

Virtual Reality Video Promotes Effectiveness in Advance Care Planning

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Research article

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Abstract

Background: In 2019, the Patient Autonomy Act went into effect, allowing Taiwanese citizens to establish legal advance decisions. In an effort to secure a more realistic and accurate perception of situations, a virtual reality video was developed by the palliative care team of Chi-Mei hospital in southern Taiwan for citizens to use before advance care planning. This study explores the change in participants' preference and certainty regarding end-of-life decisions after using this tool. **Methods:** Participants were at least 20 years old and capable of reading and understanding the information provided in the written handout with information about the legal process of making an advance decision. They completed pre-test questionnaires, viewed a six-minute 360-degree virtual reality video on a portable headset and then completed a post-test questionnaire about their preference on the 5 medical options including CPR, life-sustaining treatments, antibiotics, blood transfusion, and artificial nutrition and hydration, followed by feedback on the helpfulness of the virtual reality. The control group included 40 participants who only read the handout and they also completed pre-test and post-test questionnaires. **Results:** After viewing the virtual reality video, preference for refusing CPR, life-sustaining treatment, antibiotics, blood transfusion, and artificial nutrition and hydration increased significantly in the virtual reality intervention group. Uncertainty regarding the 5 medical options mentioned above are significantly decreasing. The intervention was generally recognized by participants for its help of making decision. **Discussion:** The decrease in the number of participants who could not make decisions indicate that the virtual reality video may be helpful for users in making end-of-life decision. According to feedback, the virtual reality video helped equip users with better understanding of medical scenarios, and it is a good decision aid for advance care planning. **Conclusion:** This is the first study since the Patient Autonomy Act has been passed that explores the effectiveness of using a virtual reality video as a decision aid in advance care planning and reveals decreased preference of CPR, life sustaining treatment, antibiotics, blood transfusion and artificial nutrition and hydration after intervention. This decision aid proved to be an effective tool for clarifying their end-of-life care preferences.

Background

In January 2019, the Patient Autonomy Act of Taiwan (hereafter, "the Act"), the first of its kind in Asia, officially went into effect, allowing Taiwanese citizens to establish an advance decision (AD) with legal effect. An AD enables someone, who is still capable, to refuse specified medical treatment in the future when they may lack the capacity to consent to or refuse medical treatment¹. According to the Act, a patient must complete an advance care planning (ACP) consultation with the medical team before documenting their wishes with a formal AD. The aim of this consultation is to ensure that the wishes, values, and preferences of a patient about future care and treatment documented in their AD will be respected when they lose capacity^{2,3}.

Our hospital (a medical center in southern Taiwan) is one of the seven trial hospitals entrusted by the Ministry of Health and Welfare for the implementation of the Act since it was passed at the end of 2015 and announced in January 2016 (a three-year preparation period accompanied the Act). We have

observed that our citizens had strong desire of self-determination in end-of-life medical decision but were limited by insufficient knowledge of medical treatments, clinical scenarios, education, and legal literacy. There is a great deal of clinical knowledge and legal terms that have to be explained and presented in a way that the general public can understand. In the past, medical options have typically been written on handout forms provided to patients and only short conversations between medical teams and patients before patients make their choices. However, the imagination of medical treatments and future disease status merely based on words in the reading materials and verbal communication are likely insufficient for patients to truly clarify their preferences for end-of-life decisions⁴. To improve this situation, several video decision aids have been introduced to ACP to improve the accuracy and certainty of end-of-life decision making, and have been confirmed as valuable in helping patients increase their knowledge of medical treatments and allow patients to clarify their medical decision preferences with more certainty^{5 6 7}.

Methods

PARTICIPANTS

This study had a total of 160 participants, 40 of whom were randomly assigned to the control group and 120 of whom were randomly assigned to the intervention group with the VR video. Participants were at least 20 years old and capable of reading and understanding the information provided in the written handout with information about the legal process of making an advance decision. Recruitment occurred between January 23, 2019 and May 10, 2019 by a flyer pasted on the board of the medical center I worked in, one long-term care facilities, and activity centers in the community in Tainan, Taiwan. Eligibility criteria of participants included age over twenty and capability in reading and verbal communication. Written informed consent was obtained from all eligible participants prior to the research after explanations concerning the study's purpose, methods, protection of anonymity, and freedom to withdraw. Institutional Review Boards from Chi-Mei Medical Center approved all study procedures (IRB approval number: 10710-008).

DESIGN

The language used in the handout and questionnaires was traditional Chinese. Participants were asked to complete written questionnaires about sociodemographic information, past experiences for medical decision-making, and preference for different kinds of treatment options when they meet the clinical conditions prescribed by the Act, namely terminal illness, irreversible coma, permanent vegetative state, severe dementia, and other incurable acute and critical diseases that will be announced by the central competent authority in the future. The sociodemographic data included gender, age, and level of education. The past experiences questionnaire included knowledge of AD and do not resuscitate (DNR), self-reported completion of DNR, experiences of caring for loved ones with terminal illness, and experiences of making medical decision for them on whether to use life-sustaining treatment and artificial nutrition and hydration at that time. Five treatment options were included: CPR, life-sustaining

treatment, antibiotics, blood transfusion, and artificial nutrition and hydration. Participants who were unable to decide whether to use the treatments when they are under specific clinical conditions, unconscious, or unable to clearly express their wishes could choose “uncertain.” The questions of individual preference for treatments were intended to observe if there is any difference in participants’ decisions after the intervention. The process of the study for VR video watching intervention group is shown in the diagram below (Figure 1).

Participants were asked to read a handout published by Hospice Care Foundation of Taiwan with clear information including the introduction of the Act and an illustration of the legal process for making an effective AD to help the participants understand their fundamental right to make medical choices for themselves.

Participants then viewed a six-minute VR video that was produced by the palliative care team of our hospital on a portable VR headset. The 360-degree VR video was filmed and developed by members of the palliative care center with experts from different professional backgrounds including physicians, nurses, senior social workers, and psychologists to ensure the comprehensiveness of the presented clinical information and scenarios. Technical expertise was provided by a commercial company that specializes in VR techniques. The designed video used a first-person perspective of a patient with chronic obstructive pulmonary disease (COPD) to allow participants to immerse themselves in the complete clinical process of typical end-of-life care, starting with CPR in the intensive care unit, followed by withdrawn LST, hospice ward care, and hospice home care. The video also displayed the soul of this patient at the end of this film to reflect spiritual care. The displayed film features physicians, nurses, psychologists, and relatives, so that in addition to medical scenarios in different settings, the process involved consensus among family members.

Participants then completed the post-test questionnaire. Identical questions were reassessed regarding individual preference for treatment options when they are under specific clinical conditions, unconscious, or unable to clearly express wishes, followed by a feedback survey on the help of the decision aid using a 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). The nine feedback questions were developed on the basis of research by Hossler et al. (2011)¹⁷, evaluated the effect of VR video on preparing ones to open a discussion with doctors, family and others, choosing a spokesperson, clarifying one’s value and preference regarding medical treatments, equipping one’s understanding of medical scenarios and AD as well as making end-of-life decisions. Validity of the whole questionnaire was established by using a panel of experts including two palliative doctors, one oncologist, one judge, and one chair professor of Chi-Mei medical center to review the wording, content, and constructs.

STATISTICAL ANALYSIS

Participants’ characteristics and past experiences for medical decision-making were described using descriptive statistic with frequency distributions. Participants’ feedback about the VR based decision aid

after the intervention was summarized using mean and standard deviation. The impact of the intervention change was evaluated with a one-sided McNemar’s exact test. Data were organized by SPSS 22 and analysis was performed using software R (version 3.6.0) and R package “exact2x2” (cite: Fay MP (2010). “Two-sided Exact Tests and Matching Confidence Intervals for Discrete Data.” R Journal, 2(1), 53–58. <https://journal.r-project.org/>.) The significance level was $\alpha = .05$.

Result

STUDY PARTICIPANTS

Baseline characteristics of participants are presented in Table 1. There are no significance differences between the different education levels, which means that this intervention can be adopted for people with different education and health literacy levels.

Table 1. Baseline characteristics of participants

| | Control group, N=40 N(%) | Intervention group, N=120 N(%) | p-value |
|---|-----------------------------|-----------------------------------|-------------|
| Gender | | | 0.3344 |
| Male, 1 | 16 (40.00) | 38 (31.67) | |
| Female, 2 | 24 (60.00) | 82 (68.33) | |
| Age | | | 0.7116 |
| 20-29 | 6 (15.00) | 22 (18.33) | |
| 30-39 | 13 (32.50) | 33 (27.50) | |
| 40-49 | 10 (25.00) | 40 (33.33) | |
| 50-59 | 9 (22.50) | 18 (15.00) | |
| 60≤ | 2 (5.00) | 7 (5.83) | |
| Educational level | | | > 0.9999 |
| Elementary school and below | 0 (0.00) | 2 (1.67) | |
| High school graduate | 4 (10.00) | 14 (11.67) | |
| College graduate and above | 36 (90.00) | 104 (86.67) | |
| Q5 Heard of DNR | 32 (80%) | 95 (79.17%) | 0.9102 |
| Q6 Signed a DNR permit | 4 (10.00) | 22 (18.33) | 0.3219 |
| Q7 Have heard about Patient Autonomy Act | 33 (82.50) | 100 (83.33) | 0.9030 |
| Q8 Have experience of caring for terminally ill loved one until death | | | 0.7316 |
| Yes (primary caregiver) | 12 (30.00) | 32 (26.67) | |
| Yes (not primary caregiver) | 21 (52.50) | 60 (50.00) | |
| No | 7 (17.50) | 28 (23.33) | |
| Q9 Have experience of LST decision making for loved one | 5 (12.50) | 17 (15.17) | 0.7909 |
| Q10 Have experience of ANH decision making for loved one | 7 (17.50) | 24 (20.00) | 0.7290 |

DNR means the “Do Not Rescue Form”, a form signed by patient or their closest relatives including the options about refuse CPR and LST during the predying status under severe illness or injury

PREFERENCE FOR TREATMENT OPTIONS

Figure 2 illustrates the control group's change of the percentage of individual preference for the five medical treatments before and after participants read the handout. Figure 3 illustrates the results of the intervention group after participants read the handout and viewed the VR video.

Table 2 shows the statistical analysis result of the pre-test questionnaires. After the VR video intervention, preference to not use CPR, LST, antibiotics, blood transfusion(BT), and artificial nutrition and hydration(ANH) increased significantly. Uncertainty about using CPR, LST, antibiotics, blood transfusion, and artificial nutrition and hydration decreased significantly. This trend is not observed in the statistical analysis of the control group.

Table 2. p-Values of Control and Intervention Groups

| | Control group | | Intervention group | |
|-------------------|---------------|-----------|--------------------|-----------|
| | Refusal | Uncertain | Refusal | Uncertain |
| CPR | 0.25 | 0.25 | 0.00209 | 0.009605 |
| LST | 0.25 | 0.125 | 0.003769 | 0.0006561 |
| Antibiotic | > 0.9999 | 0.125 | < 0.0001 | 0.02069 |
| BT | 0.9688 | 0.1875 | < 0.0001 | 0.00845 |
| ANH | 0.8906 | 0.3437 | < 0.0001 | 0.001288 |

One-sided McNemar's exact test was performed.

Control group participants read handout only

Intervention group participants read handout and watched the VR video

FEEDBACK ON THE VR DECISION AID

Across the 9 items collecting feedback from participants' experience (where 1=strongly disagree, 5=strongly agree), the highest rated item was "After the intervention, you think that it increased your knowledge about advance decision" (4.41±0.54). The lowest rated item was "After the intervention, you think that it helped prepare you to discuss your wishes with your family"(4.29±0.56). Overall, the intervention was generally recognized by participants for its help of making decision (See Figure 4).

Discussion

This study provides an innovative VR video approach to assist with ACP. To my knowledge, this study represents the first decision aid for ACP using VR technology.

When facing the possibility of meeting one of the five prescribed clinical conditions under the Act, approximately a quarter of participants were uncertain about the decision of whether to use or refuse LSTs before watching the VR video. However, for each treatment the percentage of people who were uncertain decreased to less than 20% after watching the VR video. Meanwhile, preference for not using these medical treatments had the opposite trend after the videos watching. The findings of our research

were consistent with previous research that aimed at enriching patient understanding of worsening health states and better informing decision making with the use of a video decision aid¹⁸.

End-of-life decision making has never been an easy task for people, especially in Asian cultures where it is taboo to talk about issues of death and palliative care. The Hospice Palliative Care Ordinance of Taiwan (HPCOT) was passed in 2000, with the aim to promote hospice palliative care and dying with dignity and to respect the will of patients with terminal illness and their right to personally decide about medical treatment. Although Asian culture still regards talking death as a taboo, HPCOT has had a significant impact on the number of DNR rates (Figure 5)¹⁹. Almost four-fifths of participants had heard about DNR order. Before watching the VR video, the largest proportion of participants refused to use LST and CPR, which may be the result of people Taiwan becoming more familiar with these terms due to HPCOT. Preference for not using these medical treatments has statistically significant increasing after viewing the VR video. The decrease in the number of participants who could not make a decision after watching the VR video indicates that our decision aid may help users make decisions. These results achieve the purpose of our research and are consistent with prior studies about video decision aids for ACP in patients with cancer¹⁸.

The use of decision aids for medical decision making has been proved helpful in improving people's knowledge regarding treatment options in previous studies²⁰. The complexity of medical scenarios makes it relatively hard for people to imagine and clarify their real needs and make concrete choices about them. In response to this, we set a storyline for our video, and the scene changed from the ICU to a hospice home care from the first-person perspective. The way doctors spoke in the film followed the disease state with the options of hospice care progressively. According to the feedback, the VR video significantly helped equip users with better understanding of medical scenarios. Developing a storyline with patient-centered ACP in a video has also been recognized as highly meaningful for patients and family members preparing for a major surgery²¹. In addition, during development we collected professional opinions from medical staff as well as members of an interdisciplinary team including psychologists and senior social workers. Participants said that the VR video helped prepare them to discuss their wishes with their family and doctors.

Feedback collected from participants about this tool was positive, suggesting that it is a useful tool for well preparing the users for ACP, insofar as study participants report being highly agreed with how this VR video help 1) prepare them to discuss with family, medical team and others, 2) make end-of-life decisions 3) choose a spokesperson 4) clarify their preferences for medical treatments and their values 5) have better understanding of medical scenarios and increased knowledge of advance decision.

Limitations

Firstly, having no qualitative information collected to explore what participants thought these terms mean and further exploration is considered. Secondly, only one scenario was shown of the possible scenarios "irreversible coma, permanent vegetative state, severe dementia, etc." There is a strong degree of bias in

influencing participants' decisions by only showing one outcome (e.g., patient survives with reduced level of function). Providing only one type of scenario and one kind of outcome seemed to have ethical consideration, but the VR video is produced and used as a decision aid, not for the main part of ACP and our consultation team will discuss all the pros and cons of any end-of-life care medical options to overcome this consideration. Thirdly, participants were mostly highly educated younger adults with no chronic or life limiting illnesses, and their choices may be different from older participants with chronic life-limiting diseases. Fourthly, the emotional impact of viewing the video is also not explored, but we can observe that the VR video induced the connection of memory about the tester's end-of-life care experience about their close family members and we also conducted qualitative interview for these testers and the research result will be submitted further. Fifthly, we cannot conclude that VR video is better than conventional videos from the results of this study, and the cost of making a VR film is higher than the cost of making a conventional video. However, according to the literature review, VR video can achieve better long-term retention of learned information²². The benefits of VR video need to be further explored to determine if VR video cost is mitigated by its effectiveness.

Conclusion

Previous studies have revealed a gap between ADs and the real wishes of patients in palliative care. The traditional way for presenting ACP information to patients includes verbally communicating the given scenario between medical team and patients²³. Visual impact on decision-making has been mentioned in previous studies and the emotion, understanding, and motivation for discussing end-of-life care preferences were important issues in Taiwan's society. ACP involves far more than merely establishing an AD for certain treatments; additional factors include family dynamics, emotional response, and the values of patients. These elements were emphasized in the VR film, but the real impact of VR video needs further study. Participants reported the highest satisfaction rating regarding the helpfulness of the VR video to increase knowledge about AD, which supports the fact that this study was effective in its purpose.

This is the first national study to explore the effectiveness of VR video as a decision aid in end-of-life care issues since the passing of the Act in Taiwan. This study revealed the statistical significance on the certainty in choosing and decreased preference of CPR, LST, antibiotics, blood transfusion and artificial nutrition and hydration. This decision aid also proved to be an effective tool for clarifying values and helping figure out and discuss end-of-life care preferences with others. In response to the implementing of the Act, we recommend this decision aid to promoting this Act as well as preparing users for ACP.

Abbreviations

ACP (advance care planning), AD (advance decision), VR (virtual reality), DNR (do not resuscitate), CPR (cardiopulmonary resuscitation), COPD (chronic obstructive pulmonary disease), LST (life-sustaining treatment)

Declarations

- Ethics approval and consent to participate: Institutional Review Boards from Chi-Mei Medical Center approved all study procedures. (IRB approval number: 10710-008)
- Consent for publication: The consent form are available from the corresponding author on reasonable request.
- Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.
- Competing interests: Not applicable
- Funding: Financial support from Ministry of Science and Technology, Taiwan, (MOST 107-2511-H-384-001-MY2) for running the project “Promote People’s Humanistic Legal Literacy about Life Self-determination: Facilitate Advance Care Planning Effect by Intelligent Educational Systems.” However, the funding was not directly for the design of this study, the collection, analysis, and interpretation of data, or the writing of the manuscript.
- Authors' contributions: The corresponding author is the main and only author
- Acknowledgements: The palliative care team of Chi-Mei medical center, Tainan, Taiwan and two research assistants, Yu-Ting Huang and Yi-Ting Cheng

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Figures

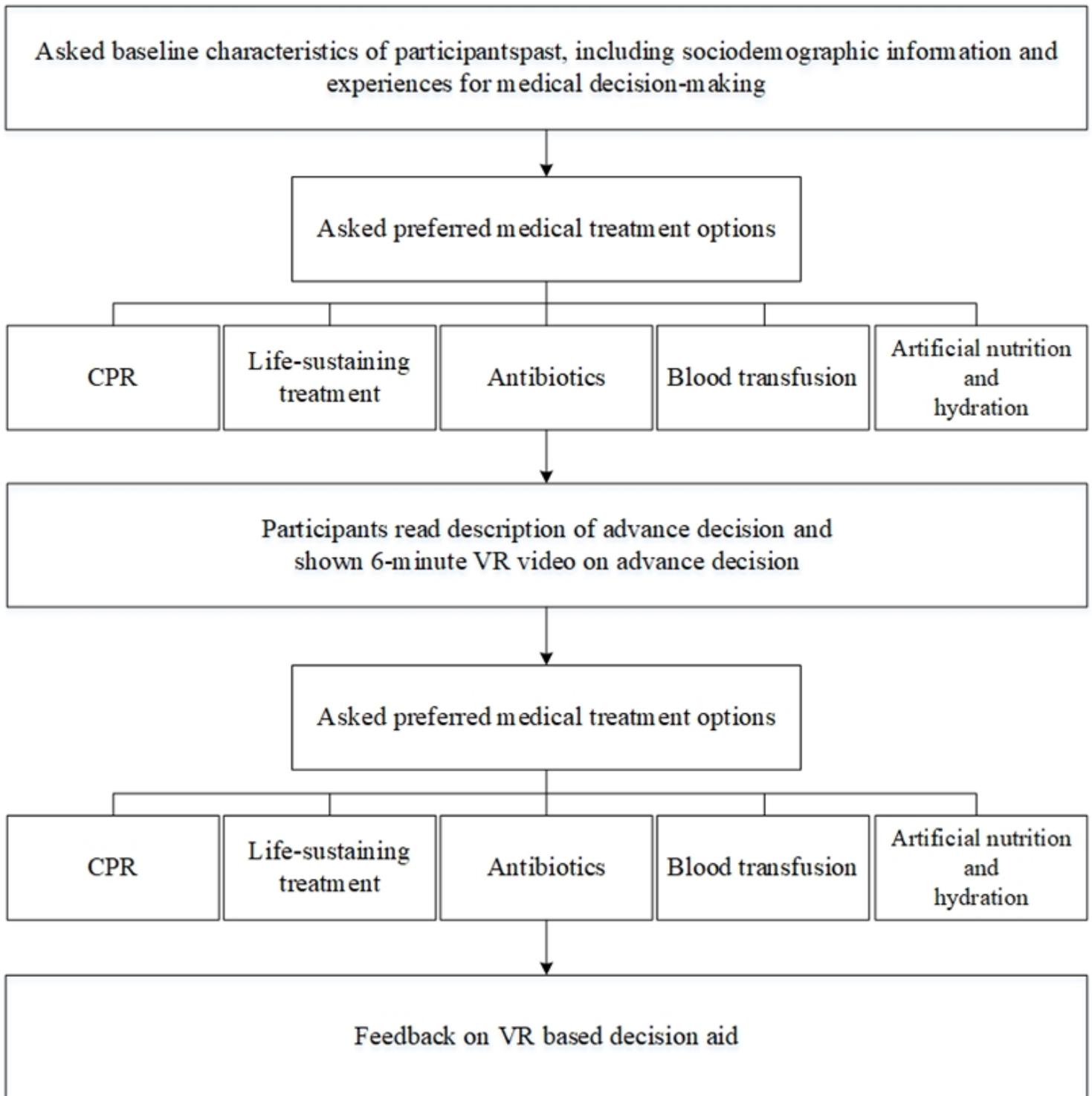


Figure 1

displays the flow chart of the whole research design. All participants answered pre-test questionnaires containing 5 choices about life-sustaining treatment options and artificial nutrition preference, read the handout, watched a 6-minute VR video, and then answered a post-test questionnaire identical to the pre-test one.

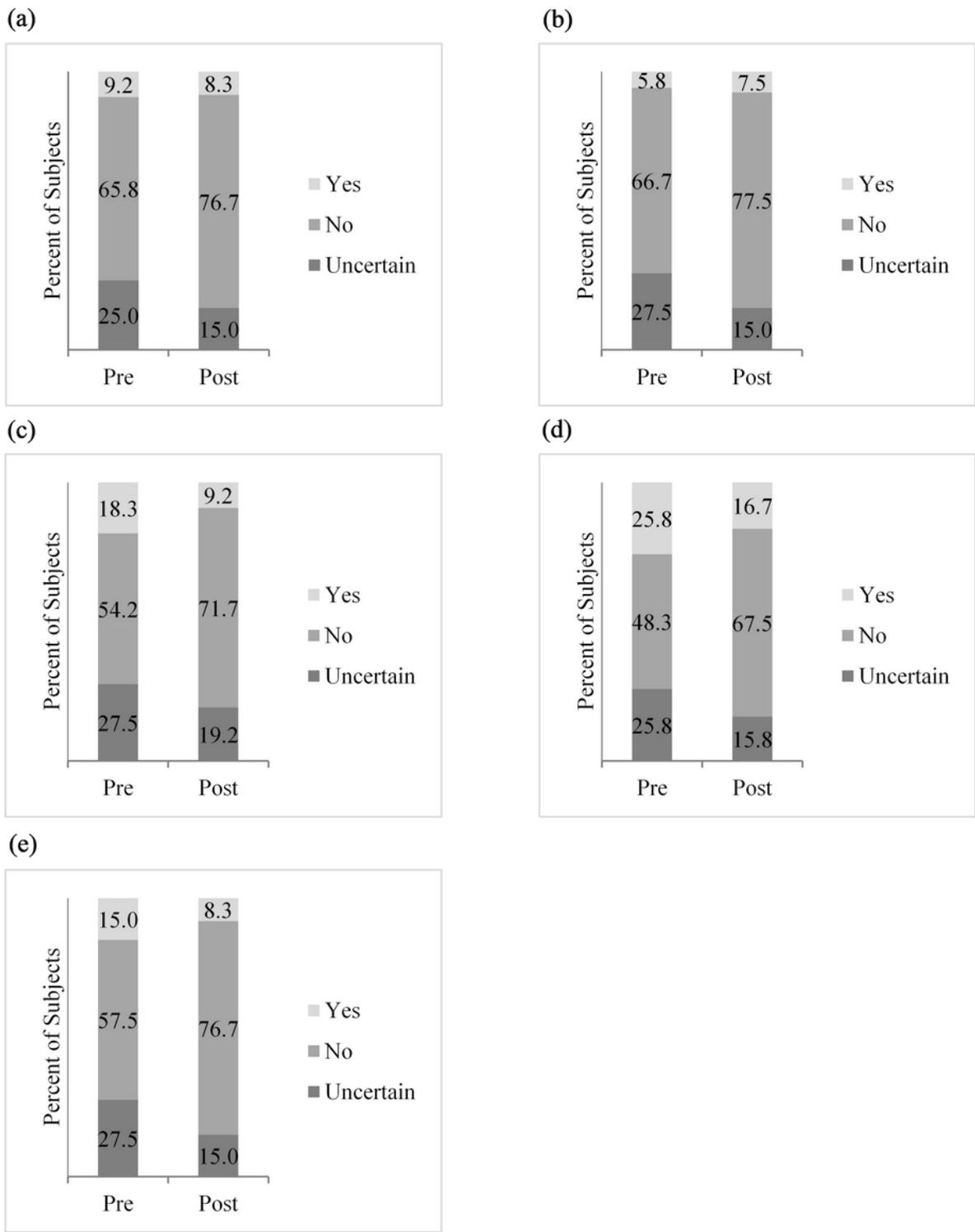


Figure 2

illustrates the control group's change of the percentage of individual preference for the five medical treatments before and after participants read the handout and there is no significant statistical difference.

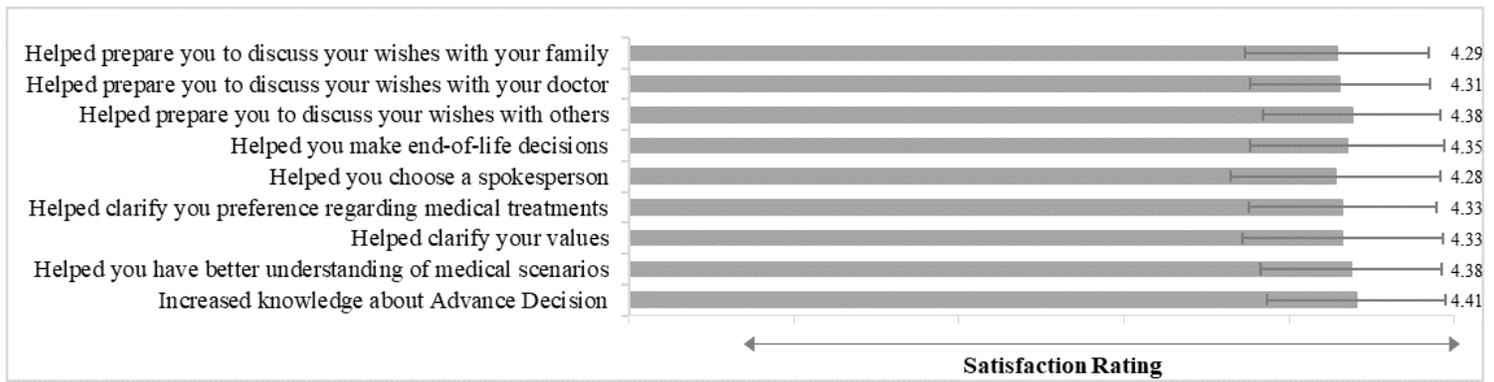


Figure 3

illustrates the results of the intervention group after participants read the handout and viewed the VR video. After the VR video intervention, preference to not use CPR, LST, antibiotics, blood transfusion(BT), and artificial nutrition and hydration(ANH) increased significantly. Uncertainty about using CPR, LST, antibiotics, blood transfusion, and artificial nutrition and hydration decreased significantly. This trend is not observed in the statistical analysis of the control group.