration rate (GFR) less than 10 mL/min/1.73m, this condition is known as end stage renal disease (ESRD), and for survival the patient has only one of two options either dialysis or renal transplantation ***(Smith, 2021)***. The incidence of ESRD in Egypt increased up to 483 individuals per million people, based on the 9th Annual Report of

The Egyptian Renal Registry released by the Egyptian Society of Nephrology and Transplantations (ESNT) ***(El Rasheed et al., 2020)***. The average age is almost 49.8 ±19 years. In comparison to women, who made up around 44.8%, men made up 55.2%. Transplantations rapidly risen till there were 90–100 performed annually ***(Hedayati et al., 2017)***. There are currently 80 institutions in Egypt performing kidney transplants, with a total experience of more than 7000 living donors ***(Wyld et al., 2021)***.

Renal transplantation particularly when compared to other abdominal organ donations like liver and pancreatic transplantation, the procedure's complications incidence is low ***(Li et al., 2020)***. However, it is crucial for the team caring for those individuals to identify, correctly diagnose, and promptly treat postoperative problems that arise following kidney transplantation ***(Haugen et al., 2018)***. In addition to the danger of grafts failure and death, a delaying in the detection or treatment of these issues may cause the recipients to suffer from substantial morbidity.

Kidney transplantation survivors' or renal graft survival rates havesignificantly improved in recent years. This is mostly because of enhanced immunosuppressive, co-morbidity treatment, and medical management ***(Cheung & Tang, 2022)***. Nevertheless, the renal transplantation wounds or the three anastomosis sites are of the majority of surgical problems (renal arteries, renal veins, or ureters) ***(Pinter et al., 2017)***. Pathological or surgical problems can result from kidney transplantation. Although surgery problems included lymphocele, wounds infections, and herniation, pathological problems involve rejections, infection, and cardiovascular problems ***(Kim et al., 2020)***. For effective therapy, the majority of these problems necessitate surgical or radiographic treatment ***(Harhay et al., 2020)***.

The renal nurse plays a crucial role in communicating with, teaching, and assisting those patients in their transition from the early post-operative stage into the maintenance stage and work to optimize independence within their own management ***(Husain et al., 2019)***. The drugs that sufferers might need to consume, how lifestyle might change after transplanting and the potential behavioral effects of this, in addition to the likelihood of new or recurring disease, are all things that renal nurses need to be knowledgeable with***(Burns & Turner, 2018)***.

There are various difficulties in managing and providing short and long-term healthcare for the successful recipients of a kidney transplant. Long-term chances of success have improved as a result of the consistent short-term success rate improvements, and many individuals now have kidney transplants that are still functional after several years ***(Mahdizadeh et al., 2020)***.

A sizable population of people who have a specific and complicated system of long-term medical treatment necessities has been produced due to the requirement for lifelong immunosuppressive medication safety to avoid rejection and the existence in many patient populations of a wide range of other medical issues dating from the time of renal dysfunction (i.e., pre-transplantation) ***(Kulkarni et al., 2019)***. This issue is made more challenging by the reality that several kidney transplantation recipients obtain the

majority of their long-term healthcare outside of the transplantation center due to limitations of the managed care/healthcare insurance, distance, and patients' preferences ***(Koken et al., 2019)***.

The allograft and patients' lives can both be greatly extended with the right care. ***(Serrano et al., 2019),*** consequently, for providing follow-up care for this patient's population it is crucial for the nurses caring for those individuals to be aware of the complicated and interrelated medical concerns those individuals confront in order to provide them with the best care possible ***(Bouchard et al., 2020)***.

Among the primary obstacles for receiving medical care is the cost of the medical care, which has long been acknowledged. Up to 18% of American adults cite expense as a factor in postponing hospital services ***(Younis et al., 2018)***. Furthermore, in addition to financial concerns, numerous individuals confront challenges include appointments accessibility, distance traveled, and durations off from work that exceed their capacity to pay for treatments ***(Ahmed et al., 2020)***. These difficulties are frequently best illustrated in rural areas where access to services and distances from them have a substantial impact on how individuals are treated ***(Rohan et al., 2020)***.

With its capacity to bridge the gap between patients and healthcare professionals, telemedicine has been used more frequently in recent years to increase accessibility to medical care. Telemedicine has other benefits like accuracy, price-effectiveness, and higher patient satisfaction ***(Angell et al., 2021)***. Telemedicine is the use of telecommunication and information technology to provide healthcare from a distance***(Kosoku et al., 2018)***. Telemedicine also is called tele-health, which is the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient and professional health-related education***(Angell et al., 2021)***.

The Extension for Community Healthcare Satisfaction (ECHS) Modeling tool by the University of New Mexico Health Sciences Center was among the most common telemedicine services***(Espino et al., 2018)***. Employing videoconferencing and telephone calls that linked primary care doctors and professionals together to co-manage patients, the ECHS program provides specialty treatment to sizable rural underserved communities***(Chen et al., 2021)***. Other telemedicine initiatives have been utilized successfully for long-term diseases including heart problems or follow-up after lungs transplants***(Schütte-Nütgen et al., 2017).***

In addition to eliminating travel time, telemedicine has other benefits like accuracy, price-effectiveness, and higher patient satisfaction ***(Kosoku et al., 2018)***. According to a University of California, Davis research, over the course of 18 years, telemedicine services saved individuals five million miles of travelling duration, or the average of nine years ***(Allareddy et al., 2017)***. Further research that involved 11 general clinics found that patients were very satisfied with their telemedicine sessions, citing convenience and shorter wait times as the main reasons for the improved experiences***(Alfieri et al., 2022)***.

Significance of the study:

According to an investigation on healthcare-associated infectious diseases and outpatients' follow-up for surgeries, renal transplantation had an estimated 157,500 surgical complications in 2018; while about ten thousand renal transplants were performed from 2011 to 2021, the annual mean number of kidney transplantation between 2011 and 2016 increased to 1100 cases/year. The number of transplant centers has also grown from 12 in 1997 to 80 currently licensed centers. However, Egypt is still lacking a national transplant registry data***(Elrggal M., et al., 2022)***.

This research is an effort to investigate methods for enhancing patients' satisfaction in post-transplantation long-term care and even as, limited investigations had shown the value of telemedicine for people recovering from kidney transplantation surgery and to the best of our knowledge, this was the first research to show how telemedicine can benefit patients who have undergone kidney transplantation surgery.

Aim of the study

Caring of a patient receiving a kidney transplant is complicated, and typical post-operative nursing interventions in the follow-up period must take into account both the avoidance of infection and the assessment of indicators of rejections ***(Agrawal et al., 2022)***. Thus, the decisive responsibility of renal nurse in the care administration and supporting of transplantation recipients as they adjust to a new life without dialysis, diet restrictions or fluids limitations ***(Gill et al., 2017)***. Hence, the present study examined kidney transplantation patients' satisfaction between two diagnostic categories: the telemedicine sample, which had follow-up meetings via telemedicine, and the control or the outpatient clinic or standard follow-up sample that only received follow-up consultations via traditional follow-up outpatient clinic (the controls).

Hypothesis of the study

(H1): Telemedicine follow-up could be an effective substitute in telemedicine patients for routine or standard outpatient clinic follow-up for controls.

(H2): Telemedicine follow-up will provide comparable, if not higher patients' satisfaction in the form of knowledge and care satisfaction level, with the added benefits of sparing the patients' time and money necessary for transportation to and from routine or standard in-clinic follow-up visits.

(H0): Telemedicine follow-up does not help post-operative kidney transplanted patients get the treatment they needed.

Operational definitions:

Telemedicine: Telemedicine also is called tele-health, which is the use of electronic information and telecommunications technologies to support and promote long-distance clinical health care, patient, and professional health-related education***(Angell et al., 2021)***. In this study, telemedicine was used in the form of videoconferences and telephone calls.

Renal-transplanted patient's Satisfaction: patients' satisfaction in this study was regarding waiting lists, accuracy, price-effectiveness, and financial concerns needed for receiving care like saving patients' money and travel time, numerous individuals confront challenges include appointments accessibility, distance traveled, and durations off from work that exceed their capacity to pay for treatments.

Subjects and Method

Research design: A quasi-experimental study conducted between January 2021 and February 2022.

Setting: Present study was conducted at the Menoufia University Hospital's renal surgeries follow-up outpatient clinic, Menoufia Governorate, Egypt.

Subjects:

A convenient sample of Forty-two adult renal-transplanted participants; half of them who underwent follow-up care via video and telephone calls interaction (telemedicine group) and the other half in scheduled follow-up clinic care (control group). The sample size was determined using the equation below ***(Aliasgharpour et al., 2016)***:

$$n = \frac{Z^2 \times p(1-p)}{\xi^2}$$

Where:

- Z is the z score
- N is calculated sample size
- ξ is the margin of error and
- p is the population incidence

The sample size is calculated to be 42 participants.

In order to achieve the aim of the study the following criteria were taken into consideration when selecting the present study participants:

Inclusion criteria:

- Adult
- Had renal transplantation surgery since more than two weeks and up to one month prior the beginning of the study
- Attended at least one telemedicine follow-up session from the start of the study
- Able to use mobile apps

Exclusion criteria:

- Any mental illness or disease that, in the perspective of the researcher, would make it difficult for the patients to communicate
- Had not any telecommunication device like android telephone, tablet or laptop

Tools: For gathering data, four questionnaires were used in this research, the sociodemographics' questionnaire, besides two validated patients' satisfaction questionnaires 2 &3, and the health Utilization Questionnaire were used:

1. ***The sociodemographics' questionnaire:*** The researcher designed this questionnaire after a comprehensive reviewing of recent literature to collect information about participants' attributes of socio-demographic factors and medical data. This questionnaire inquired about the participants' age, gender, marital status, (single, married, or widowed), educational level (illiterate, primary, secondary, or high education) and living status (alone or with others), as well as their previous, current, and family medical history.

2. ***The Kidney Transplant Understanding Tool (K-TUT)*** was created by a Canadian researcher, ***Mansell in 2017***, with the primary goal of assessing which patients' knowledge about kidney transplantation (KT) in regard to leading a healthy lifestyle and adhering to therapeutic interventions. These interventions such as aspects relevant to KT, immunosuppressant drugs, identifying and preventing complications, physical variations after KT, conventional therapeutic options, and infections, over the counter medications, pregnancy and sexual health, ... etc.

The questionnaire consisted of 22 items; of them 4 items on immunosuppressant drugs, 6 items on rejection signs and symptoms,7 items on precautions and infection preventions, 2 items on herbal and over the counter medications,1item on back to work, and 3 items on pregnancy and sexual health. Additionally, the questionnaire consisted of 13 items multiple-choice, and 9 items were judgment-based questions. Every choice can be thought of as a sole judgment concern so, the tool is converted into 69 assessment items ***(Rosaasen et al., 2017).***

Scoring system

The overall score is 69 points, with 1 point awarded for each accurate response and 0 point for each incorrect response and as the patient had a stronger understanding of KT-related knowledge the greater the score***(Rosaasen et al., 2017)***.

Reliability:*(Urstad,et al., 2021; &Rosaasen et al., 2017)*tested the ***Kidney Transplant Understanding*** tool's intra-group correlation coefficient which was in the range of0.76 to 0.94 and its Cronbach's alpha ranged from 0.79 to 0.88, indicating appropriate reliability**.**

3. ***The Telemedicine Satisfaction Questionnaire (TSQ)***was created in 2003 by ***(Yip et al., 2003)*** and used to assess the patients' satisfactions with the telemedicine services in sessions ***(Grogan et al., 2000; Marshall & Hays, 2014; Thayaparan & Mahdi, 2013; Yip et al., 2003)***. The questionnaire comprised of 14 items, which were grouped into three areas: (1) the level of the healthcare provided, (2) the resemblance to a face-to-face contact, and (3) impression of the connection.

Scoring system

A Likert scale with five-points ranging from, "Strongly Disagree" (1) to "Strongly Agree" (5), was used by the participants to register their answers. Adversely phrased items' ratings were inverted throughout assessment so that for every item. Hence, the total scores ranged between 14 and 70 with lower ratings consistently denoted poor telemedicine satisfaction and higher marks consistently denoted good telemedicine satisfaction, while the result for every topic was the average of all the items within that topic ***(Grogan et al., 2000; Marshall & Hays, 2014; Thayaparan & Mahdi, 2013; Yip et al., 2003)***.

Reliability: ***The Telemedicine Satisfaction Questionnaire*** has shown satisfactory validity and reliability properties to be used in the assessment of patients' satisfactions with the telemedicine services. It has been demonstrated to have a good degree of validity, internal consistency, and reliability based on its acceptable internal consistency for; the level of the healthcare provided, the resemblance to a face-to-face

contact, and impression of the connection, were r= 0.72, 0.84, and 0.75, respectively ***(Yip et al., 2003)***.

4. ***Health Utilization Questionnaire (HUQ)*** was used to evaluate the travel time and expenses related to follow-up consultations after renal transplants**.** It was created by ***(Le et al., 2019)*** and had 9 items that evaluated specific elements of the expenditure of time and money by individuals to schedule follow-up appointments, whether they were made in clinic or via telemedicine.

Scoring system

A Likert scale with five-points ranging from, "Strongly Disagree" (1) to "Strongly Agree" (5), was used by participants to register their answers. Adversely phrased items' ratings were inverted throughout assessment so that for every item, lower ratings consistently showed poor experience and higher marks consistently showed positive experience as the total score ranged between 9 and 45, while the result for every topic was the average of all the items within that topic.

Reliability:*(Mahdizadeh et al., 2020)* tested the reliability of the HUQ tool and found that it was 0.73, whereas it was 0.825 for the current study. The former study revealed that the questionnaire is a simple and brief assessment tool with good internal consistency and reproducibility asit demonstrates a remarkable internal consistency (Cronbach's alpha = 0.89) and a strong relationship with clinical parameters of health care satisfaction.

Method

- **Formal approvals:** An official permission numbered (895) was obtained on June 16, 2020, from the ethical committee in the Faculty of Nursing, Minofiya University after submitting the proposal, explaining aims and methods of the study. Written official approval was sent to the Menoufia University hospital's director and the head nurse of outpatient clinics after the justification of the current study's aim for getting their written administrative approval to start data collection from the Menoufia University Hospital's renal surgeries follow-up outpatient clinic, Menoufia Governorate, Egypt.
- **Study Period:** Collection of data for the study was done during a period of thirteen months starting from January 2021 to February 2022.
- **Ethical Consideration:** The Faculty of Nursing's Research Ethics Committee at Minofiya University on June 16, 2020, gave its permission to conduct the current study with an approval number (895).
- The participants who were being examined were made aware that their involvement was optional and that they had the ability to discontinue the research at any moment without explanation.
- Furthermore, all information gathered from the participants in the study was handled with complete confidentiality.
- Additionally, the data collection process did not interfere with the efficiency of the setting's functioning.
- **Tool development:** the researchers created the first study instrument after inclusive reviewing of the literature, while the second, third and fourth instruments were adopted

respectively from***(Rosaasen et al., 2017;Yip et al., 2003 &Le et al., 2019)*** **.**

- **Content validity:** Panel of seven Medical-Surgicalnursing academic staff members and two healthcare informatics' specialists confirmed the accuracy, relevance and comprehensiveness of the data collection tools. Actual quotes from experts, in-clinic interviews, and reviews were all included to strengthen the credibility of the information.
- **Reliability:** The reliability co-efficient regarding sociodemographic attributes was assessed using the Cronbach's alpha coefficient ($\alpha = 0.95$). Regarding knowledge, it was valid and reliable as it was adopted from ***Rosaasen et al., (2017***), revealed (0.88). Regarding telemedicine satisfaction questionnaire's reliability was adopted from ***Yip et al., (2003***), in its three dimensions, the level of the healthcare provided, the resemblance to a face-to-face contact, and impression of the connection, were r= (0.72, 0.84, and 0.75) respectively. Finally, the reliability co-efficient Cronbach's alpha was equal to (0.89) for the fourth tool as adopted from ***(Mahdizadeh et al., 2020),*** nevertheless the investigator repeated it and was equal to (0.896). Hence, the study tools indicated good reliability for conducting the research study.
- **Pilot study:** pilot study was applied on 10% of four patients who had taken part in the pilot trial and were added to the selection. The pilot trial's objectives were to evaluate the tools' accessibility and comprehension and to determine how long it would take each patient to complete the questionnaire and observational assessment.
- **Informed Consent:** after explaining the research's purpose to hospital leaders, participation in the study received their permission. Furthermore, after explaining the purpose of the research and the specific data collection process to each participant, their consent was obtained so that they were aware of the significance of their involvement. Also, nurses were given a thorough description of the study and assurances that the data collected would be kept confidential and utilized only for the study's objectives.
- **Data Collection Procedure:**
- Each participant who attended at least one telemedicine follow-up consultation made up the experimental treatment group in this investigation, whilst individuals who had only received conventional or in-office follow-up appointments made up the control sample. The control sample only performed the K-TUT and HUQ, while the telemedicine group received all three surveys (K-TUT, TSQ, and HUQ).
- The trial was open to kidney transplant recipients at Menoufia University Hospital's renal surgeries follow-up outpatient clinic, Menoufia Governorate, Egypt institution who were at least 18 years old. Individuals who attended at least one telemedicine follow-up session between January 2021 and February 2022 comprised the telemedicine sample.
- All accepted patients were initially emailed a survey through ‘Google form’ application that included the K-TUT, TSQ, and HUQ. Post-kidney transplantation controls who were kept

without telemedicine follow-up were matched to each telemedicine patient who completed the questionnaire.

- The TSQ was also performed by the telemedicine cohort to gauge their level of satisfaction with the telemedicine services.

Interventional procedures

- Initially, 32 telemedicine participants were determined to be qualified to take part in the trial. Eventually, 21 of the original 32 subjects consented to the research by submitting the K-TUT, TSQ, and HUQ.
- For a combined amount of 98 initially control participants, three control individuals were paired to each telemedicine patient to ensure sufficient answers for 1:1 pairing.
- The K-TUT, HUQ and sociodemographic assessment questionnaires were then sent to these matched control subjects. Through online survey creation software, the completed questionnaire for each group was sent via text messages to all participants. Everyone who has not replied after a month receives a maximum of three reminding telephone calls. The poll received no responses from 11 telemedicine participants. As a result, 21 individuals in the telemedicine sample and 21 individuals in the control group were matched to one another.

The interventional program steps for this phase included:

- **Step 1:** Prior to conducting the educational program at the Menoufia University Hospital's renal surgeries follow-up outpatient clinic, Menoufia Governorate, Egypt, evaluating the participants' graft wounds healing is necessary.
- This process required 8 sessions, each lasting four hours from 9 AM to 1 PM. Two days weekly were accessible by the researcher (Mondays and Thursdays). Each visit, the researcher evaluated the condition of the wounds as it is being dressed.
- The clinic's timetable for the forthcoming clinic sessions was evaluated by the researcher and then a list of kidneys transplanting patients who would be eligible for telemedicine follow-up was made depending on their health insurances, comforts degree in dealing with mobile interfaces.
- Participants also received a text message with comprehensive details alongside a video explaining how to use ‘Zoom application’ or an online video teleconference facility. The beneficiary and the researcher joined a virtual conference session on the day of the visit
- **Step 2:** Establishment of the telephone and video calls follow-up educational program for post kidney transplantation caring.
- The course lasted about two months (2 sessions per week; each taking 4 hours).
- Calls were made to those in the intervention cohort 2 weeks, 4 weeks, and 8 weeks (about 2 months) following surgery.
- To avoid bias, one of the renal surgeries follow-up outpatient clinic's nurses was in charge of the randomized process, another one was in charge of setting up follow-up appointments for the control group, and the

researcher made the phone calls in order to gather data.

- The researcher utilized a script throughout the calls that included inquiries and suggested telephone call interventions based on the patient's responses to each item. Advices were recommended against; pain, urinary incontinences, infectious risks, physical-functioning health or self-care limits, dietary concerns, and health maintenance requirements. Whenever determined that a patient required an in-person re-evaluation or procedures, the hospital's physician was called.
- The control group's subjects underwent standard or routine follow-up method utilized at the hospital was calling them to set up medical visits at the outpatient clinics. Participants typically get a standardized discharge plan during these visits.

Five distinct assessments were conducted on participants in both groups:

- **Pre-test**—two weeks following surgery, when the patient came to remove the wound sutures in the renal surgeries follow-up outpatient clinic
- **After one month**—during the participant's first follow-up appointment with the kidney transplantation physician, 4 weeks following surgery
- **After three months**— following surgery, during the participant's second follow-up appointment with the kidney transplantation physician
- **After six months** following surgery, during the participant's third follow-up appointment with the kidney transplantation physician
- **After 12 months** following surgery, during the participant's follow-up appointment with the kidney transplantation physician

Step 3: Program evaluation:

- The researcher sent the appropriate link for each questionnaire on every cohort to patient populations as earlier mentioned, and all surveys were created using 'google form' that creates customizable polls.
- Only the K-TUT and HUQ beside the sociodemographic assessment questionnaire were delivered to the controls, while all survey items were supplied to the tele-health cohort.
- The researcher completed all visits for controls face-to-face at the follow-up outpatient clinic.
- The evaluation and comparison between results of the study's participants of both groups was carried out before and after implementing the educational program to scrutinize the effect of applying telemedicine follow-up versus scheduled clinic follow-up on renal-transplanted patients' satisfaction.

Statistical Analysis

- Strata 2013 (College Station, TX) and Microsoft Office excel 2013 (Redmond, WA) were used for the computations.
- Using a one-way multivariate analysis of variances (MANOVA), the K-TUT's total average scoring and the mean scoring for each individual component were evaluated between the telemedicine sample and the controls.

- Using a one-way analysis of variance (ANOVA), the average values for every item on the HUQ were contrasted between the two samples.
- Statistical significance was defined as a p value <0.05. The participants' group made up the independent variables, and the tests result served as the dependent variables.
- Results for the TSQ were presented as the average scores for each item and the standard deviations.

Results

General characteristics (Table 1)

In the telemedicine group, most of participants are males (61.9%) aged between 35 and 60 years and the majority of them were married and highly educated (85.7%), while for the control group, more than half of participants were females (52.38%) aged between 35 and 60 years old and most of them were married (76.2%) and living alone (85.7%). There was no significant difference between the two groups according to complications.

There was no statistically significant difference between the telemedicine and controls according to the general characteristics (Table 1).

Participants' knowledge

Table 2 showed that there was a substantial statistically significant difference between the telemedicine and control group scores according to all items of kidney transplant knowledge tool ($p<0.001$).

Telemedicine Participants' Satisfaction level

Table 3 provides a summary of the proportion of telemedicine participants who responded with a score of 1 to 5. This table especially evaluated patients' satisfaction with the telemedicine services that illustrated, a moderate to a high degree of satisfaction with the telemedicine services was indicated by the average scoring (± SD) of 4.11 (± 0.15). Importantly, 84% of the individuals' responses for each item in the TSQ were below 4, and 12 out of the 14 items had an average score greater than or equal to 4 (out of a possible total of 5). Every single telemedicine participant expressed satisfaction with the care obtained throughout the telemedicine follow-up session. This research discovered that reduced travel duration was the biggest benefit of telemedicine appointments for telemedicine participants, as evidenced by the related TSQ item earning the highest score (4.51 ± 1.05) in this regard.

Contrarily, the TSQ item with the lowest average score indicated a need for support when utilizing the telemedicine platform, emphasizing the significance of fully educated participants before their first telemedicine session. In the last item, 42.8% (9/21) of the sample selected "strongly agree" compared to 38.09% (8/21 participants) who responded, "Agree" to a declaration of overall satisfaction with the telemedicine services. One participant from the remaining group said, "Uncertain" and another said, "disagreed" with the assertion.

Health Utilization Questionnaire (HUQ)

In this investigation, a one-way ANOVA testing was employed to compare the results for each HUQ issue between the two groups. Generally, the telemedicine group had elevated mean scores for all HUQ items, with

significant p-values for five out of nine (56%) of the items (Table4). The greatest level of satisfaction for the telemedicine sample was for the reduced cost of follow-up visits (item 5, scoring 4.74 ± 0.25) and the time saved travelling (item 1, scoring of 4.74 ± 0.37).

In addition, in five of the nine HUQ items, the telemedicine sample outperformed the control sample by a substantial margin as illustrated; item 1: telemedicine 4.74 ± 0.37 against controls 2.8 ± 0.014, $p < 0.0001$; item 2: telemedicine 3.76 ± 0.25 against controls 2.9 ± 0.18, $p = 0.03$; item 3: telemedicine 4.66 ± 0.45 against controls 2.7 ± 0.48, $p < 0.0001$; item 4: telemedicine 4.56 ± 0.55 against controls 3.08 ± 0.5, $p<0.0001$; item 5: telemedicine 4.74 ± 0.25 against controls 2.72 ± 1.01, $p < 0.0001$.

Which could be interpreted as the telemedicine cohort considerably outperformed the controls in the following areas; (1) reduction for time taken off work to participate in follow-up visits as telemedicine's mean score was 4.56 ± 0.55 and controls was 3.08 ± 0.7, p< 0.0001. As well, reduced wait periods for their healthcare providers as telemedicine's mean score was 4.74 ± 0.15 and controls' was 2.72 ±1.01, p< 0.0001. Also, less frequently did they need to request that a friend, family member, or caregiver take time off from work to join them in their follow-up appointments as telemedicine's mean score was 3.08 ± 0.59 and controls was 2.03 ± 0.61, p = 0.002.

Table (1): General characteristics of the studied groups

Item	**Telemedicine (n=21)**	**Controls (n=21)**	**P-value**
Age			**0.369**
• Mean ± SD	50 ± 5.51	51± 6.01	
• Range	35-60	35-60	
Sex			**0.09**
• Male	13 (61.9%)	10 (47.6%)	
• Female	8 (38.09%)	11 (52.38%)	
Marital status			**0.115**
• Single	2 (9.5%)	0 (0%)	
• Married	18 (85.7%)	16 (76.2%)	
• Widowed	1 (4.8%)	5 (23.8%)	
Level of education			**0.063**
• Illiterate	0 (0%)	1 (4.8%)	
• Primary	0 (0%)	4 (19.04%)	
• Secondary	3 (14.3%)	6 (28.6%)	
• High education	18 (85.7%)	10 (47.6%)	
Living status			**0.84**
• Alone	2 (9.5%)	18 (85.7%)	
• With others	19 (90.5%)	3 (14.3%)	
Complications			
• Pyelonephritis	4 (19.05%)	5 (23.8%)	0.645
• Reflux nephropathy	5 (23.8%)	7 (33.33%)	0.254
• Renal calculi	1 (4.8%)	3 (14.3%)	0.121
• Polycystic kidney	0 (0%)	2 (9.5%)	0.001
• Glomerulonephritis	1 (4.8%)	1 (4.8%)	1
• Diabetes mellitus	5 (23.8%)	7 (33.33%)	0.548
• Hypertension	7 (33.33%)	6 (28.6%)	0.364
• Infection	3 (14.3%)	5 (23.8%)	0.4441

Table (2): Comparison between participants of both groups according to their responses regarding elements of Kidney Transplant Understanding Tool (K-TUT)

Elements	Telemedicine (n=21)	Controls (n=21)	t-value	P-value
1. Every person who receives a kidney transplant feels better than he/she did before the transplant.	3.220 ± 1.22	1.786 ± 0.42	8.077	<0.001
2. Immunosuppressive agents must be taken on time to help prevent rejection.	3.505 ± 0.25	0.572 ± 0.85	10.852	<0.001
3. Some diseases that cause kidney failure can come back in the kidney transplant	3.536 ± 0.74	0.288 ± 0.65	10.274	<0.001
4. Anti-rejection medications are also called immunosuppressant	1.321± 1.33	0.174 ± 0.846	4.633	<0.001
5. The kidney transplant is also called a graft	2.668 ± 0.69	0.225 ± 0.986	9.752	<0.001
6. You should always take your anti-rejection medications unless instructed by your transplant team	3.225 ± 0.77	1.36 ± 0.41	5.054	<0.001
7. You will need to do blood testing at least monthly for as long as the kidney transplant is functioning	2.005 ± 1.22	1.36 ± 0.15	7.355	<0.001
8. Over the counter medications are generally unsafe to your transplanted kidney, otherwise the prescribed by the transplant team.	3.874 ± 0.78	1.645 ± 0.25	6.014	<0.001
9. Most people can to return to work after receiving a kidney transplant.	2.347 ± 1.88	0.452 ± 0.34	2.034	<0.001
10. When thinking about herbal or traditional therapies, which of the following are true?	1.45 ± 0.54	0.192 ± 0.56	3.881	<0.001
11. Which statements are true regarding anti-rejection medication?	2.88 ± 0.45	0.267 ± 0.765	1.424	<0.001
12. If you are experiencing a side effect from your anti-rejection pills, what should you do?	1.45 ± 0.75	0.176 ± 0.641	3.364	<0.001
13. What precautions should you take to prevent colds or flu illness?	1.88 ± 0.65	0.292 ± 0.564	1.457	<0.001
14. It is important to tell all your doctors that you received a kidney transplant because:	2.66 ± 0.39	0.394 ± 0.95	3.647	<0.001
15. It is important to tell your pharmacist that you received a kidney transplant because:	2.78 ± 0.42	0.275 ± 0.86	4.912	<0.001
16. Which statements are true about creatinine?	3.44 ± 0.482	0.353 ± 0.96	5.647	<0.001
17. When thinking about transplant rejection, which of the following are true?	1.99 ± 1.23	0.183 ± 0.86	4.194	<0.001
18. In the first few months after your kidney transplant, which of the following are true?	2.45 ± 0.99	0.385 ± 0.154	4.016	<0.001
19. Years after kidney transplantation, which of the following are true?	3.63 ± 0.456	0.278 ± 0.44	7.654	<0.001
20. Which statements are true about pregnancy in women who have received a kidney transplant?	1.74 ± 0.895	0.176 ± 0.15	8.254	<0.001
21. Which statements are true about men who have received a kidney transplant?	3.48 ± 0.46	0.209 ± 0.024	2.612	<0.001
22. When thinking about sexually transmitted infections (STIs) after kidney transplant, which of the following are true?	1.44 ± 0.456	0.137 ± 0.874	6.547	<0.001

Table (3): Contrasting the telemedicine participants' mean scores regarding their Telemedicine Satisfaction Questionnaire answers

Telemedicine Satisfaction Questionnaire issues	Score Mean ± SD
Total score	4.11 ± 0.15
1. I find it simple to communicate with my doctor	4.09 ± 1.1
2. I can clearly hear my healthcare provider	4.13 ± 1.05
3. My medical needs are met by telemedicine	4.09 ± 0.54
4. I don't get enough attention.	4.37 ± 0.40
5. I spend less time driving to a hospital or specialized clinic because to telemedicine	4.51 ± 1.05
6. Using telemedicine, I have improved access to medical treatments	3.60 ± 0.80
7. I believe telemedicine delivers consistent medical care	4.27 ± 0.77
8. I am at ease speaking with my healthcare provider	4.22 ± 0.80
9. I don't require help using this system	3.60 ± 1.17
10. I can see my doctor as if we were face to face	4.03 ± 1.14
11. My medical professional is able to comprehend my medical condition	4.18 ± 1.08
12. I consider telemedicine to be a suitable method of receiving medical care.	4.13 ± 0.53
13. I'll use tele-health services once more.	4.27 ± 1.07
14. Overall, I am pleased with the caliber of telemedicine services offered.	4.22 ± 0.75

Table (4): Comparison between the Healthcare Utilization Questionnaire's (HUQ) mean scores among participants of both groups

Items	Telemedicine Mean ± SD	Control Mean ± SD	P-value
1	4.74 ± 0.37	2.8± 0.014	<0.0001
2	3.7 ± 0.25	2.9± 0.18	0.03
3	4.66 ± 0.45	2.7 ± 0.48	<0.001
4	4.56 ± 0.55	3.08 ± 0.5	<0.0001
5	4.74 ± 0.25	2.72 ±1.01	<0.0001
6	3.08 ± 0.59	2.03 ± 0.61	0.002
7	4.2 ± 0.48	4.5 ± 0.13	0.83
8	3.8 ± 0.57	4.0 ± 0.49	0.71
9	4.7 ± 0.57	3.8 ± 0.33	0.12

Discussion

To the best of our knowledge, this is the first research evaluating patients' comfort with and use of telemedicine healthcare services after kidney transplantation. By utilizing a matched control sample, the current research discovered that using telemedicine reduced the financial strain on renal transplantation recipients without compromising the growth of a medicinal patients-nursing relationship. The TSQ scores indicated a higher level of general satisfaction with

telemedicine appointments. (The mean ± SD was 4.11 ± 0.58) while, The K-TUT findings confirmed no distinction between the two groups in terms of patients' experience (p = 0.78). Additionally, it was discovered that patient satisfaction was comparable between the controls and telemedicine populations, with no instances of transplanting rejections.

According to the kidney transplant understanding, the current study showed a statistically significant difference between the telemedicine and controls for all tool items. One reason for this could be that the present study sample recovered more quickly following transplantation thanks to telemedicine advancements in kidney transplantation treatment management therapy ***(Baker et al., 2017; Wray, 2017).***

Moreover, the shift in healthcare learning needs may be a more significant component in interpreting the discrepancy in post-transplantation satisfaction between the telemedicine and control research samples. There are now new opportunities for finding health information due to the Internet's widespread distribution of health informatics and accessibility to it. Individuals are more at ease using online services as their go-to resource for fundamental health data. Educational materials about transplanting are now accessible online and through TV shows. More people are sharing their disease experiences on social media sites like Face book ***(Yan et al., 2019)***.

Several studies showed that Internet-survey individuals are more active knowledge searchers, frequently inquire of and request additional details from health professionals and consider sharing lived experiences as among the most significant sources of data ***(Tan & Goonawardene, 2017; Yan et al., 2019)*** besides, sufferers of renal disease frequently have a lengthy history of working with medical professionals. They might have been able to interact with medical professionals about their health conditions more effectively with the use of the Internet's health services, making them adequately prepared for the transplants ***(Urstad et al., 2021)***.

According to the greatest mean score in the TSQ (question 9, 4.75 ± 0.54), the majority of individuals were grateful for the telemedicine services and concurred that the telemedicine interviews saved them time they would have otherwise spent time attending to the clinic. Participants indicated in their data collected that they might utilize telemedicine again in the future if given the opportunity and that they thought telemedicine follow-up was an appropriate approach to get hospital facilities. This result is consistent with earlier studies that showed patients satisfaction with telemedicine in diverse therapeutic contexts ***(Dullet et al., 2017; Otten et al., 2016; Polinski et al., 2016)***.

In addition, The TSQ's lowest mean value (item 5, 3.60 ± 1.17) suggested that several participants needed help utilizing the telemedicine application. This result highlights the requirement for a thorough orientation program before a participant's initial telemedicine visit. Patients also expressed higher levels of overall happiness,

contentment with post-transplantation planning, contentment with the standard of medical treatment, and compliance with accessibility to experts and medical care.

What is more, the telemedicine cohort considerably outperformed the controls in the following areas; (1) reduction for time taken off work to participate in follow-up visits as well; reduced wait periods for their healthcare providers as telemedicine's mean score. Also, less frequently did they need to request that a friend, family member, or caregiver take time off from work to join them in their follow-up appointments This result confirms the researcher's theory that telemedicine services enable individuals to miss fewer follow-up consultations after kidney transplants while spending less money and time doing so.

In addition, telemedicine participants could take fewer times off from work, if any, and required fewer children's care arrangements than those in the control sample. As the two highest average values in the HUQ for telemedicine participants indicated that telemedicine could greatly reduce the length of time that individuals need to wait for healthcare professionals in clinics or might expand the availability of care by lowering the cost of attending consultations (Item 1: 4.74 ± 0.37, $p < 0.0001$; Item 5: 4.74 ± 0.25, $p < 0.0001$). As well,***(De La Torre-Díez et al., 2015&Dullet et al., 2017)***conducted a stakeholder engagement process and discovered that individuals prioritized treatment between appointments in order toenhance independence and functioning. Smart technology and the growth of telemedicine programs offer the chance to tailor treatment to each patient's requirements.

In this investigation, there were no discernible differences between the control sample and the telemedicine sample in terms of overall patients' satisfaction. As the results show, implementing that telemedicine did not affect the overall patients' satisfaction with the researcher's practice. Our article's participants scored higher on the TSQ than those in earlier telemedicine research ***(Westra et al.,'s*** study: 4.22 ± 0.26, &***Otten et al.,'s*** study: 3.8 ± 0.5***)***, demonstrating a better degree of satisfaction compared to our present telemedicine services ***(Otten et al., 2016; Westra & Niessen, 2015; Zilliacus et al., 2011).***

Surprisingly, telemedicine services did not have a negatively impact on patients-nurses rapport and communications, as seen by the positive results for items linked to communication in both the K-TUT and TSQ that may be rationalized due to the long period of nurse-patient contact and communications during thirteen months of study period that increased their rapport and affinity.

Limitations

Numerous restrictions applied to the current investigation;

- Initially, the researcher intended to take the sample from an immediate post-operative/transplant patient, but because there were no available any governmental or even private hospitals for renal transplant surgeries

in Minofiya Governorate. Therefore, the researcher was obligated to obtain the studied participants in their first follow-up visit at the Menoufia University Hospital's renal surgeries follow-up outpatient clinic, which was two weeks after surgery.

- Secondly, the current telemedicine program's sample selection procedure might have an exhibited selection bias because the researcher prioritized participants with favorable clinical profiles, insurance coverage, and computer and mobile skills.
- Furthermore, the researcher paired the control individuals with comparable clinical diagnoses, age ranges, and forms of transplants to reduce the consequences of any selection bias.
- Additionally, the strength of this investigation was insufficient to identify modest variations in mean scores because of the limited sample size.
- What is more, this investigation was inevitably survey-based, which increased its susceptibility to some level of responses' bias.

Conclusions:

To conclude;

- Telemedicine was a more convenient and affordable option than scheduling follow-up meetings in renally transplanted patients without sacrificing the nurse-patient interaction.
- The majority of participants in the current study thought that the telemedicine follow-up sessions' total medical background and patients-nurses relationship were just as beneficial as in-clinic appointments, and they would utilize the service once more in the future if given the chance.
- Telemedicine can greatly increase clinical efficiency, decrease patients' waiting lists, and save their money for transfer.

Recommendations:

- To maximize the use of healthcare in our nation, greater research into the application of telemedicine in a wide range of clinical environments is therefore necessary.
- To shorten waiting lists and give patients more flexibility planning, crowded facilities across the country should seriously explore offering telemedicine services.
- Further research should examine unnecessary expenses' avoidance, like commuting time and lost time at the clinic.
- Investigations might need to examine how different employment categories, workplaces, and residential locations interact and influence each other while using telemedicine.
- Future research evaluating the usefulness of telemedicine must seek to recruit more individuals, employ validated questionnaires whenever appropriate, and accurately estimate the amount of time and money cost spend on a meeting instead of depending on respondents' memories.

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