ED-Explain: Personalized Video Instructions for Patients Discharged from the Emergency Department

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This paper presents ED-Explain, an integrated, AI-driven system that transforms emergency department (ED) discharge instructions and electronic health records into personalized video presentations featuring a virtual healthcare provider. By leveraging multimodal ED data, large language models, and video generation, we aimed to produce accessible discharge instructions tailored to patients' ED visits. Four board-certified Emergency Medicine physicians reviewed 39 pairs of original and ED-Explain-produced discharge instructions. AI video summaries received significantly higher ($p<0.001$) average ratings (1-5) of completeness (4.1 vs. 3.1), correctness (3.9 vs. 3.5) and patient accessibility (3.4 vs. 2.9). Physicians expressed reservations about 13.3% of ED-Explain's discharge instructions for patient viewing, and only 4.6% of ED-Explain's instructions were found inappropriate for use with patients. Physician feedback suggests that AI-enhanced video discharge summaries have potential to improve communication of discharge information to ED patients, though patient-centered evaluation is needed. This work contributes to the growing field of AI-assisted healthcare communication and offers insights into the potential for AI to improve physician-patient communication and patient self-efficacy.

Keywords: Patient-centered Understanding; AI-generated Discharge Instruction.

1. Introduction

Background and motivation. Emergency department (ED) discharge represents a critical yet vulnerable transition point in patient care. The ED environment-characterized by high patient volumes, heterogeneous clinical presentations, time pressure, and frequent interruptions—creates substantial barriers to effective physician-patient communication. These communication challenges have serious consequences: between 41% and 78% of patients fail to adequately understand their diagnosis, treatment plan, or follow-up instructions upon leaving the ED.[1–8] More concerning, many patients overestimate their own comprehension,[5] creating a dangerous gap between perceived and actual understanding. Despite recognition of these problems and numerous efforts to improve discharge communication,[8–10] practical implementation has been limited by the requirement of substantial additional time from already-overburdened

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healthcare providers, making widespread adoption impractical in busy ED settings.

AI in provider-patient communication. Recent advances in artificial intelligence (AI) offer a potential solution. Large language models (LLMs) have demonstrated capability in simplifying complex medical information, including radiology reports[11] and consent documents.[12] A cross-sectional study by Kumar et al.[13] showed that GPT-4-based plain language translation of discharge materials significantly improved both objective and subjective patient comprehension. However, existing research has focused primarily on simplifying text-based materials without leveraging the established benefits of multimodal communication. Evidence from multiple domains suggests that video-based patient education can be more effective than written materials alone. Synchronized visual and verbal explanations improve patient comprehension and satisfaction.[10,14] In radiology, "ReXplain"[15] demonstrated the feasibility of AI-generated video reports with high ratings from radiologists. However, creating personalized video content manually remains time-intensive and impractical for routine clinical use.

Our approach and contributions. In this paper, we present ED-Explain, an integrated, AI-driven system that transforms multimodal visit data and original text discharge instructions into personalized, plain-language video presentations from a virtual healthcare provider. ED-Explain combines multimodal structured and free-text data, LLMs, and video generation to create engaging, accessible discharge instructions tailored to the patient encounter. 39 pairs of original and ED-Explain-generated discharge instructions, Emergency physicians rated the AI-generated discharge instructions as significantly more complete, correct, and accessible than the original discharge instruction. The physicians also deemed that ED-Explain could benefit both patients and providers if deployed. Our contributions include: (1) a multimodal approach that synthesizes diverse ED data types into coherent patient-friendly narratives, (2) empirical evidence that AI-generated instructions can exceed the quality of standard discharge materials as judged by emergency physicians, and (3) insights into physician perspectives on implementation challenges and opportunities.

2. Related Works

2.1. *Health Literacy and Outcomes*

The underlying issue extends beyond the ED environment to the broader challenge of health literacy—defined as the ability to obtain, process, and understand basic health information needed to make appropriate health decisions.[16] According to the Centers for Disease Control and Prevention, nearly nine out of ten adults struggle to understand and use health information when it contains unfamiliar or complex medical terminology,[17] highlighting the critical need for clearer communication strategies. This health literacy challenge is strongly associated with higher rates of hospital admission and readmission, increased healthcare costs, and higher all-cause mortality.[18] These consequences disproportionately affect marginalized populations, including older adults, racial and ethnic minorities, patients with limited English proficiency, and those with limited education.[19] Moreover, health literacy influences health outcomes through a multidimensional causal pathway.[20] The strongest evidence for its impact

appears at the most proximal (health knowledge) and distal (mortality) ends of this pathway, with less consistent evidence for intermediary outcomes such as self-management behaviors.[16] While health literacy directly influences knowledge acquisition, the translation of this knowledge into improved health behaviors and outcomes is mediated by additional factors including motivation, resources, and system-level barriers.

2.2. *Interventions to Improve Discharge Communication*

Various approaches have been proposed to enhance patient understanding of discharge instructions, ranging from improved written materials to multimodal communication strategies. DeSai et al.[9] evaluated the impact of simplified discharge instructions, finding significant improvements in patient comprehension. Teach-back methods, in which patients are asked to repeat instructions in their own words, have shown promise in improving comprehension. Slater et al.[8] found that incorporating teach-back methods into the discharge process improved retention of key domains of emergency department discharge instructions, particularly regarding follow-up appointments and medication management. In a systematic review, Oh et al.[21] further demonstrated that discharge education with the teach-back method was associated with reduced 30-day readmission rates, suggesting clinical benefits beyond improved comprehension.

Multimodal communication approaches that combine visual, auditory, and textual elements have emerged as a promising direction for improving patient comprehension. Bloch et al.[10] conducted a randomized controlled trial demonstrating that video discharge instructions improved caregivers' understanding of their child's emergency department visit compared to standard written instructions. The effect was particularly pronounced for follow-up care instructions, where comprehension improved from 59% to 91%. Building on this foundation, Wray et al.[22] developed and evaluated standardized discharge instruction videos for common emergency department conditions, finding that they improved patient satisfaction and reduced callbacks for clarification. However, these standardized videos lacked personalization to individual patient circumstances, potentially limiting their effectiveness for complex cases.

In the field of radiology, Recht et al.[14] found that video reports created by radiologists, featuring explanations and visual guidance, were strongly preferred by patients over written reports alone. Similarly, Balkman et al.[23] demonstrated that audio/video reporting workflows supplementing standardized radiology reports improved patient comprehension and satisfaction. However, both approaches required substantial radiologist time for video creation, limiting their scalability in practice. Neto et al.[24] further established the value of audiovisual reports in emergency musculoskeletal radiology, finding that patients preferred them over traditional reports and demonstrated improved understanding of their conditions. The authors noted that the production of such videos required specialized software and significant radiologist time, highlighting the need for more efficient production methods.

2.3. *AI Applications in Healthcare Communication*

Recent advances in large language models (LLMs) have created new opportunities for improving healthcare communication. LLMs demonstrate capability in translating medical terminol-

ogy into patient-friendly language while maintaining clinical accuracy. Large language models, such as GPT-4, have shown promise in simplifying radiology reports and medical consent, as well as translating appropriate patient instructions for incidental findings, though instances of hallucination underscore the need for clinical oversight.[12,13,25] Cross-sectional evaluation of GPT-4-based clinical note translation revealed significant improvements in patient comprehension, with larger gains among traditionally underserved populations.[13] Beyond text-only applications, multimodal approaches are emerging. "ReXplain" integrates language models with image segmentation and avatar generation to transform radiology reports into patient-friendly videos. Initial feedback from radiologists suggests this approach effectively simulates one-on-one consultation.[15] These developments highlight AI's growing role in bridging communication gaps between healthcare providers and patients.

Clough et al.[26] conducted a pilot study evaluating AI-generated discharge summaries based on mock patient vignettes, finding that all AI-generated summaries were deemed acceptable by general practitioners, compared to 92% of summaries written by junior doctors. Similarly, Kim et al.[27] developed and validated patient-friendly discharge summaries based on GPT technology in Korea, demonstrating high acceptance among both patients and physicians. However, Williams et al.[28] observed instances of hallucination or omission of clinically significant facts in LLM-generated discharge summaries for complex cases, highlighting the need for improved factual grounding.

2.4. *Gaps in the Current Literature*

Despite advances in AI for healthcare communication, significant gaps remain that limit clinical impact. First, many of previous studies have approached discharge summary generation as technical challenges focused on clinical accuracy rather than patient comprehension. Second, translation-based approaches remain constrained by the quality and structure of original documents, merely simplifying language without addressing possible organizational flaws. Third, research has remained almost exclusively text-based, failing to leverage the established benefits of multimodal communication, despite evidence that video formats significantly enhance understanding of complex medical concepts.[10,14,15,29] These limitations collectively highlight the need for an approach that fundamentally reimagines discharge communication through multimodal formats while directly measuring impact on clinical outcomes.

3. Method

ED Visit Data. Discharge instructions are particularly important for patients at high risk of complications and return visits. Therefore, we randomly sampled 50 ED visits from the Stanford Adult Emergency Department (2020–2024) followed by a return visit within 30 days of the original encounter. We excluded 11 cases lacking original discharge instructions, which produced a final cohort of 39 ED visits. Data are de-identified following the approach by Kansal et al.[30]

Multimodal Visit Documentation. The term "multimodal" in this study refers to the integration of multiple types of electronic health record data, specifically structured data fields

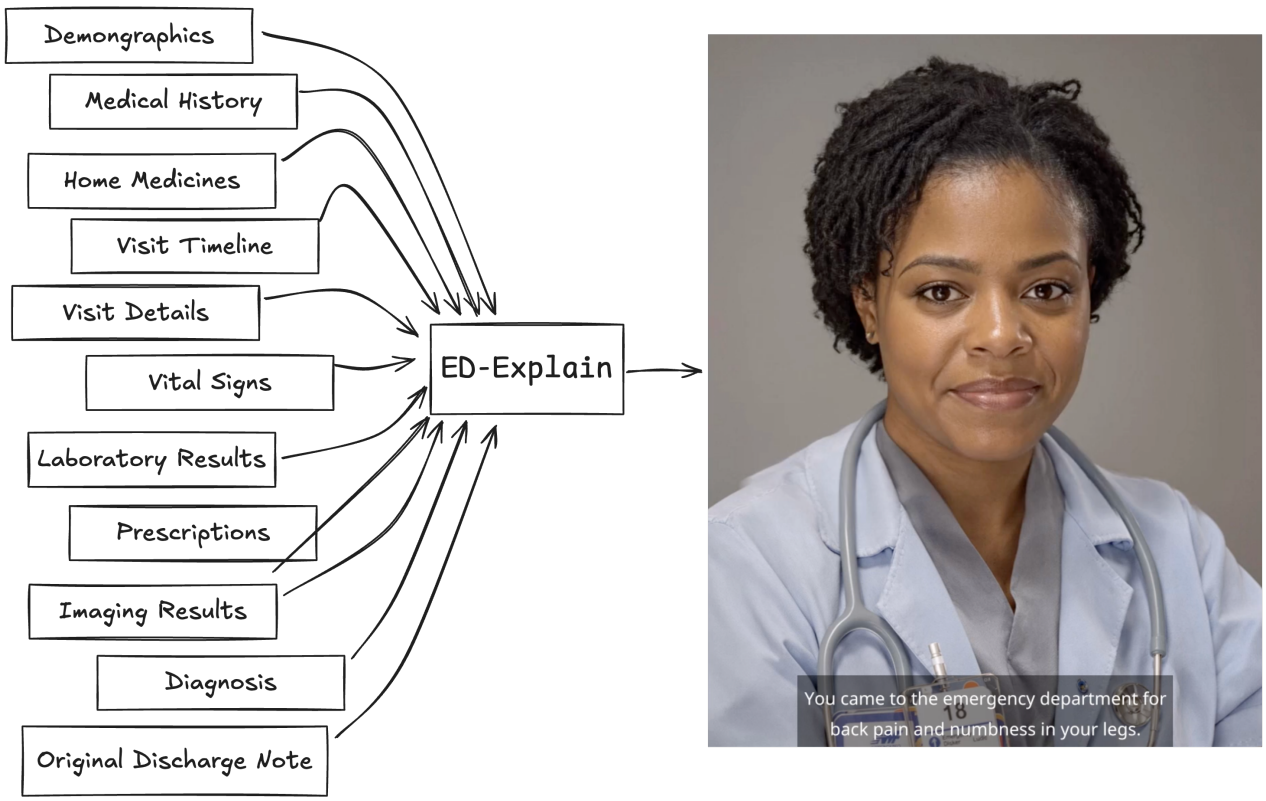

Fig. 1. **ED-Explain workflow**. We produced structured visit documents containing patient demographics, past medical history, home medications, vital signs, laboratory and imaging results, diagnoses, prescriptions, and original ED discharge instructions. ED-Explain converted visit documents into video discharge instructions featuring a virtual healthcare provider.

(such as vitals) and unstructured free-text narratives. This approach differs from multimodal AI systems that process images, audio, or video.

We first convert de-identified multimodal visit data into a single visit document. Structured data included: patient demographics (age, gender, payor), home medications, past medical history, visit metadata (chief complaint; triage information; diagnosis, arrival, disposition, and departure times), orders (medications, laboratory and imaging tests, consults), laboratory results, and vital signs. De-identified free-text data included: radiology report impressions, and the original text of discharge instructions given to patients upon discharge from the ED.

Home medications included names and medication classes. Past medical history included ICD-10 codes, descriptions, and Clinical Classification Software (CCS) categories. Vital signs—including heart rate, respiratory rate, oxygen saturation, temperature, systolic blood pressure, and diastolic blood pressure—are summarized by minimum, maximum, and final recorded values from the visit. Laboratory results were represented both categorically (normal/abnormal/critical) and as numerical values with reference ranges. Imaging results included study types and de-identified free-text narrative impressions.

Visit documents also included details of previous visits to capture patterns of healthcare utilization, including chief complaints, diagnoses, and dispositions.

Discharge Instruction Translating Prompt

You are helping explain what happened in the emergency department visit for the patient. You will be given a note recording the patient's visit and discharge summary. Help explain the note as follows:
(1) Briefly summarize the reason for the visit and what was found
(2) Provide a coherent narrative of what happened during the ED visit in chronological order, highlighting key events with general timing (e.g., "Initially," "Later," "Following that," "Toward the end of your visit")
(3) Note any specific findings that require follow up
(4) Any actions the patient should take
(5) Scheduled follow up plan
(6) Reasons to return to ED

Requirements:
*Begin with a coherent story introduction: "You came to the emergency department for [chief complaint]."
*Then provide a smooth narrative of the ED visit: "When you first arrived, [initial assessments/procedures]. After that, [subsequent events]. Based on these initial findings, [additional tests/interventions] were performed. The results showed [relevant findings]."
*Include approximate timing where meaningful (e.g., "Shortly after arrival," "Several hours into your visit," "Before discharge"), but prioritize the flow of the story over precise timestamps.
*Include relevant test results, noting both normal and abnormal findings within the narrative context they occurred.
*Discuss trends in serial results when applicable, and where results fall in the patient's past distribution of results.
*All explanations should be conversational. *Try your best to generate the explanation in a way that can be understood by a layman with an eighth-grade reading level.
*Try your best to make the explanation concise while maintaining clarity.
*When there are abbreviations, expand them. *Do not suggest anything except for those already mentioned in the report.

Example:
"You came to the emergency department late last night for chest pain and shortness of breath.

When you first arrived, the nursing team checked your vital signs and found your heart rate was slightly elevated. The doctor then examined you and ordered several tests to check your heart and lungs. First, you had an electrocardiogram (ECG) to check your heart rhythm, which was normal. Shortly after, blood samples were taken to check for signs of heart damage.

Later in your visit, you had a chest X-ray. When all your test results came back, your ECG and blood tests were reassuring against heart attack, but your chest X-ray showed a likely pneumonia, as well as a pulmonary nodule (small spot on the lung) that should be followed by your primary care physician. You were then given your first dose of antibiotics through an IV before the doctor discussed your diagnosis and treatment plan.

Take Amoxicillin (antibiotic) twice daily for 7 days. Take Tylenol 1000mg and Ibuprofen 400mg every 6 hours as needed for pain or fever.

Follow up with your primary care physician within 1 week. Return to the emergency department for worsening shortness of breath, persistent fever above 101°F, or loss of consciousness."

Please generate a discharge summary based on the following information:
MEDICAL DOCUMENT:{patient_document}
ORIGINAL DISCHARGE INSTRUCTION:{original_discharge_instruction}

Fig. 2. **Discharge Instruction Translating Prompt** used in this study to translate original discharge summary and electronic health records into patient-friendly narratives. {} represents placeholders for inputs.

ED-Explain (Video Discharge Instructions). [a] Fig. 1 illustrates the framework of ED-Explain. The system prompts OpenAI o3-mini (2024-12-01-preview) to explain the patient's ED visit and discharge instructions by synthesizing the de-identified multimodal visit data and original discharge instructions in patient-friendly language, while preserving critical clinical information. A structured prompt guides the model to create a coherent narrative of the ED visit, including the reason for the visit, key events and outcomes, specific findings requiring follow-up, and recommended patient actions, follow-up, and reasons to return to the ED. ED-Explain aims for better readability while maintaining clinical accuracy. The patient-accessible text is checked for complete de-identification, then converted via HeyGen (`https://www.heygen.com/`) to a video featuring a virtual healthcare provider who delivers the information in a conversational manner. The prompt for translating the discharge instructions can be found in Fig. 2.

Physician Evaluation. We presented four board-certified Emergency Physicians with the structured and unstructured visit data, the multimodal visit document, the original ED note and discharge instructions, and ED-Explain's AI-generated text and video discharge instructions. These materials were presented on a standardized rating dashboard. The evaluation included structured ratings (1-5) of completeness, correctness, and patient accessibility for original text and ED-Explain text and video discharge instructions. For the videos, physicians provided additional assessments of potential patient acceptability, potential to improve comprehension and adherence, potential to supplementing or replace existing discharge instructions, and appropriateness for supervised and unsupervised viewing by patients. These supplementary metrics were scored on a 5-point Likert scale (1=very unlikely, 2=unlikely, 3=maybe, 4=likely, 5=very likely).

4. Results

Three physicians completed numeric ratings of individual pairs of discharge instructions. Sixteen pairs were rated by two physicians and 23 pairs were rated by one. All four physicians completed the open-ended survey.

4.1. *Comparison of Text and ED-Explain-generated Discharge Instructions*

Fig.3 A shows mean completeness, correctness, and accessibility ratings, with ED-Explain discharge instructions rated superior to the original written instructions across all three criteria. The largest difference was observed in completeness, with AI instructions receiving a mean rating of 4.1 for completeness, compared to 3.1 for original instructions. For correctness, AI video instructions scored 3.9, compared to 3.5 for original instructions. AI instructions averaged 3.4 in ratings of patient accessibility, compared to 2.9 for original instructions. All differences were significant at $p<0.001$ by Wilcoxon signed-rank test. These results suggest that multimodal AI discharge instructions can both preserve clinical accuracy and enhance

[a] A sample video can be found via
`https://drive.google.com/file/d/1_B1OdR0fiB1nia9SNiwp3CcXhDA-QJk5/view?usp=sharing`

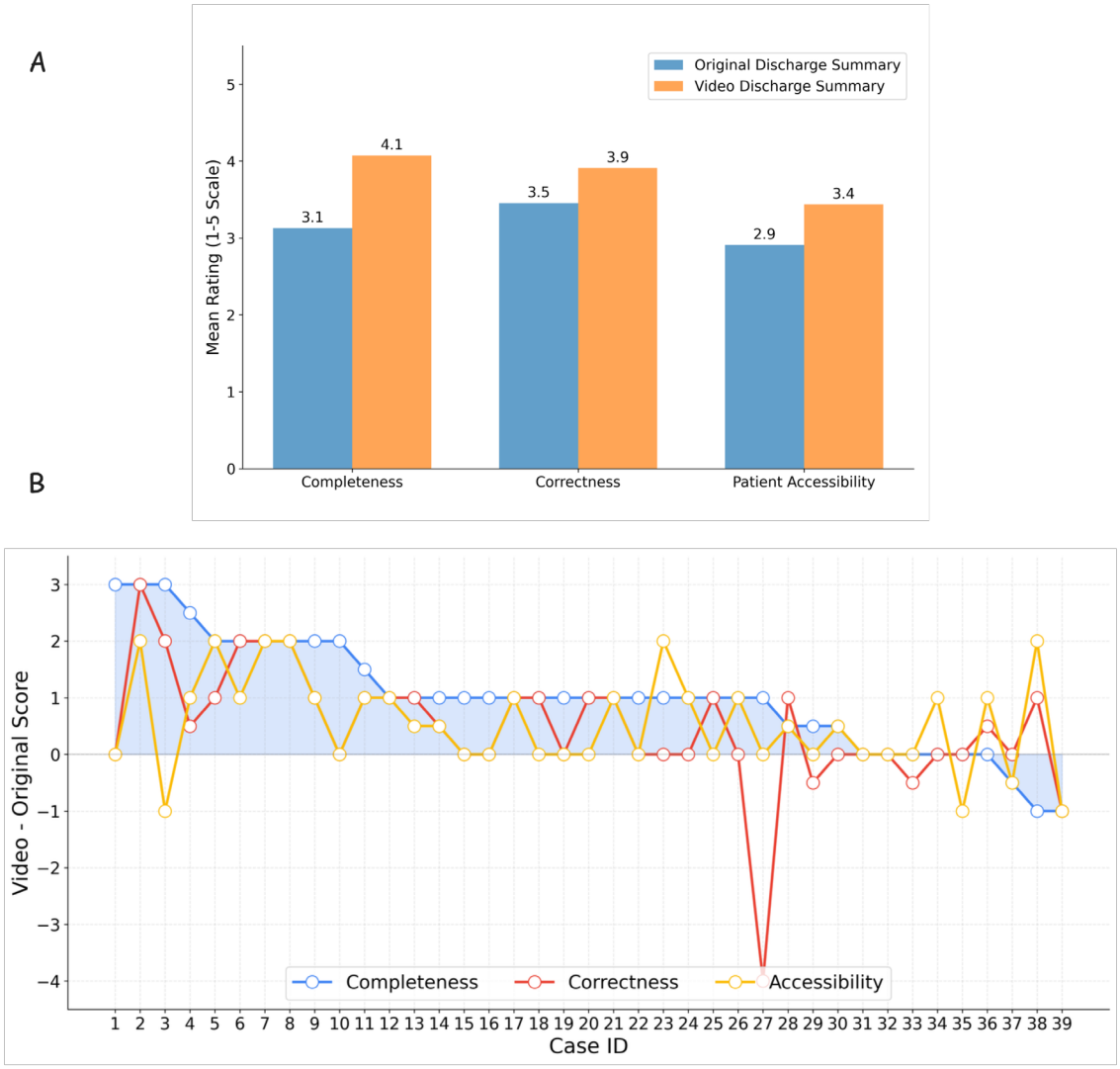

Fig. 3. **(A)** Mean physician ratings (1-5 scale) of completeness, correctness, and patient accessibility of original text (blue) and ED-Explain (orange) discharge instructions . **(B)** Case-level differences between original and AI-generated discharge instruction scores across all 39 evaluated cases, with positive values indicating that ED-Explain was rated superior in completeness (blue), correctness (red), or accessibility (orange) compared to original discharge instructions.

accessibility to patients.

We averaged the scores for each case to analyze case-level differences in ratings (Fig. 3 B). In 30 of 39 cases (76.9%), AI discharge instructions were rated more complete than the original instructions (improvements ranging from 0.5 to 3.0 points on a 5-point scale). In 20 of 39 cases (51.3%), ED-Explain was rated more correct than original instructions, though with more modest gains (typically between 0.5 and 2.0 points). For patient accessibility, ED-Explain was found superior to the original instructions in 21 of 39 cases (53.8%), with differences of 0.5 to 2.0 points.

In 8 of 39 cases (20.5%), the AI discharge instructions were found inferior to the original

instructions in at least one dimension. The most serious instance of AI underperformance was in correctness for a case involving a complex therapeutic regimen not accurately captured by the AI-generated instructions, highlighting an area for improvement.

4.2. *Video Assessment*

Survey results (Fig. 4) provide insights into physicians' perspectives on the practical implementation of video discharge instructions.

Physicians believed it was "likely" that the generated videos could improve patient understanding in 44.4% of cases, and responded "maybe" in 51.1% of cases. Only 4.5% of cases were rated as "unlikely" to improve understanding. This distribution suggests cautions optimism from physicians about the real-world patient education impact of the AI discharge instructions. Physicians responded that they would consider supplementing traditional discharge instructions with AI videos in 40.9% of cases, and responded "maybe" for another 54.5%. Only 4.6% of videos ratings were deemed clearly unsuitable for use. Physicians were less amenable to completely replacing text instructions, with only 18.2% of cases rated as suitable for video instructions alone.

When asked about patient supervision requirements, physicians found 60.0% of examples suitable for independent viewing by patients (8.9% "very likely" and 51.1% "likely"). Few videos were rated as unsuitable for patient viewing with or without supervision. When asked whether the ED-Explain-generated discharge instruction videos would better help patients follow discharge instructions, physicians found this outcome "likely" for 22.7%, were uncertain for the majority (72.7%), and doubtful about 4.6%. Similarly, when asked if video format would be preferred by patients, physicians responded affirmatively in 27.3% of cases, were uncertain for 68.2%, and skeptical for 4.5%.

These results indicate that physicians see potential in AI video discharge instructions.

4.3. *Qualitative Findings from Physician Feedback*

Four physicians provided their opinions on the perceived value and potential implementation challenges of ED-Explain-generated video discharge instructions. Responses were collected through open-ended survey questions focused on utility, improvements, clinical integration, and anticipated barriers. We summarize key themes from this feedback.

Perceived Value of Video Discharge Instructions. Physicians identified several aspects of the AI-generated discharge videos as particularly valuable. The narrative format was highlighted as a significant improvement, with one physician noting that the videos offered "a more comprehensive explanation of what actually occurred during the ED encounter." Another physician valued how the AI system could "assimilate multiple forms of data and fit them to a theme" while maintaining "the right balance between specific and general data." The potential beneficiaries of such a system were primarily identified as patients with limited health literacy and those who had complex ED encounters:

> "I think patients with poor health literacy and a poor understanding of what took place during an ED encounter [would benefit most]."

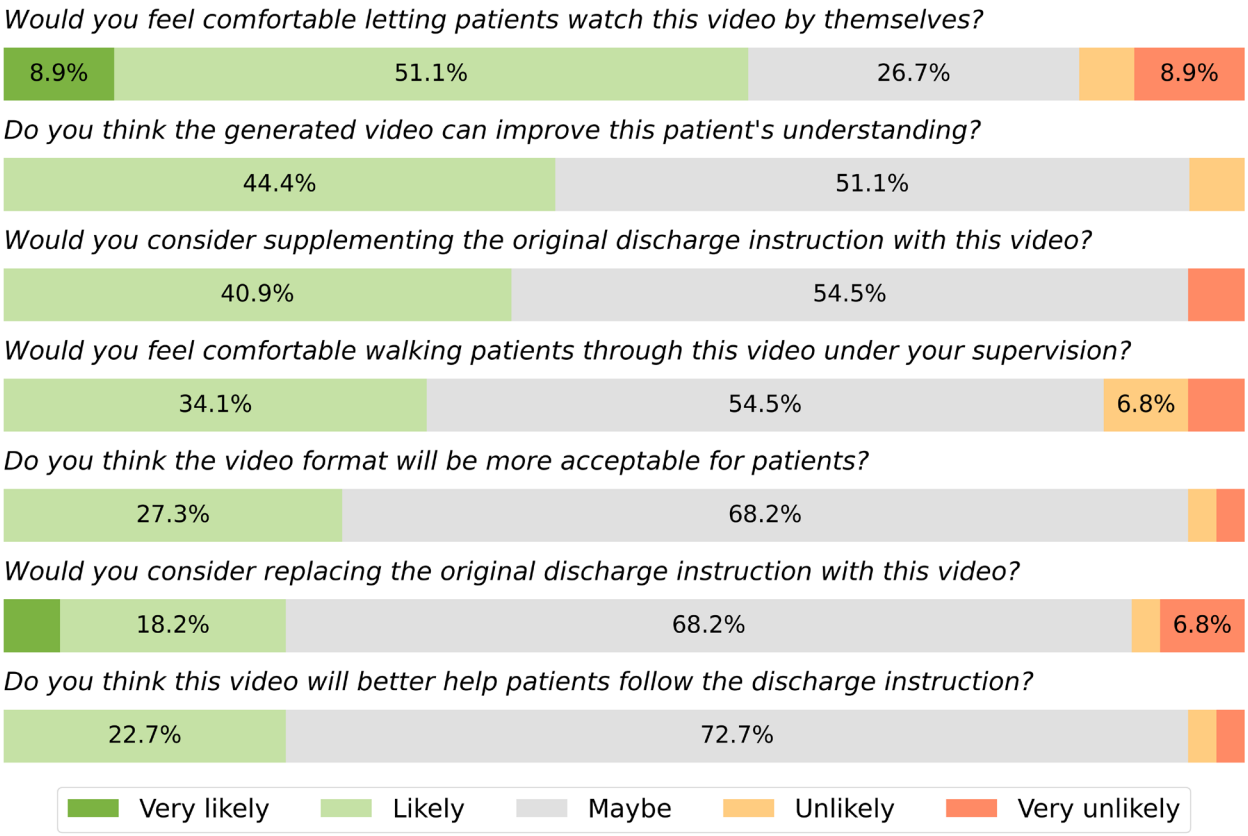

Fig. 4. **Physician perspectives on implementing ED-Explain video discharge instructions in clinical practice.** The bar chart displays survey responses from Emergency Physicians (n=4) evaluating seven key implementation questions. Color-coded segments represent the distribution of responses on a 5-point Likert scale from "Very likely" (dark green) to "Very unlikely" (red).

Additionally, physicians recognized value for family members and caregivers who may not have been present for the ED visit, with one physician suggesting that "patients should be allowed to forward it to their family and/or caregivers."

Implementation Considerations. When asked about implementation in clinical practice, physicians envisioned using the system primarily at the end of visits, with one suggesting they would have patients "review/watch the video prior to me being available to answer additional questions/clarify points." Similarly, another physician would consider having the patient "interface with it toward end of visit/end of visit" and "then ask them if they had questions." Anticipated institutional barriers centered on safety and risk management:

> "There will likely be data privacy concerns. I would imagine some physicians might be concerned about inaccuracies presented in the AI instructions."

Another physician highlighted the fear of malpractice risk "if the AI gets something wrong," while a third emphasized that such a system will "ALWAYS need a human-in-the-loop." The most valuable potential outcomes identified by physicians included improved patient

understanding, better adherence to treatment plans, reduced revisits, and time savings for physicians. As one physician summarized:

> "Patients have very poor understanding of discharge instructions, which often impairs follow up, treatment adherence, and increases revisits to the hospital. Improving all of those factors would be beneficial."

These qualitative insights provide important context for understanding the potential real-world implementation challenges and benefits of ED-Explain. While physicians see significant value in the approach, careful attention to content organization, customization, and risk management will be essential for successful clinical deployment.

Suggested Improvements. Specific suggestions for improving the video discharge instructions are focused on content organization, presentation, and customization:

(1) **Content organization**: Most physicians recommended better structuring of information, with one suggesting to start with "a brief summary of the entire visit, then give more details" and another recommending separating content into "sections that the patient can expand based on their interest."
(2) **Simplification**: Physicians noted that some aspects were "too detailed and may detract from the main message," with specific recommendations to "remove ICD codes," "remove dosages," and eliminate "generic boilerplate phrases."
(3) **Presentation format**: Feedback on the avatar itself was mixed, with one physician finding "the AI face mannerisms were distracting" while others focused more on content than delivery method.
(4) **Customization**: Physicians suggested adapting content to "patient-preferred language" and providing "specific resources/recommendations based on patient location and best-practice guidelines."

Key Stakeholders and Adoption. When asked which stakeholders would be most interested in adopting such a system, providers identified several key groups:

> "If done in the correct way that would reduce the burden on physicians they would be a major stakeholder. Demonstrating better adherence to follow up recommendations and decreased revisits would be major things for the hospital/healthcare system."

Other providers specifically mentioned discharge coordinators and planners as well as callback services, walk in clinics, and ED care providers as primary stakeholders. A provider suggested that "with improvements to clarity and reliability, everyone would be interested in adoption."

5. Limitations and Future Directions

Our study has limitations. First, our evaluation focused on physician assessment alone and was not blinded—physicians knew which instructions were AI-generated and thus could potentially influence ratings. Additionally, this was a retrospective study from a single academic medical center. However, this study represents a crucial first step in demonstrating that AI-

generated discharge instructions can meet clinical standards in real-world practice. By establishing physician acceptance and clinical appropriateness, this work provides the essential foundation needed to advance to patient-centered studies. Future studies would assess acceptability to diverse patient populations. Second, the cases in which AI-generated discharge instructions were rated inferior to original instructions highlight the need for improved handling of complex therapeutic regimens. Third, this was a retrospective study on de-identified data. Future research should assess long-term patient retention of discharge information and its impact on adherence to treatment plans. Finally, an important practical consideration for implementing ED-Explain is the time and cost associated with video generation. Current commercial video generation platforms require several to tens of minutes per video, which could constrain scalability in high-volume ED settings. However, the rapidly evolving video generation technology is expected to substantially reduce processing time and cost, making real-time generation[31] at scale feasible for widespread clinical deployment.

6. Discussion

Our results suggest that ED-Explain-generated video discharge instructions can enhance communication of discharge information compared to conventional written instructions. The AI-generated instructions' superior ratings for completeness, correctness, and patient accessibility align with previous research on video discharge.[10] The cautious physician reception, with most responses falling into the "maybe" category, suggests a need for iterative implementation under clinical supervision, rather than wholesale replacement of text instructions. This aligns with previous findings,[26] which emphasized the importance of physician oversight for AI-generated patient information. The positive physician feedback on narrative format and comprehensive explanation indicates that our approach can address known challenges in discharge communication while preserving clinical accuracy. The minimal outright opposition to implementation (only 13.3% of cases provoking reservations about patient viewing, and 4.6% firm opposition to patient viewing) indicates openness to this approach.

In summary, ED-Explain demonstrates the potential to enhance patient comprehension of discharge instructions through AI-generated video that synthesizes structured and unstructured visit data. Physicians found ED-Explain's multimodal discharge instructions to be more complete, correct, and accessible than conventional text-only discharge instructions. While the value of this approach is recognized, implementation will require appropriate clinical oversight. At present, AI-generated discharge instructions are more suitable as a supplement to standard instructions than as a replacement. AI-driven healthcare communication tools can bridge the gap between complex medical information and patient understanding. As healthcare systems seek to improve patient-specific personalization, ED-Explain represents a scalable solution to persistent challenges in discharge communication, a high-risk, high-impact aspect of health care. Future work should focus on patient reception and outcomes, improved performance on complex cases, and clinical workflows to maximize the benefits of the technology while maintaining the highest standards of quality and safety.

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