

## OPEN

# Development and Preliminary Evaluation of a Patient-facing Educational Video About Live Kidney Donor Surgical Complications

Sophia Smith, BA,<sup>1</sup> Nicole Haseley, RN, BS,<sup>1</sup> Maria Keller, MS,<sup>2</sup> Renee Cadzow, PhD,<sup>3</sup> Thomas H. Feeley, PhD,<sup>4</sup> and Liise K. Kayler, MD, MS<sup>1,5</sup>

**Background.** Living kidney donation (LKD) improves transplant access; however, its use is compromised, in part, by individuals' unaddressed concerns about perioperative complications. **Methods.** We developed an animated, patient-centered educational video about LKD surgical complications, with input from experts in transplantation, communication, and anthropology, 35 patients/care partners (5 LKD candidates, 5 prior LKDs, 10 kidney transplant recipients, 10 kidney transplant candidates, 5 care partners), and 1 community advocate. We then conducted an online pre-post study with 24 potential kidney donors and recipients to measure the video's acceptability and feasibility to improve donation complication knowledge and concerns. **Results.** Knowledge of LKD surgical complications increased 23% (mean 5.7 to 7.0,  $P < 0.01$ ) from pre- to post- animation viewing. Large knowledge effect size increases were observed for different levels of age, race, health literacy, and technology access. The frequency of positive responses about donation safety increased from 88% preanimation to 96% postanimation. Concerns about surgical complications remained at 17% before and after exposure. After viewing the animation, over 90% indicated positive ratings on ease of watching, understanding, and engaging. **Conclusions.** An animated educational video about LKD surgical complications was developed in collaboration with multiple stakeholders. The video was well received and promised to positively impact individuals' knowledge and concerns.

(*Transplantation Direct* XXX;00: e00; doi: 10.1097/TXD.0000000000001194. Published online 6 August, 2021.)

Received 12 May 2021.

Accepted 1 June 2021.

<sup>1</sup> Department of Surgery, Transplant and Kidney Care Regional Center of Excellence, Erie County Medical Center, Buffalo, NY.

<sup>2</sup> Department of Community Health and Health Behavior, State University of New York at Buffalo, Buffalo, NY.

<sup>3</sup> Department of Health Administration and Public Health, D'Youville College, Buffalo, NY.

<sup>4</sup> Department of Communication, State University of New York at Buffalo, Buffalo, NY.

<sup>5</sup> Department of Surgery, Jacobs School of Medicine and Biomedical Sciences, State University of New York at Buffalo, Buffalo, NY.

This study is supported by The Health Resources and Services Administration (HRSA) of the US Department of Health and Human Services (HHS) under grant number R39OT31887 as part of an award totaling \$1.2 million with no percentage financed with nongovernmental sources. The contents are those of the author(s) and do not necessarily represent the official views of, nor an endorsement by, HRSA, HHS, or the US Government. For more information, please visit HRSA.gov. The authors declare no conflicts of interest.

L.K.K. and T.H.F. participated in research design, analysis, article preparation and editing. S.S. participated in data collection, analysis, and article preparation. M.K. participated in analysis. R.C. and N.H. participated in editing.

Correspondence: Sophia Smith, BA, Department of Surgery, Erie County Medical Center, 462 Grider St, Buffalo, NY 14215. (ssmith13@ecmc.edu).

Copyright © 2021 The Author(s). *Transplantation Direct*. Published by Wolters Kluwer Health, Inc. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

ISSN: 2373-8731

DOI: 10.1097/TXD.0000000000001194

## INTRODUCTION

The shortage of kidneys from deceased donors has created a backlog of nearly 100 000 individuals waiting on the list.<sup>1</sup> A solution to increase the opportunity for kidney transplantation is living kidney donation (LKD), but only approximately 6000 LKDs happen in the United States every year. A primary reason for low LKD is individual concern for the donor's medical outcome, including perioperative complications. Although rates of major complications after donation surgery are low,<sup>2</sup> individual concern about donor perioperative complications has been cited by candidates who refuse kidney offers,<sup>3,4</sup> by friends and family members who do not volunteer to donate,<sup>4</sup> and by the general public hypothetically considering donation.<sup>5</sup>

Intervention research has shown that increased knowledge mediates kidney donation,<sup>6</sup> which has been primarily attributed to a decrease in the perception of risks.<sup>7</sup> Acquiring greater knowledge about LKD helps increase candidate willingness to accept living donation<sup>3</sup> and allay potential donors' fears.<sup>8-10</sup> However, explaining perioperative risks to lay individuals is challenging. Although some risks are easily learned, such as the risk of death due to donation, other donation-related risks are not well understood despite patient-centric education.<sup>11</sup> Incomplete information, fear of the unknown, and misperceptions can weaken candidate acceptance of LKD and donor volunteerism. Past living donors have stated that the most useful topics for making a decision about donation were postoperative care and short-term medical risks such as

infection, hernia, pneumonia, or blood clots after surgery.<sup>12</sup> Other research, including our own, suggests that patients and families evaluating LKD educational materials desire more information about surgical risks,<sup>13</sup> and improved transparency may promote awareness and trust in LKD.<sup>14</sup>

Videos have been recommended as useful educational aids by past living donors.<sup>12</sup> In particular, animated video is recognized as a powerful instructional format that may promote understanding by widening audiences, with the added benefit of reducing anxiety.<sup>15-17</sup> Our research team recently developed a series of educational animations about living kidney donation and transplantation, named *KidneyTIME*, in a stakeholder-driven process that has been previously published.<sup>13</sup> During the subsequent proof of concept testing, additional information needs about donation surgical complications were identified.<sup>18</sup> In this paper, we (1) review the development process of an animated educational video about perioperative complications of LKD for lay individuals and (2) report preliminary evidence of the video's acceptability and feasibility in an online pilot study with potential kidney donors and recipients.

## MATERIALS AND METHODS

The study included 3 components. First, we used qualitative methods to develop content for an educational animated video about perioperative complications of LKD. Second, we developed a survey to test knowledge and concerns related to the content of the video. Third, we performed a preliminary evaluation of the video, with an uncontrolled, quasi-experimental, 1-group, pre-post study conducted online. This study was approved by the University at Buffalo, The State University of New York Institutional Review Board.

### Component 1: Development of the Video

Between February 2020 and September 2020, an iterative, evidence-based, and stakeholder-driven process was used to develop the video. The approach included theoretical underpinnings and health communications best practices. As shown in Figure 1, 4 domains were addressed in the development process: (1) health communications and animation best practices; (2) integration of conceptual and theoretical frameworks; (3) stakeholder engagement; and (4) use of a multidisciplinary team.

The content for the video was based on the literature, guided by health communications best practices, and written and reviewed by subject experts (Figure 1). Key content included: (i) complications that occurred during or close to the time of surgery (eg, conversion to open, bleeding, deep vein thrombosis, incisional hernia, death), (ii) donor behaviors to enhance recovery (eg, walking, avoiding heaving lifting), and (iii) mitigating actions of healthcare providers (eg, thorough screening, blood transfusion). The content was transformed into a script and was reviewed and rewritten by a health communication expert and an opportunistic layperson using plain language in a conversational style with active voice. Both content and visuals were carefully developed for a multicultural population and used the characters featured in the *KidneyTIME* video curriculum.<sup>13</sup> Informal reviews were conducted with the experts through email or in person and recorded with field notes.

Stakeholders (kidney transplant candidates and recipients, kidney donors and potential donors, and care partners) were

involved throughout the process, and many changes were made based on their feedback. Feedback was continuously obtained through cognitive interviews and incorporated into the next version of the animation.<sup>12</sup> The 35 cognitive interviews were conducted in-person before March 13 (n = 16) and moved online after March 13 (n = 19) to promote stay-at-home efforts due to the Coronavirus disease 2019 (COVID-19) pandemic. Participants were individuals who had participated in the original *KidneyTIME* video development research study, which included consent for multiple viewing sessions.<sup>13</sup> Those who were first to schedule an interview were enrolled. Sessions were conducted using an interview guide to gather information about animation suitability and acceptability. African American patients were purposively approached to achieve a minimum of 40% of the kidney transplant candidate/recipient sample. In-person sessions were audio recorded and transcribed verbatim, and telephone sessions were recorded with accompanying field notes.

The theoretical construct of Self-Efficacy Theory was operationalized by using characters representative of the target audience, modeling character actions, and providing gain-framed messages and images of supportive healthcare providers.<sup>13</sup> We emphasized providing information in an emotionally reassuring way. Information was organized based on Elaboration Theory, which starts with the problem and then sequentially introduces each relevant concept.<sup>13</sup> Animation design was informed by animation multimedia learning theory,<sup>19</sup> which describes how to blend audio and visual stimuli to promote visual ease and quickly align the viewer mentally to maintain orientation to the message. The video design was a short 2-dimensional animation of standalone education optimized for viewing on small screens. The senior author oversaw the development and production of the video, working closely with the animator.

### Component 2: Development of Surveys

A multidisciplinary group of transplant providers and researchers developed questionnaires—aligned with animation content and written with simple language—to examine knowledge and concerns about LKD complications. Research staff used the questionnaires to conduct cognitive interviews with 7 kidney transplant recipients, 3 prior living kidney donors, 2 potential kidney donors, and 1 care partner. Research staff asked respondents about item clarity, relevance, and response option inclusiveness. Their responses were used to modify the questions.

### Component 3: Feasibility and Acceptability Testing of the Final Video

Between October 2020 and January 2021, the final video was evaluated with potential kidney recipients and donors who had received standard education at Erie County Medical Center (NY). Inclusion criteria were at least 18 y of age, English speaking, and email available in administrative records.

Consecutive potential kidney recipients and donors meeting inclusion criteria were emailed invitations that contained a link to the study, an opt-out option, and contact information for the research coordinator. Those who did not participate after the invitational email received up to 2 telephone calls. The study link was valid for 2 mo or until they donated a kidney or received a transplant, respectively, whichever came

## Health Communications & Multimedia Best Practices

Frameworks	Content	Design
Evidence Based	<ul style="list-style-type: none"> <li>Literature review</li> <li>Written and re-reviewed by subject experts (1 KTX surgeon, 1 KTX nephrologist, 3 living donor coordinators, 1 post-donation nurse)</li> </ul>	<ul style="list-style-type: none"> <li>Standalone education</li> <li>Mobile-friendly</li> <li>Short duration</li> </ul>
Health Literacy	<ul style="list-style-type: none"> <li>Audio-visual format</li> <li>Plain language, conversational style, active voice</li> <li>Review and re-review by 1 health communication expert and 1 layperson</li> </ul>	<ul style="list-style-type: none"> <li>Writing guidelines &amp; training for research and production teams</li> </ul>
Cultural Relevance	<ul style="list-style-type: none"> <li>Specific topics responsive to minority concerns</li> <li>Review by experts (1 medical anthropologist, 1 African American community advocate)</li> </ul>	<ul style="list-style-type: none"> <li>Identifying donor &amp; provider characters</li> <li>Review of previously produced characters and images</li> </ul>

### Conceptual & Theoretical Frameworks

Frameworks	Content	Design
Self-efficacy Theory	<ul style="list-style-type: none"> <li>Review of content for emotional and cognitive messages</li> </ul>	<ul style="list-style-type: none"> <li>Representative characters</li> <li>Modeling patients &amp; providers</li> <li>Positive framing</li> </ul>
Elaboration Theory	<ul style="list-style-type: none"> <li>Complications as main concept</li> <li>Other facts added 'just in time'</li> </ul>	<ul style="list-style-type: none"> <li>Simplifying conditions method</li> </ul>
Animation Multimedia Learning Theory	<ul style="list-style-type: none"> <li>Review of presentation format for orientation to message</li> </ul>	<ul style="list-style-type: none"> <li>Synchronized audio with images</li> <li>Signaling</li> </ul>

### Stakeholder Engagement

Frameworks	Content	Design
Stakeholder Input	<ul style="list-style-type: none"> <li>Review by target audience (10 KTX candidates, 10 KTX recipients, 5 potential LKDs, 5 LKDs, 5 care partners)</li> <li>Systematic Review Process</li> </ul>	<ul style="list-style-type: none"> <li>Develop content refinement &amp; review process</li> <li>Interviews &amp; User testing</li> </ul>

### Multi-Disciplinary Team

Frameworks	Content	Design
Multi-Disciplinary Team	<ul style="list-style-type: none"> <li>Health Communication Expert</li> <li>Dialysis Providers</li> <li>Transplant Providers</li> <li>Behavioral Researcher</li> </ul>	<ul style="list-style-type: none"> <li>Develop content refinement &amp; review process</li> <li>Interviews &amp; User testing</li> </ul>

**\*KTX, Kidney transplant, LDK, Live kidney donation**

**FIGURE 1.** Application of theory and best practice frameworks for the development of the educational video. KTX, kidney transplant; LKD, live kidney donation.

first. The link opened to the study, including electronic consent, survey questions, and the video on an Alchemer platform (Alchemer, Boulder, CO). The features of the study platform were informed by usability feedback previously conducted with transplant candidates at our center, which led to a simple context-sensitive interface.<sup>20</sup>

All participants opened the study link on the device of their choice. Following completed electronic consent, participants completed 31 questions about their sociodemographic characteristics (sex, age, race, employment status, education level, marital status, total annual household income), dialysis vintage, health literacy, technology access, and measures

of donation surgical complications knowledge (8-item true/false/I don't know) and concerns (2-item, 5-point Likert scale). After survey completion, the participants were taken to the animation, which they started by pushing the play button. The video could be watched, paused, or restarted by participants until the "next" button was pushed, leading to a single question about whether or not they viewed the video and the device used, followed by survey questions identical to the pretests, with the sociodemographic question substituted with animation acceptability questions (11-items, 4-point Likert scale) developed by the researchers ( $\alpha=0.92$ ). All survey questions were posed sequentially without the option of going backward. Participants were compensated with a \$25.00 check.

### Sample Size Determination

Patient-level changes in LKD perioperative complications knowledge prestudy to poststudy with 24 subjects will provide 80% power to detect at least a 0.60 standardized effect size using a 1-group *t*-test (level of significance  $\alpha=0.05$ , 2-tailed). We included 2 types of patients: (1) potential live kidney donors and (2) kidney transplant candidates since both donor volunteerism and candidate willingness to accept a kidney offer are required for live donor kidney transplantation to take place. We purposively sampled 50% of potential living donors to inform subanalytic comparisons.

### Data Analysis

Statistical analyses were conducted using SPSS Version 24 (IBM Corp, Armonk, NY). Frequencies were computed for all categorical variables and summarized numeric variables using simple descriptive statistics. Categorical data were compared using McNemar's test. As a measure of effect sizes, the point biserial correlation (Fritz 2012) was calculated as the test statistic (*z* score) divided by the square root of the total observations (Effect size,  $r = Z/\sqrt{N}$ ) with 0.1, 0.2, and 0.32 representing small, medium, and large effects. Knowledge scores were calculated by summing the number of correct answers, with unsure and unanswered questions considered false. All Likert scales were anchored by strongly agree and strongly disagree. Higher scores reflect greater understanding and concerns, respectively. We provided categorical level data attributing to participants' animation acceptability data using a bar graph. Statistical significance was established at a 2-tailed alpha of 0.05.

## RESULTS

### Video Development

Of 35 participants who completed the cognitive interviews to inform video development, the age range was 31–72 y; 13 were male; 8 African American, 23 non-Hispanic White, and 4 were other race (2 Hispanic, 1 Asian, 1 Native American); 23 had completed some college; most had annual household incomes between \$50 000 and \$75 000 or more; 20 were kidney transplant patients, 10 were potential and previous live kidney donors, and 5 were care partners (Table 1). We also sought input from multiple other stakeholders during video development, as shown in Figure 1.

Refinement of the video based on stakeholder feedback is depicted in Table 2. Participants recommended stressing the "rarity" of the complications. It was suggested that the

**TABLE 1.**  
Baseline characteristics of study participants

Characteristic	Phase 1 video development participants (N = 35)	Phase 2 transplant candidates (N = 12)	Phase 2 donor candidates (N = 12)
Kidney transplant candidates, n	10	100 (12/12)	.
Kidney transplant recipients, n	10	.	.
Prior live kidney donors, n	5	.	.
Potential live kidney donors, n	5	.	100 (12/12)
Care partner, n	5	.	.
Age, median $\pm$ SD, y	51 $\pm$ 11.7	52.6 $\pm$ 18.6	46 $\pm$ 14.7
Male sex, % (n/N)	37 (13/35)	33 (4/12)	17 (2/12)
Black race, % (n/N)	23 (8/35)	50 (6/12)	17 (2/12)
Dialysis duration, % (n/N)			
Not on dialysis	40 (8/20)	25 (3/12)	.
<1 y	15 (3/20)	58 (7/12)	.
$\geq$ 1 y	45 (9/20)	17 (2/12)	.
Prior kidney transplant, % (n/N)	50 (10/20)	8 (1/12)	.
Education, % (n/N)			
High school or trade school graduate	34 (12/35)	58 (7/12)	33 (4/12)
Some college or higher	66 (23/35)	42 (5/12)	67 (8/12)
Lives with another adult in the household, % (n/N)	74 (26/35)	75 (9/12)	100 (12/12)
Full- or part-time employment, % (n/N)	46 (16/35)	25 (3/12)	83 (10/12)
Total household yearly income, % (n/N), US\$			
$\leq$ \$30 000	17 (6/35)	58 (7/12)	8 (1/12)
\$30 000–\$50 000	20 (7/35)	0 (0/12)	8 (1/12)
>\$50 000	51 (18/35)	25 (3/12)	67 (8/12)
No response	11 (4/35)	17 (2/12)	17 (2/12)
Access to technology, % (n/N)			
Participant has a working internet-capable cellular phone	97 (34/35)	100 (12/12)	100 (12/12)
Household has a working internet-capable cellular phone	83 (29/35)	83 (10/12)	100 (12/12)
Participant has a working computer or tablet like an iPad	83 (29/35)	75 (9/12)	100 (12/12)
Household has a working computer or tablet like an iPad	77 (27/35)	58 (7/12)	100 (12/12)
Participant sends or receives text messages	100 (35/35)	100 (12/12)	100 (12/12)
Participant sends or receives email	100 (35/35)	100 (12/12)	100 (12/12)
Internet and social media use, % (n/N)			
Spends >1 h on the internet weekly	.	92 (11/12)	100 (12/12)
Uses social media at least once a week	.	75 (9/12)	92 (11/12)
Has active Facebook account	.	92 (11/12)	83 (10/12)
Frequency that someone helps you read hospital materials, % (n/N)			
Never	57 (20/35)	58 (7/12)	83 (10/12)
Sometimes	29 (10/35)	33 (4/12)	8 (1/12)
Often	11 (4/35)	8 (1/12)	0 (0/12)
A lot	3 (1/35)	0 (0/12)	8 (1/12)
Comfort level filling out forms alone, % (n/N)			
Very comfortable	77 (27/35)	50 (6/12)	75 (9/12)
Somewhat comfortable	11 (4/35)	25 (3/12)	25 (3/12)
Somewhat uncomfortable	3 (1/35)	25 (3/12)	0 (0/12)
Very uncomfortable	9 (3/35)	0 (0/12)	0 (0/12)
Quite good or extremely good at working with percentages, % (n/N)	.	42 (5/12)	67 (8/12)
Quite good or extremely good at figuring out how much a shirt will cost if it is 25% off, % (n/N)	.	67 (8/12)	75 (9/12)

**TABLE 2.**

**Animation revisions based on input from individuals with kidney disease, family members, and potential and prior live kidney donors**

Stakeholder feedback	Animation revision
<ul style="list-style-type: none"> <li>Content is confusing about laparoscopic approach, conversion to open, blood thinner mode of delivery, and source of payment for donor-related complications.</li> <li>Narrator is monotone, and video lacks the “positivity” of previous videos.</li> <li>Recommended stressing the rarity of the complications and framing each complication from positive to negative, such as starting with how rare or uncommon each complication is followed by a description.</li> <li>The kidney in the operating room scene “does not look like a kidney.”</li> <li>Overly positive about the outcomes of hernia repair.</li> <li>Lack of information that “the donor heals and returns to normal pretty quickly.”</li> </ul>	<ul style="list-style-type: none"> <li>Improved description and visuals of content about complications.</li> <li>Changed narration word emphasis, inflection, and pacing.</li> <li>Changed description of each complication starting with its likelihood of occurrence.</li> <li>Increased emphasis about the thoroughness of testing to determine donor eligibility and review of every donor by multidisciplinary team.</li> <li>Changed kidney image.</li> <li>Changed overly definitive language about hernias being repairable with surgery.</li> <li>Showed images of the donor returning to normal after surgery without explicit statements since this content is already provided in other videos.</li> </ul>

description of each complication start with its low likelihood of occurrence. Revisions were made in response to the comments. Some patient participants were confused by the laparoscopic approach, conversion to open, whether the blood thinner is a pill or other type of injection, and how donor complications are paid for. Extensive revisions to the script and visuals were made in response to their comments until understood as intended. It was recommended that the video be more positive, and the tone of the narrator was described as monotone. The narration was changed to improve word emphasis, inflection, and pacing. Feedback suggested changes to the visual of the kidney during the laparoscopic procedure to make it look more like a kidney. The description about hernias being surgically repairable was described as being overly positive. These aspects were changed. Further input indicated that the video lacked information about the speed of recovery. This was addressed by showing the early recovery period with visuals but not explicit statements since content about postdonation recovery is provided in other videos in the curriculum. The final animation was 3.25 min in duration.

**Video Evaluation Pilot Study**

We invited 46 potential kidney donors and recipients who had not been involved in the video’s development to participate. The first 26 that opted in participated in the online study. Two were removed because their survey answers were incomplete. Of 24 participants within the final analytic sample, most watched the animation on a cell phone. Half were potential kidney recipients, and half were potential kidney donors (84% biologic relations or spouses of the candidate). The median age of the total sample was 50 y; 73% were female; 46% had a high school degree or less; 46% were not used; 36% had an annual household income <\$50 000; and

**TABLE 3.**

**Comparison of participant knowledge scores before and after animation viewing**

Knowledge score (IQR, 1–8)	Pretest, mean ± SD	Posttest, mean ± SD	Change, %	z score	Effect size (R) <sup>a</sup>
Total cohort (n=24)	5.7 ± 2.0	7.0 ± 1.4	23	3.34	0.48
Black race (n=8)	4.8 ± 1.3	6.6 ± 1.1	38	2.41	0.60
Non-Black race (n=16)	6.1 ± 2.1	7.2 ± 1.5	18	2.39	0.42
Education, less than college (n=11)	5.6 ± 2.0	7.2 ± 0.9	29	2.39	0.51
Education, college level (n=13)	5.8 ± 2.0	6.9 ± 1.7	19	2.39	0.47
<Median literacy/numeracy (n=10) <sup>b</sup>	5.4 ± 2.3	7.1 ± 1.0	31	2.23	0.50
≥Median literacy/numeracy (n=14)	5.9 ± 1.7	6.9 ± 1.6	17	2.55	0.48
Age ≥60 y (n=9)	4.6 ± 2.3	6.4 ± 1.9	39	2.23	0.53
Age <60 y (n=15)	6.3 ± 1.5	7.3 ± 0.8	16	2.55	0.47
Income ≤\$50 000 (n=9)	5.0 ± 2.6	6.7 ± 1.9	34	2.04	0.48
Income >\$50 000 (n=11)	5.8 ± 1.5	7.0 ± 1.0	21	2.41	0.51
Transplant candidate (n=12)	4.8 ± 2.1	6.5 ± 1.7	35	2.41	0.49
Potential live kidney donor (n=12)	6.6 ± 1.4	7.5 ± 0.8	14	2.41	0.49
<Median technology access (n=5) <sup>c</sup>	5.6 ± 3.1	7.6 ± 0.5	36	1.34	0.42
≥Median technology access (n=19)	5.7 ± 1.7	6.8 ± 1.5	19	3.12	0.51

<sup>a</sup>Effect size, interpretation: 0.10 = small effect, 0.24 = medium effect, and 0.37 = large effect. <sup>b</sup>Low health literacy/numeracy was defined as a score <10 on the summed score of 4 items. <sup>c</sup>Low technology access was defined as a score <6 on the summed score of 6 items. IQR, interquartile range.

half were African American. All participants owned a cell phone and used text messages, and 96% used email (Table 1).

**Knowledge**

Compared with preanimation, the mean total knowledge score increased postintervention by 23% (mean 5.7 to 7.0, *P*<0.01). Large effect sizes for knowledge were seen for the whole cohort (R=0.48) and in the context of age ≥60 y (R=0.53), Black race (R=0.60), lower health literacy (R=0.50), lower educational attainment (R=0.51), low technology access (R=0.42), and transplant candidate status (R=0.49) (Table 3).

**Understanding and Concerns**

The proportion of patients who agreed or strongly agreed that live kidney donation is a safe procedure increased from 88% preanimation to 96% after the animation (*P*=0.50). The proportion of patients who agreed or strongly agreed that they were worried about possible complications of kidney donation surgery remained 17% both before and after animation viewing.

**Acceptability**

Over 90% of participants agreed or strongly agreed that the information in the video was credible, relevant, and easy to understand; addressed their concerns; and helped them make better decisions about LKD. Also, over 90% agreed or strongly agreed that they experienced the video as visually attractive,

engaging, easy to watch, the right length, and relevant to their cultural background and that they felt comfortable using animations to learn, would use similar animations in the future, and would recommend the video to other patients and donors.

## DISCUSSION

Our video is the first patient-centered education about LKD surgical complications in an animated format. The video was developed iteratively in collaboration with a diverse sample of patients and family members, experts, and stakeholders to ensure accuracy, relevance, straightforwardness, and appropriateness for the intended purpose. Our development process also revealed target audience learning needs to improve uptake of the information, such as reiterating the low incidence of the complication before describing it. Perioperative complications of live kidney donation are not well understood by individuals with kidney disease and potential donors but are necessary to understand for LKD decision-making. Improving awareness of LKD surgical complications is important since recent studies suggest poor understanding of donation-related risks among transplant candidates and their families after educational sessions<sup>11</sup> and among donors after nephrectomy.<sup>21-24</sup> Lack of knowledge of surgical complications has resulted in donors feeling misled and unprepared.<sup>22</sup>

Our preliminary results support the feasibility of the animation to improve knowledge about living donor nephrectomy perioperative complications, including among older patients as well as low-literacy learners, indicating the potential for the animation to be effective within a broad spectrum of patients. These positive findings may be due to the use of audiovisuals, common language, and using concrete terms as recommended to achieve health literacy. The animation format offers efficient learning due to the enhanced cognitive processing of the medium and has been found to be accessible across age, culture, and literacy.<sup>25,26</sup>

We found that concerns about perioperative donor nephrectomy complications remained low before and after animation viewing, and perceptions of donation safety was higher by 8% after animation exposure. The slightly greater perception of safety is possible because the video provided information in an emotionally reassuring way, such as by emphasizing the low incidence of complications, that eligibility to donate is based on an individual's health, and the multidisciplinary nature of care. Additionally, animated video may be more useful than realistic presentations as a visualization format when describing surgical risks since realistic video shows real representations and depicts them in their actual complexity. Being more vivid, live-action video has more potential to generate negative emotions, in particular, fear and disgust.<sup>17</sup> Also, the video was based on the laparoscopic approach, which has a shorter recovery period. Others have noted that potential donors' concerns related to the donation surgical procedure and recovery may not reflect knowledge about new advances in transplantation,<sup>27,28</sup> such as the laparoscopic approach to nephrectomy.

High levels of acceptability of the animation were reported by participants. Our prior research and others have found the animated video format to be a feasible and acceptable media for learning about LKD by candidates, previous donors, and their social networks.<sup>13,29</sup> However, it remains unknown whether animated video education—and its potential for easy sharing—will increase kidney donor volunteerism actual

donations relative to conventional education methods. As stated in a recent American Society of Transplant Surgeons consensus conference paper, it is time to consider diverse media technologies to disseminate accurate and balanced information to improve community understanding about LKD. Digital tools are free to access by patients at a time and place convenient to them, and this may assist in recall of information and empower them to discuss this further with their family. This video, combined with other topics, could act as an engaging introduction for patients and their families to consider living donor kidney transplantation.

Our video was not intended for informed consent but rather to enhance individuals' foundational knowledge of some perioperative complications of LKD to reduce fear of the unknown and improve understanding that may lead to self-efficacy in seeking further information and better conversations with providers. Education about the risks associated with living donation requires a fair portrayal and explanation but is challenging, as information is always interpreted and experienced within the context of a person's views and earlier experiences. We included perioperative complications that are uncommon but specific to donor nephrectomy and were not covered in previous videos produced by the researchers, which had already addressed pain, bloating, neuropathy, fatigue, emotional changes, and kidney failure. Although there are many other potential complications that are disclosed in the process of informed consent, we found that 5 complications within a 3-min video were optimal to maintain attentiveness without overwhelming viewers or inducing unrealistic concern.

## LIMITATIONS

Our study has several limitations. This is a small pilot study at a single center among participants that were largely non-Hispanic White who had provided their email address. Findings may not generalize to other populations. We did not collect nonparticipant characteristics to assess differences from participants. The pre- to post- study design tends to exaggerate effect sizes when compared with randomized trials. We did not assess knowledge retention. Our animation was available at 1 time to each participant and may not reflect actual usage if made available on demand. Survey items for the donation knowledge and concerns have not been validated; however, survey items do have good face and content validity since a team of stakeholders from the kidney disease community, including nephrologists, social workers, and researchers, developed the items.

## CONCLUSION

We created an educational animated video about surgical complications of live kidney donation. The video was informed by communication and learning best practices and standards for development, including as follows: health literacy, cultural relevance, utilization of vetted evidence-based content, and rigorously solicited stakeholder and user input throughout the iterative developmental process. The results of our pilot study among kidney transplant candidates and potential donors at a single center provides support for the acceptability of the educational animation and its feasibility in improving knowledge of LKD perioperative

complications and perception of safety. Future research will focus on evaluating the video within the entire curriculum of the *KidneyTIME* intervention to increase donor volunteerism and live donor kidney transplantation. Educational interventions designed to enhance living donor referrals to donate kidneys in the United States could drive meaningful increases in the number of kidney transplants and bring the benefits of kidney transplantation to thousands of waitlisted patients.

## ACKNOWLEDGMENTS

The authors would like to acknowledge the assistance of the following persons during data collection: Dr John Von Visger and Danielle Wittek. We also appreciate the advice of the Kidney Foundation of Western New York in developing the video and Beth Dolph in editing the article for grammar and punctuation.

## REFERENCES

1. US Department of Health and Human Services. *Organ Procurement and Transplantation Network National Data*. Available at <https://optn.transplant.hrsa.gov/>. Accessed June 14, 2020.
2. Lentine KL, Lam NN, Axelrod D, et al. Perioperative complications after living kidney donation: a national study. *Am J Transplant*. 2016;16:1848–1857.
3. Zimmerman D, Albert S, Llewellyn-Thomas H, et al. The influence of socio-demographic factors, treatment perceptions and attitudes to living donation on willingness to consider living kidney donor among kidney transplant candidates. *Nephrol Dial Transplant*. 2006;21:2569–2576.
4. Reed RD, Hites L, Mustian MN, et al. A qualitative assessment of the living donor navigator program to identify core competencies and promising practices for implementation. *Prog Transplant*. 2020;30:29–37.
5. Boulware LE, Hill-Briggs F, Kraus ES, et al. Effectiveness of educational and social worker interventions to activate patients' discussion and pursuit of preemptive living donor kidney transplantation: a randomized controlled trial. *Am J Kidney Dis*. 2013;61:476–486.
6. Rodrigue JR, Cornell DL, Lin JK, et al. Increasing live donor kidney transplantation: a randomized controlled trial of a home-based educational intervention. *Am J Transplant*. 2007;7:394–401.
7. Ismail SY, Luchtenburg AE, Timman R, et al. Home-based family intervention increases knowledge, communication and living donation rates: a randomized controlled trial. *Am J Transplant*. 2014;14:1862–1869.
8. Ruck JM, Van Pilsum Rasmussen SE, Henderson ML, et al. Interviews of living kidney donors to assess donation-related concerns and information-gathering practices. *BMC Nephrol*. 2018;19:130.
9. Waterman AD, Covelli T, Caisley L, et al. Potential living kidney donors' health education use and comfort with donation. *Prog Transplant*. 2004;14:233–240.
10. Lunsford SL, Shilling LM, Chavin KD, et al. Racial differences in the living kidney donation experience and implications for education. *Prog Transplant*. 2007;17:234–240.
11. Gordon EJ, Reddy E, Gil S, et al. Culturally competent transplant program improves Hispanics' knowledge and attitudes about live kidney donation and transplant. *Prog Transplant*. 2014;24:56–68.
12. Traino HM, Nonterah CW, Gupta G, et al. Living kidney donors' information needs and preferences. *Prog Transplant*. 2016;26:47–54.
13. Kayler LK, Dolph B, Seibert R, et al. Development of the living donation and kidney transplantation information made easy (KidneyTIME) educational animations. *Clin Transplant*. 2020;34:e13830.
14. Tuong W, Larsen ER, Armstrong AW. Videos to influence: a systematic review of effectiveness of video-based education in modifying health behaviors. *J Behav Med*. 2014;37:218–233.
15. Tou S, Tou W, Mah D, et al. Effect of preoperative two-dimensional animation information on perioperative anxiety and knowledge retention in patients undergoing bowel surgery: a randomized pilot study. *Colorectal Dis*. 2013;15:e256–e265.
16. Yap J, Teo TY, Foong P, et al. A randomized controlled trial on the effectiveness of a portable patient education video prior to coronary angiography and angioplasty. *Catheter Cardiovasc Interv*. 2020;96:1409–1414.
17. Eggeiling M, Bientzle M, Shiozawa T, et al. The impact of visualization format and navigational options on laypeople's perception and preference of surgery information videos: randomized controlled trial and online survey. *J Particip Med*. 2018;10:e12338.
18. Keller M, Seibert R, Dolph B, et al. Multimedia education to facilitate communication about living kidney donation: a proof of concept. Abstract presented at: ASTS 20th Annual State of the Art Winter Symposium; January 9–12, 2020; Miami, FL.
19. Mayer RE, Moreno R. Animation as an aid to multimedia learning. *Educ Psychol Rev*. 2002;14:87–99.
20. Keller M, Seibert R, Feeley T, et al. Patient-informed design of an educational website on living kidney donation. Abstract presented at: 2020 American Transplant Congress; May 30–June 1, 2020. Available at <https://atcmeetingabstracts.com/abstract/patient-informed-design-of-an-educational-website-on-living-kidney-donation/>. Accessed March 24, 2021.
21. Leichtman A, Abecassis M, Barr M, et al; Living Kidney Donor Follow-Up Conference Writing Group. Living kidney donor follow-up: state-of-the-art and future directions, conference summary and recommendations. *Am J Transplant*. 2011;11:2561–2568. doi:10.1111/j.1600-6143.2011.03816.x
22. Hanson CS, Chapman JR, Gill JS, et al. Identifying outcomes that are important to living kidney donors: a nominal group technique study. *Clin J Am Soc Nephrol*. 2018;13:916–926.
23. Timmerman L, Ismail SY, Luchtenburg AE, et al. Exploring knowledge about dialysis, transplantation, and living donation among patients and their living kidney donors. *Int J Behav Med*. 2015;22:580–589.
24. Valapour M, Kahn JP, Bailey RF, et al. Assessing elements of informed consent among living donors. *Clin Transplant*. 2011;25:185–190.
25. Leiner M, Handal G, Williams D. Patient communication: a multi-disciplinary approach using animated cartoons. *Health Educ Res*. 2004;19:591–595.
26. Slater MD, Rouner D. Entertainment-education and elaboration likelihood: understanding the processing of narrative persuasion. *Commun Theory*. 2002;12:173–191. doi:10.1111/j.1468-2885.2002.tb00265.x
27. Horton RL, Horton PJ. Knowledge regarding organ donation: identifying and overcoming barriers to organ donation. *Soc Sci Med*. 1990;31:791–800.
28. Evers S, Farewell VT, Halloran PF. Public awareness of organ donation. *CMAJ*. 1988;138:237–239.
29. Axelrod DA, Kynard-Amerson CS, Wojciechowski D, et al. Cultural competency of a mobile, customized patient education tool for improving potential kidney transplant recipients' knowledge and decision-making. *Clin Transplant*. 2017;31:e12944.