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Impact of simulated animated video education on patients' disease uncertainty, anxiety, and sleep quality in digestive endoscopy examination

Xiaoqing Qian[1*], Lixin Wu[2] and Shuguang Xu[2]

Abstract

Background Gastrointestinal endoscopy examinations were commonly associated with patient uncertainty, anxiety, and sleep disturbances. Simulated animated video education has emerged as a potential intervention to address these psychosocial aspects in the healthcare setting. This study explores the impact of simulated animated video education on patients' disease uncertainty, anxiety, and sleep quality in the context of digestive endoscopy examinations.

Methods A total 166 patients who underwent digestive endoscopy examinations were conducted and divided into the conventional education group ($n=77$) and the simulated animated video education group ($n=89$). Disease uncertainty was assessed using the Mishel's Uncertainty in Illness Scale (MUIS), anxiety was evaluated using the Hamilton Anxiety Rating Scale (HAMA), and sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results Both conventional and simulated animated video education interventions led to a reduction in disease uncertainty, anxiety levels, and improvement in sleep quality post-education and at the one-month follow-up. However, the simulated animated video education group exhibited greater reductions in disease uncertainty (post-education: 86.69 ± 2.65 vs. 85.65 ± 3.46, $P=0.031$; follow-up: 82.57 ± 4.57 vs. 81.21 ± 3.69, $P=0.038$), anxiety (post-education: 19.88 ± 3.78 vs.18.75 ± 3.42, $P=0.046$; follow-up: 18.59 ± 3.4 vs. 17.54 ± 3.25, $P=0.046$), and improvement in sleep quality (post-education: 5.57 ± 1.25 vs. 5.15 ± 1.1, $P=0.023$; follow-up: 5.22 ± 1.13 vs. 4.89 ± 0.86, $P=0.038$) compared to the conventional education group.

Conclusion The study findings suggest that simulated animated video education was associated with reduced disease uncertainty, alleviated anxiety, and improved sleep quality among patients undergoing gastrointestinal endoscopy.

Keywords Simulated animated video education, Disease uncertainty, Anxiety, Sleep quality, Digestive endoscopy examination

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Introduction

Gastrointestinal endoscopy examinations were common procedures used for the diagnosis and management of various upper and lower gastrointestinal disorders [1–3]. Patients undergoing gastrointestinal endoscopies commonly report feelings of uncertainty and anxiety related to their medical condition and the impending procedure [4–6]. Disease uncertainty encompasses factors such as ambiguity, complexity, information deficit, and unpredictability, all of which can significantly influence patients' emotional well-being and overall experience with medical care [7–9]. Similarly, anxiety related to medical procedures was a well-documented phenomenon, characterized by symptoms of nervousness, apprehension, and distress, which can lead to suboptimal patient experiences and may even impact procedural outcomes. Furthermore, sleep disturbances were prevalent among individuals scheduled for medical procedures, potentially exacerbating pre-procedural stress and affecting overall well-being [10–12]. It was within this context of patient psychosocial well-being that the impact of educational interventions, particularly simulated animated video education, was of great interest. The emergence of simulated animated video education as a patient education tool in the healthcare setting presents a novel approach to addressing patients' informational and psychological needs before medical procedures. Fee-ley TH et al.'s research illustrates the advantages of analog animation education [13]. Simulated animated videos offer a visually engaging and interactive platform through which complex medical information can be effectively conveyed to patients in a clear and understandable manner [14]. Simulated animated video education has emerged as a potential intervention to address these psychosocial aspects in the healthcare setting. However, for patients with gastrointestinal endoscopy, the effect of simulated animation video education still needs to be studied. This manuscript discusses the results of a retrospective cohort study conducted to investigate the impact of simulated animated video education in comparison to conventional education on patients' disease uncertainty, anxiety, and sleep quality in the context of digestive endoscopy examinations.

Materials and methods

Study design and population

This study was a retrospective cohort study that selected 166 patients who underwent digestive endoscopy examinations at Zhongshan City People's Hospital, Guangdong Province, China from June 2023 to December 2023 and met the inclusion and exclusion criteria as the study subjects. Inclusion criteria: Patients with upper gastrointestinal problems such as upper gastric discomfort, bloating, pain, heartburn, swallowing discomfort, belching, regurgitation, reduced appetite, weight loss, anemia, as well as lower gastrointestinal issues including chronic diarrhea, constipation, abdominal pain, and bloating were included. Furthermore, patients with abnormal findings in gastrointestinal barium meal examinations that could not exclude tumors at the end of the colon or ileum, those with unexplained lower intestinal obstruction requiring confirmation of the extent and severity of inflammatory bowel disease, and individuals over 45 years old undergoing routine health examinations were also included. Exclusion criteria: Patients with severe heart, brain, lung, or liver diseases; those with uncontrolled acute gastrointestinal bleeding; individuals in the acute phase of gastrointestinal perforation, aortic aneurysm, or vascular rupture leading to significant bleeding; those who had undergone multiple laparotomies or had intestinal adhesions; patients with severe stenosis obstructing endoscopy passage, inability to tolerate gastric tube insertion, or those with mental disorders were excluded (Fig. 1). This study was approved by the Ethics Committee of Zhongshan People's Hospital. The procedures were conducted in accordance with the ethical standards set forth by the Committee on Human Experimentation and the Helsinki Declaration of 1964, as revised in 2013. Informed consent was waived by the Ethics Committee of Zhongshan People's Hospital for this retrospective study due to the exclusive use of de-identified patient data, which posed no potential harm or impact on patient care. This waiver was approved by the institutional review board and ethics committee of our institution in accordance with regulatory and ethical guidelines pertaining to retrospective studies.

Intervention method

Patients were divided into the conventional education group ($n = 77$) and the simulated animated video education group ($n = 89$) based on the educational mode. Conventional education involved communication between medical staff and patients scheduled for gastroscopy, informing the patients about the purpose of the examination, the procedure, and potential risks. Patients were advised about dietary restrictions before gastroscopy, discontinuation of anticoagulants and antiplatelet drugs, arranging for a companion, and attire considerations.

Simulated animated video education involved organizing conventional educational content into an educational animation. Patients were instructed to watch this animation before the examination to fulfill the educational objectives: The video includes key topics such as preoperative diet and water ban requirements, surgical steps, expected feelings, risks and complications, postoperative diet and activity guidance, and how to communicate with doctors about doubts and concerns before and after surgery, which lasts for two minutes. The two-minute video

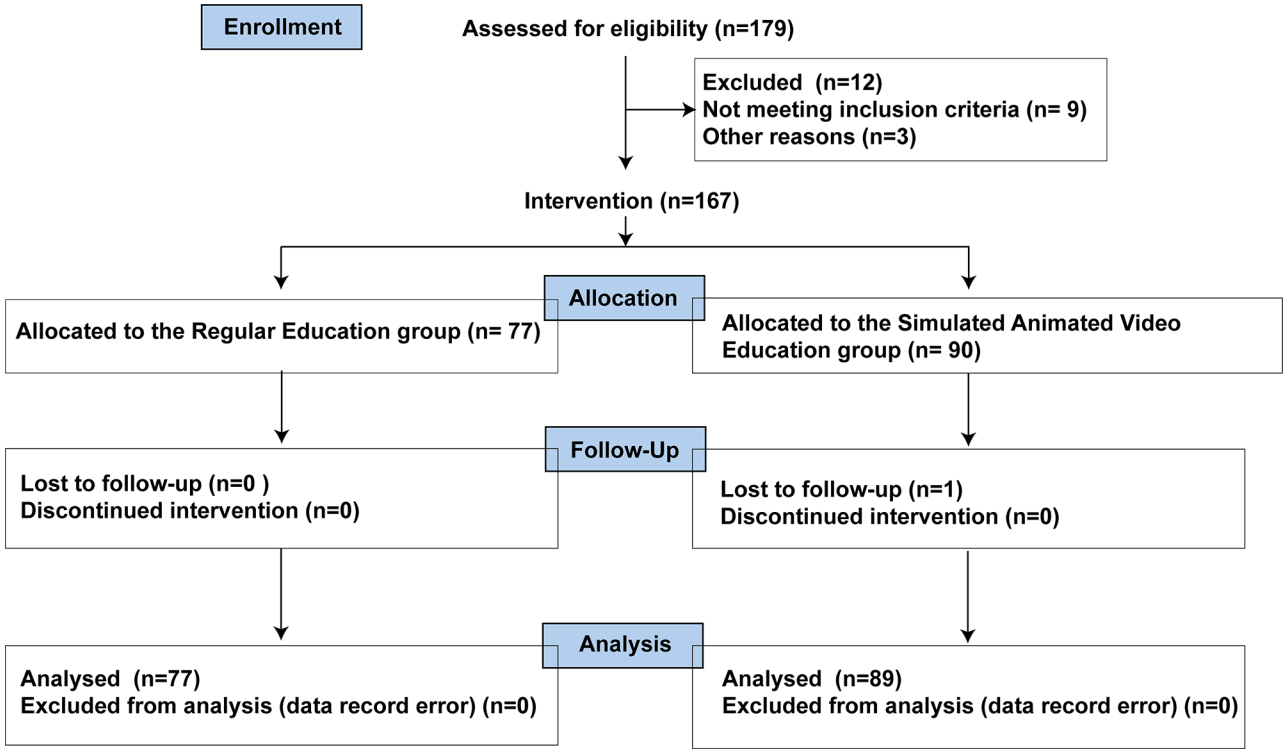

Fig. 1 Flow diagram of the patients included

was created using Adobe Animate by the Department of Gastroenterology, Endoscopy Centre of Zhongshan People's Hospital (Fig. 2).

Data collection

Patient demographic information, including age, Gender, BMI, Education Level, Hypertension, Diabetes, Hyperlipidemia was collected and recorded from the medical records system.

Gastrointestinal endoscopy examination

Prior to undergoing gastrointestinal endoscopy, patients were required to fast for 6–8 h and take oral anesthesia to anesthetize the mucous membrane of the throat to alleviate reflex nausea and vomiting during esophagogastroduodenoscopy. The physician inserts the endoscope through the oropharynx into the esophagus, sequentially enters the esophagus, stomach, and duodenum, re-examines these areas during the withdrawal of the endoscope, and takes biopsies at appropriate sites. The examination was performed using the GASTROINTESTINAL VIDEOSCOPE (Registration No. 3220720, OLYMPUS OPTICAL Co., Ltd., Japan). For colonoscopy, patients begin taking bowel-cleansing agents the day before the procedure, as the colonic mucosa cannot be adequately observed in the presence of feces. After insertion through the anus into the terminal ileum, the colon was examined internally for lesions, and the entire mucosa was observed during the withdrawal of the endoscope. The examination was conducted using the Evis Colono Videoscope (Registration No. 3220887, OLYMPUS OPTICAL Co., Ltd., Japan). Patient examination sites and disease conditions were documented.

Disease uncertainty score

Questionnaires were administered before and after the simulated video education, as well as one month after the examination. The Mishel's Uncertainty in Illness Scale (MUIS) was used for assessment. This scale primarily measures patients' levels of uncertainty regarding disease treatment, care, disease information, and prognosis during hospitalization. The scale has been translated into Chinese by domestic scholars, and its Cronbach's α above 0.8. The scale consists of 4 dimensions: disease ambiguity, information deficit, complexity, and unpredictability, with a total of 33 items. The overall score ranges from 32.0 to 160.0, categorizable into low (32.0-74.7), moderate (74.8-117.4), and high (117.5–160.0) uncertainty levels. Higher scores indicate a higher level of disease uncertainty in patients [15].

Hamilton anxiety rating

A questionnaire survey was conducted to assess anxiety levels using the Hamilton Anxiety Scale (HAMA) before and after the simulated video education and one month after the examination. The HAMA, developed

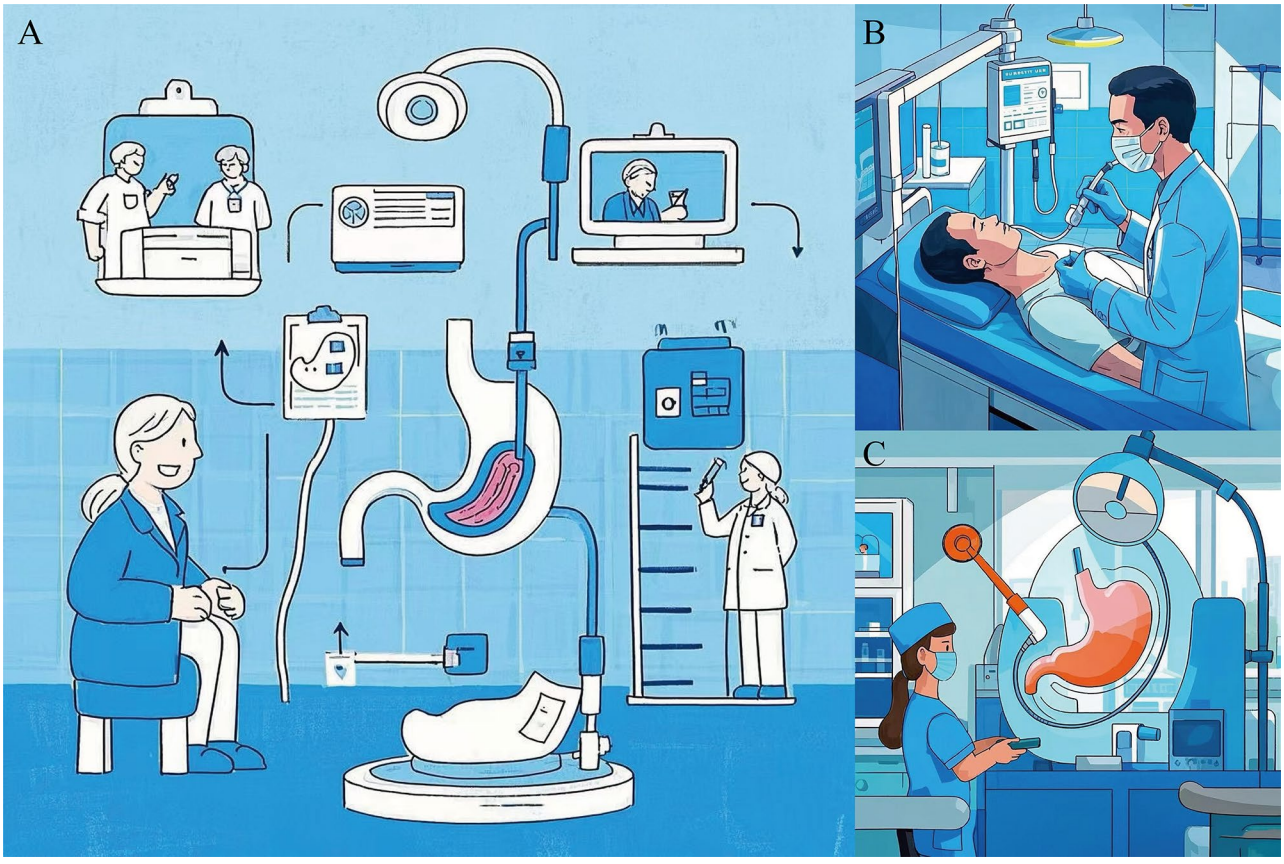

Fig. 2 The detail of the simulated animated video education on the gastrointestinal endoscopy. (**A**) The first part of the video: Flow chart of gastrointestinal endoscopy. (**B**) The second part of the video: Schematic diagram of the process of gastrointestinal endoscopy. (**C**) The third part of the video: Simulated procedure of gastrointestinal endoscopy within the human body

by Hamilton in 1959, was commonly utilized in clinical psychiatry and comprises 14 items. It was primarily employed to evaluate the severity of anxiety symptoms in patients with neurosis and other conditions. Each item in the HAMA was rated on a 5-point scale (0–4), representing: 0: none; 1: mild; 2: moderate; 3: severe; 4: very severe. The HAMA has demonstrated good internal consistency (Cronbach's alpha = 0.893). The psychological scores (Hamilton Anxiety Scale) before and after treatment were compared between the two groups [16].

PSQI sleep quality assessment

A survey on sleep quality was conducted before and after the simulated video education, as well as one month after the examination. The Pittsburgh Sleep Quality Index (PSQI), developed by Buysse Dj and colleagues from the Sleep and Circadian Rhythms Center at the University of Pittsburgh Medical Center in 1993, was specifically designed to assess the subjective sleep quality of participants over the past month. The PSQI consists of 19 self-rated questions and 5 questions rated by sleep partners, with only the 19 self-rated questions being scored. These 19 self-rated questions form seven components, each scored from 0 to 3. The sum of the scores from each component yields the total score of the PSQI, ranging from 0 to 21, with higher scores indicating poorer sleep quality. The Chinese version of the PSQI demonstrated a Cronbach's alpha of 0.71 [17].

Statistical analysis

SPSS 29.0 statistical software (SPSS Inc, Chicago, IL, USA) was used for data analysis. The classification data was expressed in the form of [n(%)]. When the sample size was ≥ 40 and the theoretical frequency $T \geq 5$, the basic formula was used to perform chi-square test. When the sample size is ≥ 40 but the theoretical frequency $1 \leq T < 5$, the Chi-square test of the correction formula is used. The Shapiro-Wilk method was used to test the normal distribution of continuous variables. For normally distributed continuous variables, they are presented as mean ± standard deviation (SD) and tested using the independent sample T-test. $P < 0.05$ for the two-sided test was considered statistically significant.

Table 1 Comparison of baseline characteristics

Parameters	Regular Education (*n* = 77)	Simulated Animated Video Education (*n* = 89)	t/χ^2	*P*
Age (years)	52.14 ± 6.87	51.75 ± 7.21	0.361	0.718
Gender (M/F)				
Male	40 (51.95%)	45 (50.56%)	0.001	0.982
Female	37 (48.05%)	44 (49.44%)		
BMI (kg/m^2)	23.57 ± 3.45	23.67 ± 3.31	0.200	0.842
Hypertension	14 (18.18%)	13 (14.61%)	0.169	0.681
Diabetes	14 (18.18%)	13 (14.61%)	0.169	0.681
Hyperlipidemia	8 (10.39%)	11 (12.36%)	0.023	0.878
Education Level			0.690	0.406
High School or Lower	29 (37.66%)	27 (30.34%)		
Higher than High School	48 (62.34%)	62 (69.66%)		
Family annual income (RMB)				
≥ 100,000	37(48.05%)	45(50.56%)	0.104	0.747
<100,000	40(51.95%)	44(49.44%)		

Table 2 Examination areas and disease types

Parameters	Regular Education (*n* = 77)	Simulated Animated Video Education (*n* = 89)	χ^2	*P*
Examination areas			1.795	0.616
Esophagus	15 (19.48%)	22 (24.72%)		
Stomach, duodenum	39 (50.65%)	43 (48.31%)		
Colon	15 (19.48%)	12 (13.48%)		
Other	8 (10.39%)	12 (13.48%)		
Disease types			2.236	0.525
Superficial gastritis	23 (29.87%)	32 (35.96%)		
Atrophic gastritis	24 (31.17%)	32 (35.96%)		
Ulcer	15 (19.48%)	12 (13.48%)		
Cancerous changes	15 (19.48%)	13 (14.61%)		

Results

Baseline characteristics

Based on the table, the simulated animated video education group had 89 participants, while the regular education group had 77 participants. There were no statistically significant differences between the two groups in terms of age (52.14 ± 6.87 vs. 51.75 ± 7.21, t = 0.361, $P = 0.718$), gender distribution ($P = 0.982$), BMI (23.57 ± 3.45 vs. 23.67 ± 3.31, t = 0.200, $P = 0.842$), hypertension prevalence ($P = 0.681$), diabetes prevalence ($P = 0.681$), and hyperlipidemia prevalence ($P = 0.878$). The groups also did not differ significantly in education level ($P = 0.406$). However, there was a statistically significant difference in the prevalence of hyperlipidemia (regular education: 8 (10.39%) vs. simulated animated video education: 11 (12.36%, $P = 0.023$) (Table 1). Overall, the baseline characteristics were well balanced between the two education groups, ensuring comparability for the subsequent analysis.

Table 3 Patients' disease uncertainty

Parameter	Regular Education (*n* = 77)	Simulated Animated Video Education (*n* = 89)	t	*P*
MUIS Pre-education	91.22 ± 3.27	92.01 ± 2.14	1.819	0.071
MUIS Post-education	86.69 ± 2.65	85.65 ± 3.46	2.177	0.031
MUIS Follow-up 1 month	82.57 ± 4.57	81.21 ± 3.69	2.095	0.038

Examination areas and disease types

The distribution of examination areas and disease types exhibited no statistically significant differences between patients who received regular education and those who received simulated animated video education (Table 2). Specifically, examination areas including esophagus, stomach, duodenum, colon, and other areas showed no significant differences between the two educational intervention groups ($P = 0.616$). Similarly, disease types such as superficial gastritis, atrophic gastritis, ulcer, and cancerous changes did not demonstrate significant differences between the two groups ($P = 0.525$). These results indicate that the distribution of examination areas and disease types was similar in both groups, allowing for a balanced assessment of the impact of educational interventions on disease uncertainty, anxiety, and sleep quality.

Disease uncertainty

The Mean Uncertainty in Illness Scale (MUIS) scores demonstrated no statistically significant differences at the pre-education assessment between patients who received regular education and those who received simulated animated video education. However, following the educational interventions, the MUIS scores at post-education and one-month follow-up showed statistically significant decreases in both groups, indicating reduced disease uncertainty over time (Table 3). These findings indicate that both interventions can reduce disease uncertainty after education and at one-month follow-up. However, the Simulated Animated Video Education has a greater impact on disease uncertainty in patients undergoing gastrointestinal endoscopy.

Anxiety scores

Comparison of HAMA scores revealed no statistically significant differences at the pre-education assessment between patients who received regular education and those who received simulated animated video education. However, following the educational interventions, the HAMA scores at post-education and the one-month follow-up demonstrated statistically significant decreases

in both groups (Table 4), indicating a reduction in anxiety levels after the educational interventions.

Sleep quality

The PQSI scores did not demonstrate statistically significant differences between patients who received regular education and those who received simulated animated video education at the pre-education assessment. However, following the educational interventions, the PQSI scores at the post-education and the one-month follow-up showed statistically significant decreases in both groups (Table 5), indicating improved sleep quality after the educational interventions.

Table 4 HAMA scores comparison between regular education and simulated animated video education group

Parameter	Regular Education ($n=77$)	Simulated Animated Video Education ($n=89$)	t	*P*
HAMA Pre-education	25.82 ± 4.45	24.86 ± 4.2	1.387	0.167
HAMA Post-education	19.88 ± 3.78	18.75 ± 3.42	2.009	0.046
HAMA Follow-up 1 month	18.59 ± 3.42	17.54 ± 3.25	2.013	0.046

Table 5 Sleep quality comparison between regular education and simulated animated video education group

Parameter	Regular Education ($n=77$)	Simulated Animated Video Education ($n=89$)	t	*P*
PQSI Pre-education	6.22 ± 1.52	6.01 ± 1.45	0.931	0.353
PQSI Post-education	5.57 ± 1.25	5.15 ± 1.1	2.305	0.023
PQSI Follow-up 1 month	5.22 ± 1.13	4.89 ± 0.86	2.091	0.038

Discussion

The impact of educational interventions on patients undergoing medical procedures was an important aspect of healthcare delivery [18–20]. This study aimed to investigate the influence of simulated animated video education compared to conventional education on patients' disease uncertainty, anxiety, and sleep quality in the context of digestive endoscopy examinations. The findings of this study highlight the potential benefits of simulated animated video education in reducing disease uncertainty, alleviating anxiety, and improving sleep quality among patients undergoing gastrointestinal endoscopy. Disease uncertainty was a common concern among patients undergoing medical examinations and procedures [21, 22]. The results of this study demonstrated that both conventional and simulated animated video education interventions led to a reduction in disease uncertainty over time. However, the simulated animated video education had a greater impact on reducing disease uncertainty in patients undergoing gastrointestinal endoscopy. This finding suggests that providing visual and interactive educational content through animated videos may be more effective in addressing patients' concerns and uncertainties regarding their medical condition and the impending procedure.

The decrease in MUIS after educational intervention may be attributed to improved patient understanding and awareness, and the significant decrease in HAMA score could reflect patient improvement in mood, cognition, and somatic symptoms. Visual aids, such as animated videos, have the potential to effectively convey complex medical information in a clear and engaging manner, thereby empowering patients with knowledge and reducing ambiguity associated with their illness and the upcoming procedure [9, 23, 24]. By addressing information deficit, complexity, unpredictability, and ambiguity related to the disease, the simulated animated video education may have positively influenced patients' perceptions and expectations, ultimately contributing to reduced uncertainty levels. Moreover, the impact of educational interventions on anxiety levels among patients undergoing gastrointestinal endoscopy was another significant aspect evaluated in this study. Both conventional and simulated animated video education interventions were associated with a reduction in anxiety levels post-education and at the one-month follow-up. A study reported by Idrees [25] demonstrated that playing mixed animated videos during self-examination among female patients could reduce the stigma associated with cancer and exhibited good efficiency and practicality in the early diagnosis of breast cancer. Animated simulation videos for educational purposes combine images, text, and audio-visual elements to vividly and innovatively present the entire process of gastrointestinal endoscopy. By enhancing patients' understanding and reducing fear stemming from the unknown, these videos help lower anxiety levels. This finding underscores the potential of innovative educational methods, such as animated simulation videos, in alleviating procedural anxiety and improving patients' overall mental health.

The reduction in anxiety levels following the educational interventions may be linked to the ability of animated videos to enhance patient preparedness and mental readiness for the upcoming procedure [26–28]. Visual depictions of the endoscopy process, along with information about the purpose of the examination and potential risks, may have helped alleviate fears and apprehensions related to the unknown aspects of the procedure [29]. Preoperative anxiety is one of the primary causes of insomnia among patients. A notable decrease in PQSI scores was observed in both patient groups one month after surgery, with the group that watched the simulated animation video outperforming the conventional

education group. The simulated animation video had a positive impact on the sleep quality of patients undergoing gastroscopy by providing intuitive understanding, enhancing psychological preparation, reducing anxiety-induced insomnia, and increasing a sense of security. As a result, patients experienced reduced anxiety, thereby lowering the risk of insomnia caused by preoperative anxiety. Additionally, the interactive nature of the animated videos may have engaged patients more effectively, providing them with a sense of involvement and control, ultimately contributing to reduced anxiety levels [30–32].

The present study has several implications for clinical practice and patient care. The results underscore the value of incorporating innovative educational tools, such as simulated animated videos, into the pre-procedural education of patients undergoing gastrointestinal endoscopy. Healthcare providers can consider integrating visual and interactive educational content into their patient education strategies to address uncertainty, alleviate anxiety, and improve sleep quality among individuals scheduled for medical procedures. Moreover, the findings emphasize the importance of personalized and patient-centered approaches to healthcare delivery, recognizing the varying needs and preferences of patients when it comes to educational interventions. Our simulated animation videos adopt advanced animation techniques and design to show the whole process of gastrointestinal endoscopy in a vivid, vivid way. This expression not only enhances the visualization of information, but also makes the educational content easier to understand and remember.

While the study provides valuable insights into the impact of simulated animated video education on patient outcomes, several limitations should be acknowledged. As a retrospective cohort study, bias may occur with the introduction of data collection and patient selection, and lack of long-term follow-up to assess sustained effects; to avoid selection bias, we ensured the reliability of data sources during data collection, adopted standardized data collection procedures, data verification and validation before data entry, and applied sound statistical analysis methods to avoid the impact of potential confounding factors on study findings. Moreover, the study focused on a specific patient population undergoing digestive endoscopy in one hospital, with small sample size and small differences in results that may not fully reflect the characteristics of all clinical patient groups, but its clinical significance and practical application value cannot be denied. However, the clinical significance and practical application value of the study findings cannot be denied. Based on the results of this study, future research should explore the long-term impact of animated educational videos on patient outcomes, consider different types of patient populations, and conduct multi-site, multi-center studies to collect broader and more representative sample data. And investigate the cost-effectiveness of implementing a simulated animation educational intervention in healthcare settings due to different cultural or regional differences. As an intuitive and easy to understand way of information transmission, simulated animation video education is also of great value in high-risk cardiac surgery and neurosurgery, requiring complex medical operations, or patients' understanding. For long-term medical processes such as chronic disease management and rehabilitation patient education, simulated animation video education can also play an important role.

Conclusion

In conclusion, the findings of this study highlight the potential benefits of simulated animated video education in reducing disease uncertainty, alleviating anxiety, and improving sleep quality among patients undergoing gastrointestinal endoscopy. The results support the integration of innovative educational approaches into pre-procedural patient education strategies as a means of enhancing patient experiences and well-being in the healthcare setting. By addressing patients' psychological and informational needs using visually engaging and interactive content, healthcare providers can contribute to improved patient outcomes and satisfaction, ultimately fostering a more holistic and patient-centered approach to healthcare delivery.

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Author contributions

All authors contributed to the study conception and design. Material preparation, data collection was performed by XQQ, and LXW. The first draft of the manuscript was written by XQQ and SQX. XQQ commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability

The data involved in this study can be made available upon reasonable request from the corresponding author (Xiaoqing Qian, 18676017461@163.com).

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Zhongshan People's Hospital. The procedures were conducted in accordance with the ethical standards set forth by the Committee on Human Experimentation and the Helsinki Declaration of 1964, as revised in 2013. Informed consent was waived by the Ethics Committee of Zhongshan People's Hospital for this retrospective study due to the exclusive use of de-identified patient data, which posed no potential harm or impact on patient care. This waiver was approved by the institutional review board and ethics committee of our institution in accordance with regulatory and ethical guidelines pertaining to retrospective studies.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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