



ORIGINAL ARTICLE **OPEN ACCESS**

Hybrid Telemedicine and In-Person Care for Kidney Transplant Follow-Up: A Qualitative Study

Suad Esayed¹ | Ellie Kim² | Hannah C. Sung² | Abdula Al-Seraji¹ | Simeon Adeyemo¹ | Hayden Troutt¹ | Ekamol Tantisattamo¹  | Antony Ferrey¹ | Uttam G. Reddy¹ | Fatima T. Malik¹ | Robert R. Redfield III³ | Hirohito Ichii³ | Abimereki D. Muzaale² | Divyanshu Malhotra⁴ | Fawaz Al Ammary¹ 

¹Department of Medicine, University of California Irvine School of Medicine, Orange, California, USA | ²Department of Surgery, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA | ³Department of Surgery, University of California Irvine School of Medicine, Orange, California, USA | ⁴Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland, USA

Correspondence: Fawaz Al Ammary (fawaz.alammary@uci.edu)

Received: 25 October 2024 | **Revised:** 2 January 2025 | **Accepted:** 28 January 2025

Funding: This work was supported by the National Institute of Diabetes and Digestive and Kidney Diseases and the National Institute on Aging: K23DK129820 (Al Ammary) and K08AG065520 (Muzaale).

Keywords: access to healthcare | attitudes | continuity of care | kidney transplantation | qualitative research | telehealth

ABSTRACT

Background: Kidney transplant recipients are immunocompromised and require lifelong follow-up. Recipients face geographic, socioeconomic, and logistical challenges when seeking follow-up that can be alleviated using telemedicine. We aimed to understand patient experiences and preferences regarding telemedicine video visits and highlight insights to advance adopting hybrid telemedicine/in-person transplant care.

Methods: We conducted qualitative in-depth, semi-structured interviews with kidney transplant recipients between November 18, 2022, and January 11, 2023. Participants had follow-up at ≥ 12 months post-transplant via telemedicine at a tertiary transplant center. Study enrollment continued until data saturation was reached ($n = 20$ participants) when no new information emerged from additional interviews. Transcripts were analyzed using inductive thematic analysis.

Results: Participants median age was 58 years (IQR, 52–72), and 50% were female, 45% were White, 30% were Black, 15% were Asian, 10% were Hispanic/Other persons, and 30% were out-of-state residents. We identified the following seven themes: (1) reducing travel time, (2) minimizing financial burden (decreasing travel-related expenses and lost wages), (3) engaging patients within their comfort space, (4) establishing rapport with patients, (5) limitations of the virtual physical exam, (6) enhancing access to transplant providers (maximizing adherence to follow-up), and (7) lowering risk of communicable diseases.

Conclusions: Integrating telemedicine with in-person visits enhances post-transplant follow-up care. A hybrid model should leverage the strengths of both modalities, ensuring patient access to care and being patient-centered and flexible. Efforts are needed to advance technological tools in physical examination and human connection, and assess patient outcomes. Policymakers and healthcare systems need to incentivize the adoption and expansion of telemedicine in transplant care.

Abbreviations: COREQ, Consolidated Criteria for Reporting Qualitative Research; IQR, interquartile range; U.S., United States.

Suad Esayed and Ellie Kim contributed equally.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2025 The Author(s). *Clinical Transplantation* published by Wiley Periodicals LLC.

1 | Introduction

Kidney transplant recipients are immunocompromised and require lifelong follow-up. Patients living farther from the transplant center have an increased risk of post-transplant mortality [1]. Post-transplant care involves complex multipart coordination between transplant providers, local nephrologists, and primary care providers. Patients may face geographic, financial, and logistical challenges to maintaining continuity of care [2, 3]. Efforts are needed to enhance transplant care and improve patient outcomes [4, 5].

Adopting an effective hybrid telemedicine/in-person care model for kidney transplant recipients can improve access to transplant centers [5–7]. Telemedicine can diminish the burden of travel and its associated costs and allow flexibility with scheduling [8–11]. A single-center study showed that telemedicine reduced post-transplant unplanned hospitalizations and nonadherence to immunosuppressive regimen [12]. Although U.S. transplant centers have historically lacked telemedicine adoption, real-time video visits during the COVID-19 pandemic proved their potential to sustain access and outreach services to transplant care [13–18]. A national survey of U.S. transplant centers found that 81% report challenges to implementing and expanding telemedicine practice, with concerns about patient's ability to cope with telemedicine technical needs [19]. The transplant community seeks healthcare models that increase access to transplant centers and support patient needs. A knowledge gap exists on how to best adopt a hybrid telemedicine/in-person model for post-transplant follow-up.

To address that gap, an understanding of patient experiences and preferences for using telemedicine video visits in post-transplant follow-up is needed. We conducted in-depth qualitative interviews with kidney transplant recipients to describe themes focusing on patient perceptions, experiences, and preferences of telemedicine and in-person visits. Findings from this study contribute to patient insights to help advance the adoption of hybrid telemedicine/in-person care in kidney transplant follow-up.

2 | Methods

2.1 | Qualitative Study Design

We conducted an inductive thematic qualitative study [20, 21]. The qualitative approach aims to gain an in-depth and rich understanding of participants' lived experiences to advance person-centered care, by deeply understanding patient perceptions, needs, and preferences. We define telemedicine as a healthcare delivery platform using a live-video visit that permits real-time communications between the patient and provider at a distant site. We define a hybrid model as a healthcare model that combines telemedicine live-video/in-person visits for kidney transplant follow-up care, where patients establish a relationship post-transplant with transplant providers via in-person visits and then receive continuity of care via video visits as appropriate (one-to-one visits with a transplant provider). We followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) when reporting our methods and results [22].

2.2 | Participant Selection and Setting

The study population was derived from a pool of 328 adult (≥ 18 years old) kidney transplant recipients who completed follow-up at ≥ 12 months post-transplant via telemedicine video visits at Johns Hopkins Hospital between May 10, 2021, and November 10, 2021. All study participants had experienced both telemedicine and in-person visits. We used purposive sampling methods to recruit our study population, selecting participants randomly based on age, gender, race/ethnicity, and state of residence to ensure diverse perspectives on the study topic of telemedicine and in-person visits for kidney transplant follow-up. The out-of-state purposeful sampling was to understand out-of-state patient experiences with telemedicine. Three authors (S.E., E.K., and F.A.) recruited participants by phone or email. The number of study participants was determined by the point of data saturation, which occurs when no new themes or insights emerge from further data collection. Study recruitment continued until data saturation was reached and no additional information contributed to a deeper understanding of the research objectives, resulting in 20 participants. Of the 25 patients we attempted to contact, one declined participation and four patients could not be reached, including two non-English, Spanish speakers (Figure 1). We emphasized to participants during the recruitment and consent process that their participation in the study was completely voluntary and would not affect their future follow-up care. Verbal informed consent was obtained from participants in accordance with the Johns Hopkins Institutional Review Board and the University of California Irvine Institutional Review Board (IRB#00359137). Participants each received a \$50 Amazon gift card for study participation.

2.3 | Data Collection

We conducted in-depth, semi-structured interviews. Our interview guide consisted of questions aiming to examine kidney transplant recipients (1) experiences with telemedicine and in-person follow-up care, (2) barriers to using telemedicine, (3) suggestions to improve the use of telemedicine for kidney transplant recipient follow-up care, and (4) preferences for future post-transplant visits. The interview guide was developed based on a literature review and conversations with transplant experts and revised after pilot testing (Supplementary Appendix, S1). The research team had training in qualitative research methods, which included measures to ensure that the interviewers did not influence the interview dynamic. The interviewers introduced themselves as researchers and clarified that they were adopting a nonclinical role for the interview. Each participant had a single interview, one-on-one, with a researcher. Three authors (S.E., E.K., and F.A.) conducted the interviews between November 18, 22, and January 11, 23 (S.E. and E.K. are clinical research coordinators with undergraduate education in public health and F.A. is a transplant nephrologist with graduate education in health services research).

The interviews were audio- and video-recorded and lasted approximately 45–60 min. No further comments or feedback were added after participant interview completion. Interviewers created memos, and recordings were reviewed to ensure the

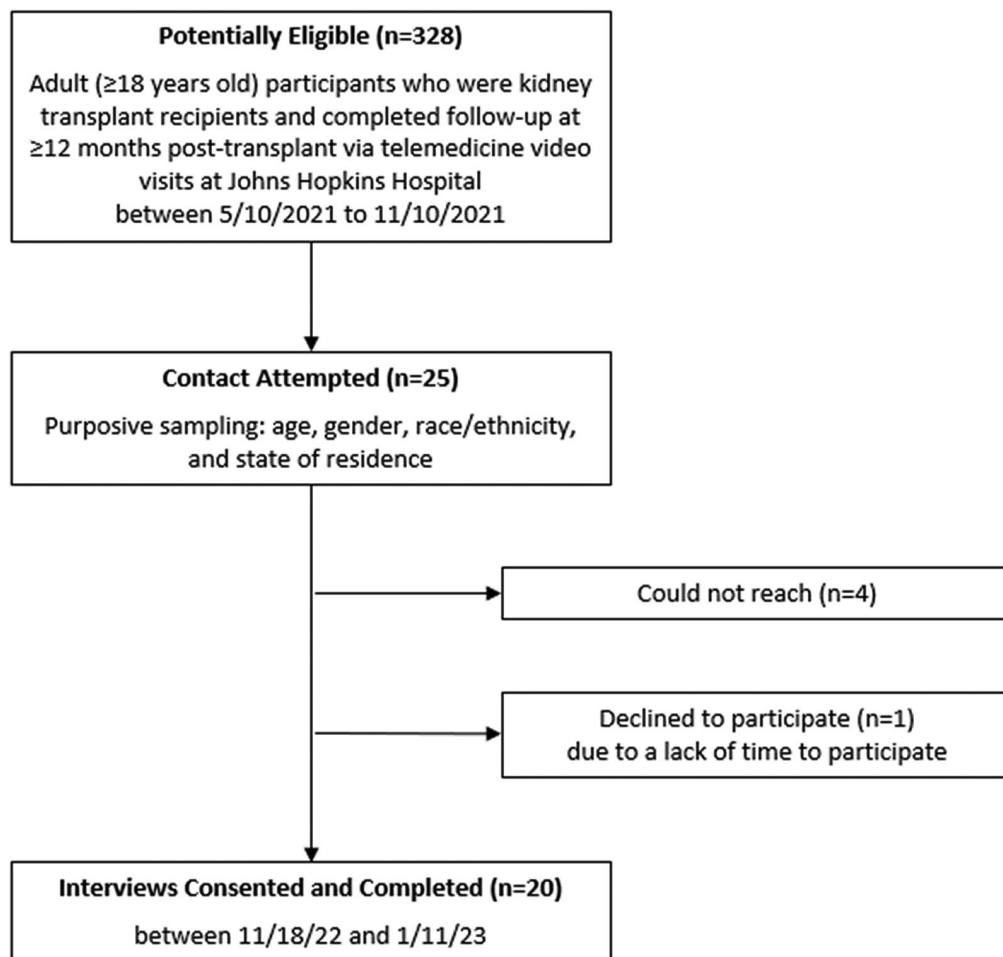


FIGURE 1 | Flow diagram of study participants.

quality and integrity of the data. The audio recordings were professionally transcribed and de-identified for data analysis.

2.4 | Data Analysis

The authors (S.E., E.K., H.C.S., and F.A.) began with a data review, which informed the development of the codebook. We iteratively developed codes identifying different aspects of follow-up care for kidney transplant recipients. The authors (S.E., E.K., A.A., and H.T.) independently coded the data with two coders per transcript and resolved disagreements via consensus. We identified themes within and across codes until thematic saturation. Themes were then finalized through group discussions to reach a consensus. NVivo 2.0 (2020), a computer-assisted qualitative data analysis software, was used to facilitate data management and analysis.

We used several techniques to enhance trustworthiness [22, 23]. For dependability and confirmability of data analysis, we (a) annotated each interview transcript, (b) created analytic memos, (c) discussed data with the research team, and (d) developed meeting notes and mind maps. For the credibility and transferability of our findings, we collected feedback from clinicians specializing in kidney transplantation outside of the study team. Further, data were linked at the five-digit zip code

level with median household income data using the American Community Surveys from the US Census. We contextualized our main findings within prior research and the challenges U.S. transplant centers face for kidney transplant follow-up care.

3 | Results

We interviewed a total of 20 kidney transplant recipients as data saturation was reached and no new information emerged from additional interviews. The study participants' median age was 58 years (IQR, 52–72), and 50% were female. Most participants were White (45%) or Black (30%), and 30% were out-of-state residents. In-state residents experienced the majority of telemedicine visits. Smartphones were the most commonly used electronic device for telemedicine visits, utilized by 55% of participants. Additionally, 40% of the study participants lived at a distance of 50 miles or more from the center. Participants' immunosuppressive regimen includes Tacrolimus (85%), Prednisone (90%), Mycophenolate mofetil (50%), and Sirolimus (15%). Most participants were on antihypertensive therapy (90%), and 50% were on antidiabetic therapy (Table 1).

Themes that emerged from participant interviews are described in the following sections, the representative quotes to support each theme are provided in Table 2.

TABLE 1 | Study participants' characteristics.

Kidney transplant recipients ^a	n = 20
Age, median (IQR)	58 (52, 72)
Female	50%
Race/Ethnicity ^b	
White	45%
Black	30%
Asian	15%
Hispanic	10%
Education level	
High school	15%
Associate	25%
Bachelor	25%
Master	15%
Doctoral	20%
Electronic device used for telemedicine	
Smartphone	55%
iPad	15%
Laptop or desktop	30%
Payor	
Medicare	50%
Private	40%
Medicaid	10%
State of residence	
Maryland	70%
Pennsylvania	25%
Delaware	5%
Resident of rural area	5%
Proximity to center, median miles, IQR	41 miles (25, 64)
<20 miles	15%
20–49 miles	45%
50–99 miles	30%
>100 miles	10%
Zip code median household Income, IQR	\$94 586 (68 075, 121 550)
Year from transplant, median (IQR)	5 (2, 9)
Serum creatinine, median (IQR)	1.21 (1.10, 1.42)
Immunosuppressive therapy	
Tacrolimus	85%
Sirolimus	15%
Mycophenolate mofetil	50%
Prednisone	90%
Antihypertensive therapy	90%
Antidiabetic therapy ^c	50%

^aAll study participants had experienced both telemedicine and in-person visits.

^bSelf-identified race/ethnicity.

^cMost common antidiabetic therapy (70%) was an insulin regimen, and 30% was an oral regimen only.

3.1 | Theme: Reducing Travel Time

Many participants expressed that telemedicine visits were more time-efficient than in-person visits. Participants shared their far distances to travel for in-person visits, and that they would have to commit to more time than the actual visit needed due to commute and waiting room times. Working participants shared that scheduling a telemedicine visit was preferred so “*they would not have to take time off the entire day*” and could do it in a secure space from work or home. Some participants said they used virtual platforms because their jobs changed during the pandemic, so it was a smoother process than going in person. Overall, participants considered less time commitment to the follow-up care a perk of telemedicine visits.

3.2 | Theme: Minimizing Financial Burden

Most participants commonly associated in-person visits with travel-related expenses and time off work. Participants shared that they accumulated expenses such as parking fees, gas, toll fees, and missed workdays when they came in person for follow-up care. Some participants also discussed that commuting for in-person visits increased stress and led to other costs that may not have been accounted for. For example, a participant shared that they were anxious heading back from their appointment to get back to work, and they ended up with a speeding ticket on top of other incurred costs. Participants viewed telemedicine as a possible solution to reduce extraneous expenses while maintaining their relationship with providers.

3.3 | Theme: Engaging Patients Within Their Comfort Space

Many participants expressed feeling at ease and more relaxed during a telemedicine visit, which facilitated them sharing information and communicating with their providers. They preferred being able to complete follow-up care from the comfort of their own space. Some participants expressed the luxury of being at home, which made the experience less stressful and reduced their apprehension towards the visit. For example, a participant stated, “I was comfortable sharing personal information since, like I said, I’m in my own house. So, it’s easier to actually even sometimes talk to the doctor when you’re at home.” Another participant said, “I would choose the telemedicine because it’s helped me, I mean, and it improved my communication with the team and all that stuff. It’s helped in my situation.”

3.4 | Theme: Establishing Rapport With Patients

Many participants described that their established relationship with providers through previous in-person visits made it much easier to discuss information over telemedicine visits. Participants expressed concerns about connecting to their providers over telemedicine if they had never met them in person and felt that the telemedicine visits would be impersonal. Some participants felt that they liked interacting with their providers in person rather than through telemedicine visits and only sufficed with a telemedicine visit due to the convenience and safety that

TABLE 2 | Themes and illustrative quotations.

Theme	Representative quote
Reducing travel time	<p>“Well, when I go down to the hospital for in-person appointments, I live, at least, an hour-and-a-half, two hours away. So I have to include all the travel time to and from face-to-face appointments. So if it’s just a video appointment, I only need the time for the video, so it’s much better, more convenient.” (263)</p> <p>“I mean like I say, this way is more convenient. I’m in my house here, and from here to the John Hopkins Hospital, I’m about 30 minutes dealing with the traffic, 30 minute go, and 30 minute comeback, so actually, this way is more convenient. It’s more convenient and I believe it’s accomplish the purpose, accomplish the purpose.” (261)</p>
Minimizing financial burden	<p>“Well, yeah, you talk about gas, and you know how much gas is right now, and then you got to pay– yeah, then you got to pay for parking. I do pay for parking, and it’s an added cost. It’s an added cost, and then I’m elderly too. I’m on a fixed income, so it’s not where—it’s a cost. It’s a cost. Like you say, gas is, what, \$4 and something a gallon, and then I’m coming about half an hour to 45 minutes away, and then I got to pay for parking, and then if I stop in the little snack cart, get a cup of coffee or get a cup of juice, yeah, it’s a little added expense on those particular days in-person.” (256)</p> <p>“Oh, I think video visits are cheaper as when you go to cost. No gas. You can prepare a lot of it in advance, if you’re that type of person to do that. And I learned from—I was in the air force that if you start taking medication we’re going to have to ground you. You’re not going to be able to fly. Now, from the standpoint that I enjoy flying. And secondly, I got paid more money. So it’s less expensive video visits for me all the way down. So I developed that mindset that you got to do all you can. I have to do all I can to make sure that I’m as knowledgeable as I can be. So therefore I’m able to prepare myself and then stay on flying status, make more money and in essence, it’s cheaper. Video visits are cheaper to me.” (270)</p>
Engaging patients within their comfort space	<p>“Well, you can let the person know that number one your house is more comfortable. Or your apartment is more comfortable than going out, you know, you don’t have to really get dressed to make the appointment at the hospital. You can sit home and put on your relaxing clothes and have the appointment.” (255)</p> <p>“It was a little... how can I say, it was more relaxing, and I could focus more because I was at my house and I had what I needed in front of me. And it’s kind of hard coming from where I live at to Baltimore, you know, and just, you know, for an hour visit and so forth. So, it’s a lot easier and you already have the information, it’s pretty much going over everything.” (271)</p> <p>“I thought it was easy and comfortable. The directions to sign on was easy and pretty much fine. I followed the directions. So, it was no problem for me. I thought it was easy. I loved the video meetings because it was quick, easy, comfortable. You’re in the presence of your own home. So, it was relaxed.” (273)</p>
Establishing rapport with patients	<p>“I’m trying to think, but I think I have had personal visits with everybody that I’ve had video visits with, so as long as I—it’s just more personal if you knew them, so I like that better. But I don’t know that that would really stop me from doing it.” (257)</p> <p>[in-person] “I just feel it’s a better connection with the doctor, and comfort level, insurance that, “Yeah, things are really going well,” and I don’t know if that’s a psychological because I’m used to having in-person visits and this is all new, but I do like—if everything’s status quo, telemed visits work because it’s more convenient and less time.” (266)</p> <p>[telemedicine] “The nephrologist and the staff were more interactive. They were freer to talk and I think that was important. It opened up the conversations and I liked it. It was good.” (268)</p>
Limitations of the virtual physical exam	<p>“Given that every time I see a nephrologist, the nephrologist generally checks my heart and checks my blood pressure, which I can do that myself. Not checking my heart, but that’s obviously totally absent. There’s no physical element to virtual call. I suppose there’s a belief that the healing hands of doctors matter somewhat. I think in the end, it’s like you have—I suppose whereas a telephone call is sort of one-dimensional and a video call is two-dimensional, if you see someone in person, it’s three-dimensional.” (258)</p>

(Continues)

TABLE 2 | (Continued)

Theme	Representative quote
Enhancing access to transplant providers	“I think that the in-person visits are important, if you do have a problem and you need to go there and they need to look at it. But if your tests and everything is coming out normal, and you’re not complaining or anything, you up-to-date with your communication with the doctor and also the transplant coordinator, which I am always in contact with my coordinator to let them know every little thing that happens. So I think certain patients should go in person and certain patients don’t need to go in person, according to your condition.” (260)
	“Okay, it depends upon my physical health. If I have some kidney problems, I prefer to visit in person, because I want the doctor to examine my physical exam. But, like now, if I don’t have any problems, just like regular checkup, I prefer a video visit, because it’s more convenient for me.” (264)
	“It just makes it easier to have less appointments there in the hospital and kind of like doing it more virtually just because it’s—like I said, it’s more accessible for people like me who work and live kind of like an hour away. So, it’s a great option. So, I’m really thankful for that and they do a great job in doing that service. I don’t feel like I’m getting treated less because it’s like a video visit. So, yeah.” (259)
	“It’s five times a year I’m driving down three and a half hours and back here three and a half hours. I would really—and I’m young. I can drive myself. If I was an elderly patient in more frail health, that would become a big issue. I’d have to get somebody to be transporting me back and forth. So I think video visits might actually help with compliance, especially for socioeconomically disadvantaged or elderly patients that don’t drive.” (262)
Lowering the risk of communicable diseases	“I would choose the telemedicine because it’s helped me, I mean, and it improved my communication with the [transplant] team and all that stuff. It’s helped in my situation.” (269)
	“I know some people may feel it’s impersonal but it keeps, you know, with as many viruses and stuff that’s going around, especially in the winter now, it keeps recipients safer by being in their own home instead of bringing them down to the hospital to see the doctor.” (265)
	“I think it’s a lot better because you’re not actually going there around six people that then you can get sick, because I’ve experienced that before, that I’ve gone there and then end up getting sick like a couple days after or a couple weeks after.” (274)

it provided. A participant stated, “I always enjoy meeting the doctors in person and asking them questions.” In contrast, few participants felt they were better connected with providers during telemedicine visits; for example, a participant said, “I mean, it really felt like you were in the same room with him because his focus is really just on you and the camera and he was able—I was able to ask all my questions that I needed to ask and the physician was attentive and was answering all my questions ... The only difference is that you don’t physically get touched. But other than that, like it’s just going to like a regular doctor’s office.”

3.5 | Theme: Limitations of the Virtual Physical Exam

Many participants expressed the need for improvement in the physical exam portion of their telemedicine visit compared to an in-person physical exam. They shared their concerns about the provider not being able to see or examine their complete body or their doubts about the accuracy of their home vital measurements. For example, a participant said, “I think one of the things that I was I guess concerned about was the doctors didn’t always get a full read of my body. They only see this much.” Most

participants mentioned their preference for an in-person visit for pressing physical health concerns. A participant explained, “I think for my first year it was really important to have in-person, but I think now that it’s pretty much just lab checks I would prefer the ability to have video. So, I think it depends on how far out you are from transplant and whether you have a physical problem that they really need to look at ... So, I think it really depends on the problem. You can’t just say one or the other. It’s like, each one is better for certain sets of circumstances.”

3.6 | Theme: Enhancing Access to Transplant Providers

Most participants emphasized the role of telemedicine in increasing access to transplant follow-up care. Some participants mentioned that telemedicine allowed them to complete follow-up visits overcoming a difficult work schedule or transportation. A participant mentioned that telemedicine can improve adherence to follow-up visits, especially for those from underserved communities stating, “I think video visits might actually help with compliance, especially for socioeconomically disadvantaged or elderly patients that don’t drive.” Another participant reported

that telemedicine provided flexibility with scheduling saying, “It was great. They actually had a lot of availability when I was scheduling calls. I never had any problem trying to find the perfect time that I would want to be in—need to have an appointment.” Further, some participants mentioned that they had more attention from transplant providers during their telemedicine visits compared to in-person visits due to the fast-paced environment of the hospital and generally hurried physicians. For instance, a participant discussed her experience with in-person visits, “They seem very harried . . . I think they’re overworked and understaffed. Sometimes I had to ask a question twice to really get the provider to focus.”

3.7 | Theme: Lowering Risk of Communicable Diseases

Many participants discussed that one of the major advantages of telemedicine visits was the reduced risk of contracting an infectious disease, especially upper respiratory infections including COVID-19. For instance, a participant explained, “Under no circumstances could I have any upper respiratory infection and COVID is upper respiratory. So, outside of doing a lot of exercise, walking in the neighborhood—everyone in our neighborhood knows us and they just keep away. If we have to talk, we’ll talk on the computer.” Participants mentioned that they felt telemedicine visits were safer because they prevented them from coming into direct contact with a lot of people, especially in clinic waiting rooms.

4 | Discussion

In this qualitative study, kidney transplant recipients provided their experiences and preferences regarding the capacity and role of telemedicine/in-person care in post-transplant follow-up. They perceived several benefits of telemedicine over in-person care, such as its convenience and comfort and the reduced logistical and financial burdens, especially for those facing difficulties with traditional in-person visits. Participants valued telemedicine in increasing access to transplant providers and reducing exposure to infectious diseases. Despite these advantages, participants expressed concerns about the limitations of telemedicine in physical examination and human connection. Overall, the study themes illuminate telemedicine’s value in routine follow-up care and highlight areas for improvement while emphasizing the importance of in-person visits for pressing physical health concerns. We highlight key areas where telemedicine can be improved to serve this patient population better.

Our findings are consistent with previous research on the advantages and barriers of telemedicine in kidney transplant care [24, 25]. Herein, we underscore the need to enhance clinical practices to integrate telemedicine in follow-up care for kidney transplant recipients effectively. While combining telemedicine with in-person visits can mitigate some limitations of remote physical exams, our findings emphasize the urgent need for enhanced technological tools to advance this task, for example, wearable devices and remote monitoring tools capable of transferring real-time patient data to healthcare providers, while leveraging artificial intelligence to analyze case progress against historical

data. Innovative solutions for virtual patient assessment are crucial to ensure that this is not a barrier to telemedicine practice, especially for patients with limited access to transplant centers, such as those from underserved communities or with travel time, work or caregiving constraints. Furthermore, the results of this study re-affirm the challenges patients face in establishing rapport with providers through telemedicine. Although this study does not include clinician perspectives, a prior national survey of U.S. transplant providers revealed that many are hesitant to rely on telemedicine exams and view communication technology issues as a barrier to telemedicine expansion. It is also noteworthy that providers perceive out-of-state licensing and payor reimbursement as a key policy/regulatory barrier to telemedicine services [15]. Advancing telemedicine policies, care techniques to improve human connection and providing comprehensive training to clinicians for effective virtual communication are critical steps in the evolution of telemedicine in transplantation. Relevantly, our findings call for regulatory efforts against any statutory limitations that were in place for Medicare telehealth services prior to the COVID-19 Public Health Emergency [17]. Policymakers should take proactive steps to support and expand access to telemedicine services, particularly for the immunocompromised transplant population.

This study underlines areas for clinical practice to advance the adoption of hybrid telemedicine/in-person care in kidney transplant follow-up: (1) Telemedicine can be used for routine follow-up visits and nonurgent consultations, enhancing patient comfort and engagement. (2) Telemedicine cannot fully replace the comprehensive physical assessments of in-person visits; telemedicine visits can be spaced out based on the patient’s stability after transplant, with more frequent in-person assessments in the first months’ post-transplant and less frequent visits thereafter. (3) Technical and staff support for patients and providers is essential to maximize the effective use of telemedicine and ensure a seamless telemedicine experience. (4) Guidance for patients on performing self-examinations or using home monitoring equipment can improve the quality of virtual physical assessments. (5) Integration of telemedicine into a multidisciplinary care approach can improve communication and collaboration among multidisciplinary healthcare providers in post-transplant care. (6) A hybrid model should be patient-centered, flexible, and adaptable to each patient’s unique needs and preferences. Thus, the frequency and modality of follow-up care should be tailored to changes in a patient’s health status or complications, a hybrid approach that prioritizes patient-centered care. (7) Transplant centers need to communicate the benefits of telemedicine in reducing the risk of communicable diseases and encourage its use among transplant recipients. (8) Policymakers and healthcare systems must incentivize the implementation and expansion of telemedicine services in transplant care.

Quality standards traditionally applied to in-person visits must equally govern telemedicine visits to ensure the quality of follow-up care for kidney transplant recipients [26]. It is imperative that the implementation of telemedicine programs does not inadvertently disadvantage under-resourced and linguistically diverse communities, which may lack the necessary technological literacy. Providers must also uphold the highest ethical standards in telemedicine interactions to safeguard patient autonomy and trust. Additionally, ensuring access to reliable internet

connections and electronic devices for low-income individuals and those in rural areas is crucial, as telemedicine can enhance their access to transplant centers.

Our study has some limitations. First, despite purposive sampling, our sample under-represented Hispanic individuals, acknowledging that only 7% of kidney transplant recipients at our center are Hispanic patients. Second, although non-English speakers were eligible, none participated, which may indicate unique challenges for this group in accessing telemedicine that warrant further investigation, especially at transplant centers with a large volume of non-English speakers, as these patients should not be marginalized using telemedicine. Third, our study represents patients who were able to access and use telemedicine synchronous video visits, which could influence our findings. Future research may explore the perspectives of patients who have difficulties accessing telemedicine, as well as assess patient views on alternative telemedicine modalities such as asynchronous models, which were not the focus of our study. Fourth, our study lacks insights from patient caregivers, which is another important area for further study to fully understand the impact of telemedicine on the broader care network, recognizing prior findings that show partner participation in telemedicine can improve care quality, especially for patients with limited health literacy [27]. Furthermore, our study was conducted during the Public Health Emergency, which may have influenced participants' perceptions towards telemedicine due to health safety concerns. However, our study included participants who had follow-up after the transplant programs and learned how to cope with the pandemic through in-person visits. While the pandemic accelerated telemedicine adoption, our findings remain relevant as its accessibility continues to grow post-pandemic.

Our study has several strengths. Our study's in-depth qualitative approach provided a rich understanding of patient experiences and the factors affecting their preferences for telemedicine. These are widely applicable and offer valuable considerations for other transplant centers aiming to develop or enhance their telemedicine practices. Further, our rigorous qualitative methods ensured the trustworthiness of our findings. We adhered to dependability, confirmability, credibility, and transferability through the use of multiple coders, analytic memos, and consensus-building techniques. Whereas the concept of results generalizability applies to quantitative studies, the concept of results transferability is used for qualitative studies, which refers to the extent to which qualitative findings could be achieved in other similar situations. Though our findings have been generated at a single center with specific characteristics, kidney transplant recipients' experiences, barriers, and preferences of telemedicine are highly transferrable to other contexts and useful considerations for other transplant centers that are interested in advancing or starting their own telemedicine practices.

In conclusion, this study highlights the benefits of integrating telemedicine into the follow-up care of kidney transplant recipients, including increased patient comfort, improved efficiency, reduced financial burden, and improved patient access to transplant care. However, challenges remain, particularly concerning the limitation of virtual physical exams and the need to establish rapport with patients. A hybrid model that combines the strengths of both telemedicine and in-person

visits may offer the most effective approach for post-transplant care. Future research should focus on refining this hybrid model, exploring innovative ways to integrate physical examinations into telemedicine, and addressing issues related to human connection and equitable access to technology. It is also imperative to assess the impact of telemedicine on patient outcomes in kidney transplantation. Furthermore, policymakers and healthcare systems need to eliminate barriers to telemedicine adoption and establish a supportive infrastructure to ensure its efficacy.

Author Contributions

Fawaz Al Ammary had full access to all the data in the study and took responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Fawaz Al Ammary, Hannah C. Sung, Suade Esayed, and Ellie Kim. Conducting interviews: Fawaz Al Ammary, Suade Esayed, and Ellie Kim. Codebook development: Fawaz Al Ammary, Hannah C. Sung, Suade Esayed, and Ellie Kim. Analysis of data and interpretation: Fawaz Al Ammary, Hannah C. Sung, Suade Esayed, Ellie Kim, Abdula Al-Seraji, and Hayden Troutt. Drafting of the manuscript: Fawaz Al Ammary, Hannah C. Sung, Suade Esayed, Ellie Kim, Abdula Al-Seraji, and Simeon Adeyemo. Critical revision of the manuscript for important intellectual content: Fawaz Al Ammary, Hannah C. Sung, Suade Esayed, Ellie Kim, Simeon Adeyemo, Hayden Troutt, Ekamol Tantisattamoa, Antoney Ferrey, Uttam G. Reddy, Fatima T. Malik, Robert R. Redfield, Hirohito Ichii, Abimereki D. Muzaale, and Divyanshu Malhotra. Obtained funding: Fawaz Al Ammary. Administrative, technical, and material support: Fawaz Al Ammary, Hannah C. Sung, and Divyanshu Malhotra. Study supervision: Fawaz Al Ammary and Hannah C. Sung.

Acknowledgments

This work was supported by the National Institute of Diabetes and Digestive and Kidney Diseases and the National Institute on Aging: K23DK129820 (Al Ammary) and K08AG065520 (Muzaale).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

References

1. D. A. Axelrod, N. Dzebisashvili, M. A. Schnitzler, et al., "The Interplay of Socioeconomic Status, Distance to Center, and Interdonor Service Area Travel on Kidney Transplant Access and Outcomes," *Clinical Journal of the American Society of Nephrology: CJASN* 5, no. 12 (2010): 2276–2288.
2. T. S. Purnell, X. Luo, L. M. Kucirka, et al., "Reduced Racial Disparity in Kidney Transplant Outcomes in the United States From 1990 to 2012," *Journal of the American Society of Nephrology: JASN* 27, no. 8 (2016): 2511–2518.
3. T. S. Purnell, X. Luo, D. C. Crews, et al., "Neighborhood Poverty and Sex Differences in Live Donor Kidney Transplant Outcomes in the United States," *Transplantation* 103, no. 10 (2019): 2183–2189.
4. I. G. Okpechi, V. A. Luyckx, S. Tungsanga, et al., "Global Kidney Health Priorities – Perspectives From the ISN-GKHA," *Nephrology Dialysis Transplantation* 39, no. 11 (2024): 1762–1771.
5. C. D. Manko, B. J. Apple, A. R. Chang, K. M. Romagnoli, and B. L. Johannes, "Telemedicine in Advanced Kidney Disease and Kidney

- Transplant: A Qualitative Meta-Analysis of Studies of Patient Perspectives,” *Kidney Medicine* 6, no. 7 (2024): 100849.
6. F. Al Ammary, B. P. Concepcion, and A. Yadav, “The Scope of Telemedicine in Kidney Transplantation: Access and Outreach Services,” *Advances in Chronic Kidney Disease* 28, no. 6 (2021): 542–547.
 7. W. Duettmann, M. G. Naik, B. Zukunft, et al., “eHealth in Transplantation,” *Transplant International: Official Journal of the European Society for Organ Transplantation* 34 (2021): 16–26.
 8. S. Lambooy, R. Krishnasamy, A. Pollock, G. Hilder, and N. A. Gray, “Telemedicine for Outpatient Care of Kidney Transplant and CKD Patients,” *Kidney International Reports* 6, no. 5 (2021): 1265–1272.
 9. N. Andrew, K. A. Barraclough, K. Long, et al., “Telehealth Model of Care for Routine Follow up of Renal Transplant Recipients in a Tertiary Centre: A Case Study,” *Journal of Telemedicine and Telecare* 26, no. 4 (2020): 232–238.
 10. F. M. Koraishy and R. R. Telenephrology, “An Emerging Platform for Delivering Renal Health Care,” *American Journal of Kidney Diseases* 76, no. 3 (2020): 417–426.
 11. E. Kim, H. C. Sung, K. Kaplow, et al., “Donor Perceptions and Preferences of Telemedicine and In-Person Visits for Living Kidney Donor Evaluation,” *Kidney International Reports* 9, no. 8 (2024): 2453–2461.
 12. A. Schmid, S. Hils, A. Kramer-Zucker, et al., “Telemedically Supported Case Management of Living-Donor Renal Transplant Recipients to Optimize Routine Evidence-Based Aftercare: A Single-Center Randomized Controlled Trial,” *American Journal of Transplantation: Official Journal of the American Society of Transplantation and the American Society of Transplant Surgeons* 17, no. 6 (2017): 1594–1605.
 13. A. Yadav and P. Singh, “Telehealth Use by Living Kidney Donor Transplant Programs During the COVID-19 Pandemic and Beyond: A Practical Approach,” *Current Transplantation Reports* 8, no. 4 (2021): 257–262.
 14. R. C. Forbes and B. P. Concepcion, “Use of Telehealth to Expand Living Kidney Donation and Living Kidney Donor Transplantation,” *Current Transplantation Reports* 7, no. 2 (2020): 56–61.
 15. F. Al Ammary, J. D. Motter, H. C. Sung, et al., “Telemedicine Services for Living Kidney Donation: A US Survey of Multidisciplinary Providers,” *American Journal of Transplantation: Official Journal of the American Society of Transplantation and the American Society of Transplant Surgeons* 22, no. 8 (2022): 2041–2051.
 16. F. Al Ammary, A. D. Muzaale, E. Tantisattamo, et al., “Changing Landscape of Living Kidney Donation and the Role of Telemedicine,” *Current Opinion in Nephrology and Hypertension* 32, no. 1 (2023): 81–88.
 17. F. Al Ammary, C. Sidoti, D. L. Segev, and M. L. Henderson, “Health Care Policy and Regulatory Challenges for Adoption of Telemedicine in Kidney Transplantation,” *American Journal of Kidney Diseases: The Official Journal of the National Kidney Foundation* 77, no. 5 (2021): 773–776.
 18. A. Yadav, K. Caldararo, and P. Singh, “Optimising the Use of Telemedicine in a Kidney Transplant Programme During the Coronavirus Disease 2019 Pandemic,” *Journal of Telemedicine and Telecare* 28, no. 7 (2022): 530–532.
 19. B. J. Boyarsky, J. M. Ruck, T. P. Chiang, et al., “Evolving Impact of COVID-19 on Transplant Center Practices and Policies in the United States,” *Clinical Transplantation* 34, no. 12 (2020): e14086.
 20. A. Tong, J. R. Chapman, A. Israni, E. J. Gordon, and J. C. Craig, “Qualitative Research in Organ Transplantation: Recent Contributions to Clinical Care and Policy,” *American Journal of Transplantation: Official Journal of the American Society of Transplantation and the American Society of Transplant Surgeons* 13, no. 6 (2013): 1390–1399.
 21. A. Tong and M. A. Dew, “Qualitative Research in Transplantation: Ensuring Relevance and Rigor,” *Transplantation* 100, no. 4 (2016): 710–712.
 22. A. Tong, P. Sainsbury, and J. Craig, “Consolidated Criteria for Reporting Qualitative Research (COREQ): A 32-item Checklist for Interviews and Focus Groups,” *International Journal for Quality in Health Care* 19, no. 6 (2007): 349–357.
 23. B. C. O’Brien, I. B. Harris, T. J. Beckman, D. A. Reed, and D. A. Cook, “Standards for Reporting Qualitative Research: A Synthesis of Recommendations,” *Academic Medicine* 89, no. 9 (2014): 1245–1251.
 24. B. Hezer, E. K. Massey, M. E. J. Reinders, et al., “Telemedicine for: Kidney Transplant Recipients Current State, Advantages, and Barriers,” *Transplantation* 108, no. 2 (2024): 409–420.
 25. B. M. Huuskes, N. Scholes-Robertson, C. Guha, et al., “Kidney Transplant Recipient Perspectives on Telehealth During the COVID-19 Pandemic,” *Transplant International: Official Journal of the European Society for Organ Transplantation* 34, no. 8 (2021): 1517–1529.
 26. A. Qaseem, C. H. MacLean, S. Tierney, et al., “Performance Measures for Physicians Providing Clinical Care Using Telemedicine: A Position Paper From the American College of Physicians,” *Annals of Internal Medicine* 176, no. 5 (2023): 694–698.
 27. K. Ladin, T. Porteny, J. M. Perugini, et al., “Perceptions of Telehealth vs In-Person Visits Among Older Adults With Advanced Kidney Disease, Care Partners, and Clinicians,” *JAMA Network Open* 4, no. 12 (2021): e2137193.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.