

Mitigating Information Asymmetry in Patient-Hospital Interactions

By Harsh, Usman & Vandita | Track: 1 (Experimentation)



The Problem: The "Healthcare Maze"

Information Asymmetry

Patients lack medical knowledge to navigate complex hospital taxonomies (e.g., Obstetrics vs. Gynaecology).

Cognitive Barrier

Traditional interfaces demand high Executive Function. Finding a specific doctor often takes >5 clicks.

The Vulnerable User

Older adults face "motivational and cognitive barriers" with complex menu structures.

Hypothesis

An NLP agent will significantly reduce **Time-to-Task** and **Cognitive Load** compared to a standard GUI, especially for high-complexity tasks.

Paper 1

Large Language Models in Medical Chatbots: Opportunities, Challenges, and the Need to Address AI Risks

by James C. L. Chow ^{1,2,*} and Kay Li ³

Problem & Approach

- Traditional chatbots used static decision trees → limited contextual understanding
- Solution: Transformer-based LLMs (GPT-4, BERT, Med-PaLM 2)
- Fine-tuned on medical datasets + RLHF with expert annotations

Key Results

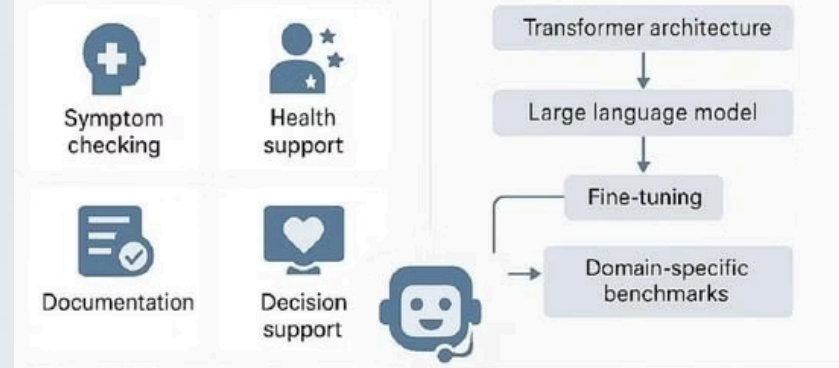
- Clinical accuracy: 3.29/4.0 → 3.58/4.0 with self-correction
- Operational efficiency: 25-35% reduction in documentation time
- Cost: \$0.01-0.05 per interaction vs. human support
- Scalability: Millions of parallel queries, 99.9% uptime

Critical Limitations

- 29.2% hallucination rate (sub-optimal responses)
- Algorithmic bias across demographic groups
- Privacy concerns with PHI in cloud processing
- No standardized evaluation framework for clinical safety

Large Language Models in Medical Chatbots: Opportunities, Challenges, and Risks

Applications in Healthcare



Challenges and Risks

- Hallucination
- Algorithmic bias
- Privacy concerns
- Legal and ethical issues

Mitigating AI Risks

- Governance frameworks
- Societal oversight
- Long-term safety

Paper 2

Retrieval-Augmented Generation (RAG) in Healthcare: A Comprehensive Review

by Fnu Neha 1,*, Deepshikha Bhati 1 and Deepak Kumar Shukla 2

Problem & Approach

- LLMs hallucinate, lack transparency, have outdated knowledge
- Solution: RAG = Retrieval + Generation

Index documents → Retrieve relevant chunks → Generate grounded response

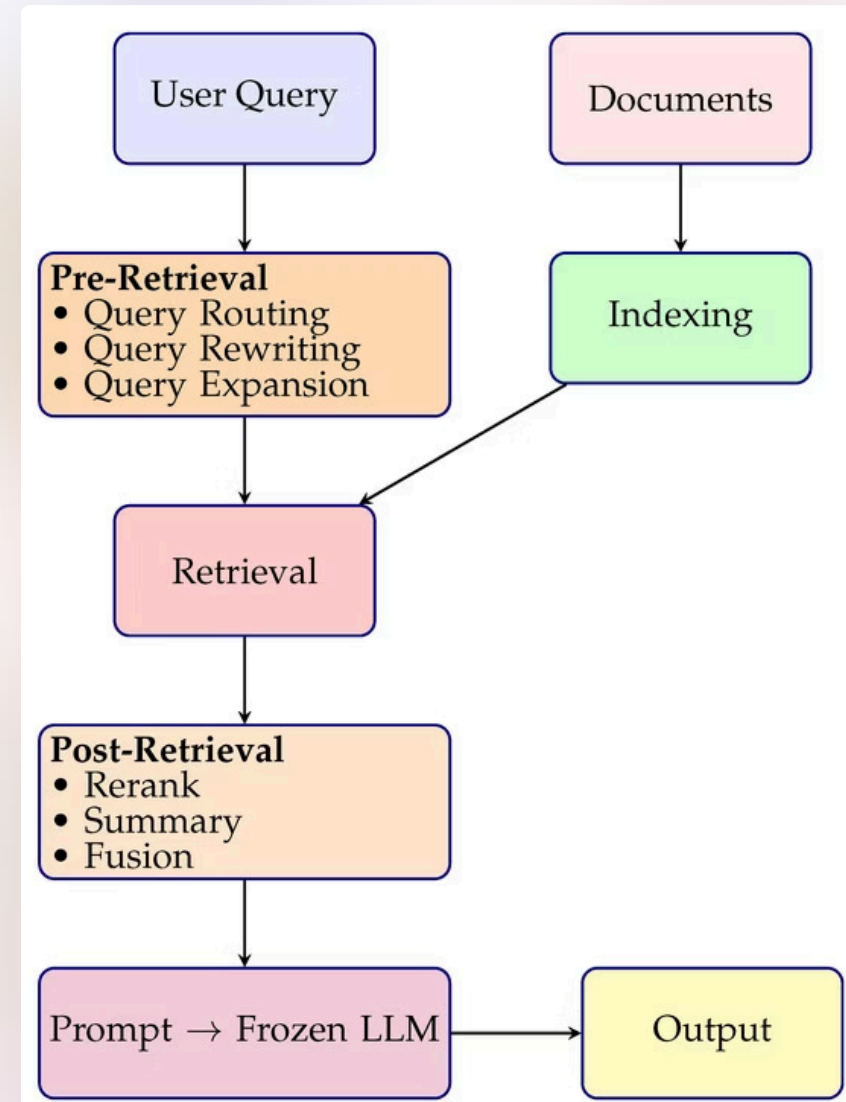
Critical Limitations

- 69/70 studies ignored privacy/safety considerations
- 45% of responses not fully backed by retrieved sources
- 78.9% English-only datasets
- No unified evaluation framework across studies
- Single-round retrieval struggles with complex queries

Key Results - Accuracy Improvements

- **GPT-4 with RAG: 79.97%** +6.5% improvement over baseline
- **GPT-3.5 with RAG: 71.57%** +10.9% improvement over baseline
- **KG-RAG: 71%** Improvement over baseline

Patient screening: 1 hour → seconds



Paper 3

AI Chatbots and Cognitive Control: Enhancing Executive Functions Through Chatbot Interactions: A Systematic Review

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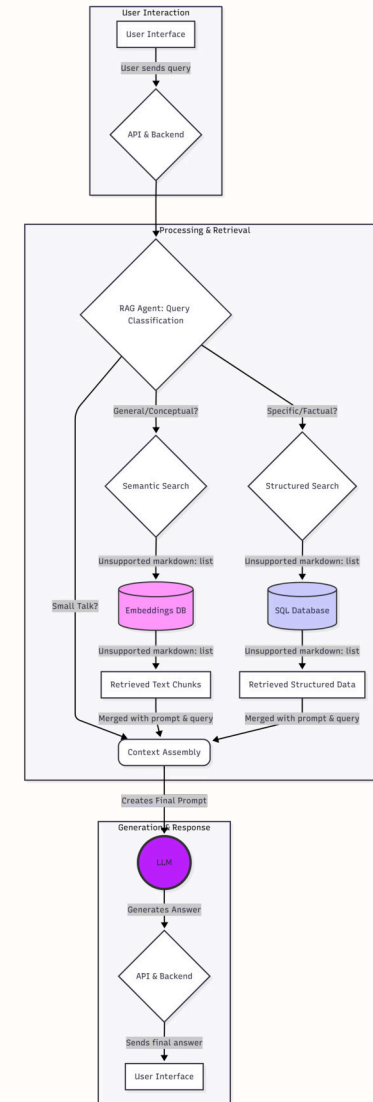
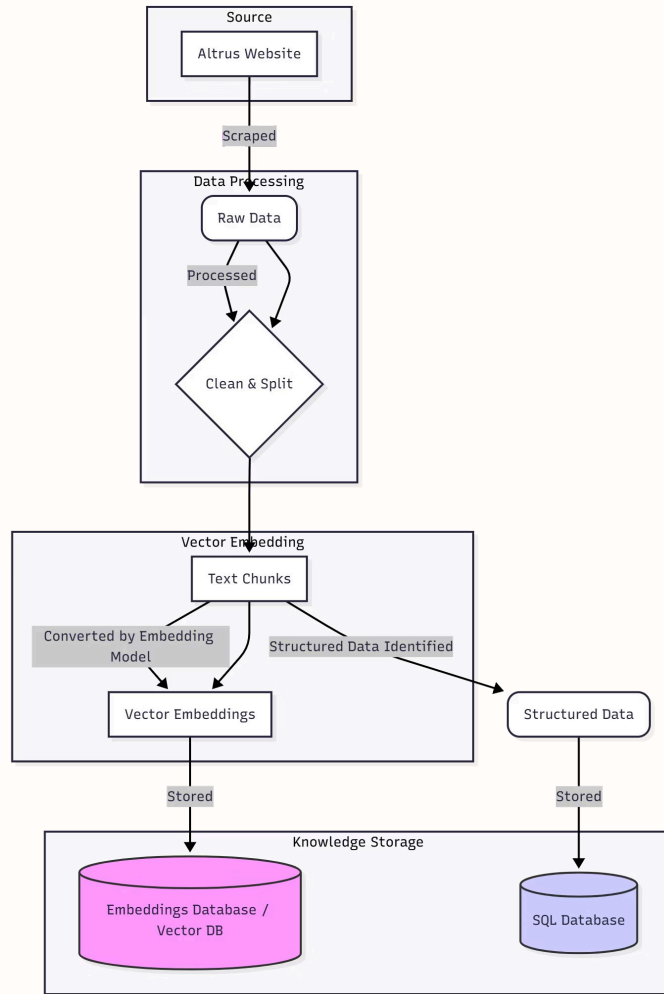
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Brain Sci. **2025**, *15*(1), 47; <https://doi.org/10.3390/brainsci15010047>

Core Argument & Mechanism

- AI chatbots function as "external digital assistants" that offload high-level cognitive processes (Executive Functions) from the human user
- They reduce Cognitive Load by taking over:
 - Planning: Structuring the search for information
 - Working Memory: Holding context across multiple turns
 - Inhibition: Filtering out irrelevant menu options

Cognitive Load	High (User must plan navigation)	Low (Bot plans navigation)
Search Strategy	Manual (Menu Tree Traversal)	Direct (Intent Recognition)
Executive Function	User Burden	Offloaded to AI





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Experiment Protocol

01

Design

Counterbalanced Within-Subjects Study (A/B Testing).

02

Participants

N=20, mixed demographics.

03

Low Complexity Task

Binary Check ("Does hospital have IVF?").

04

Med Complexity Task

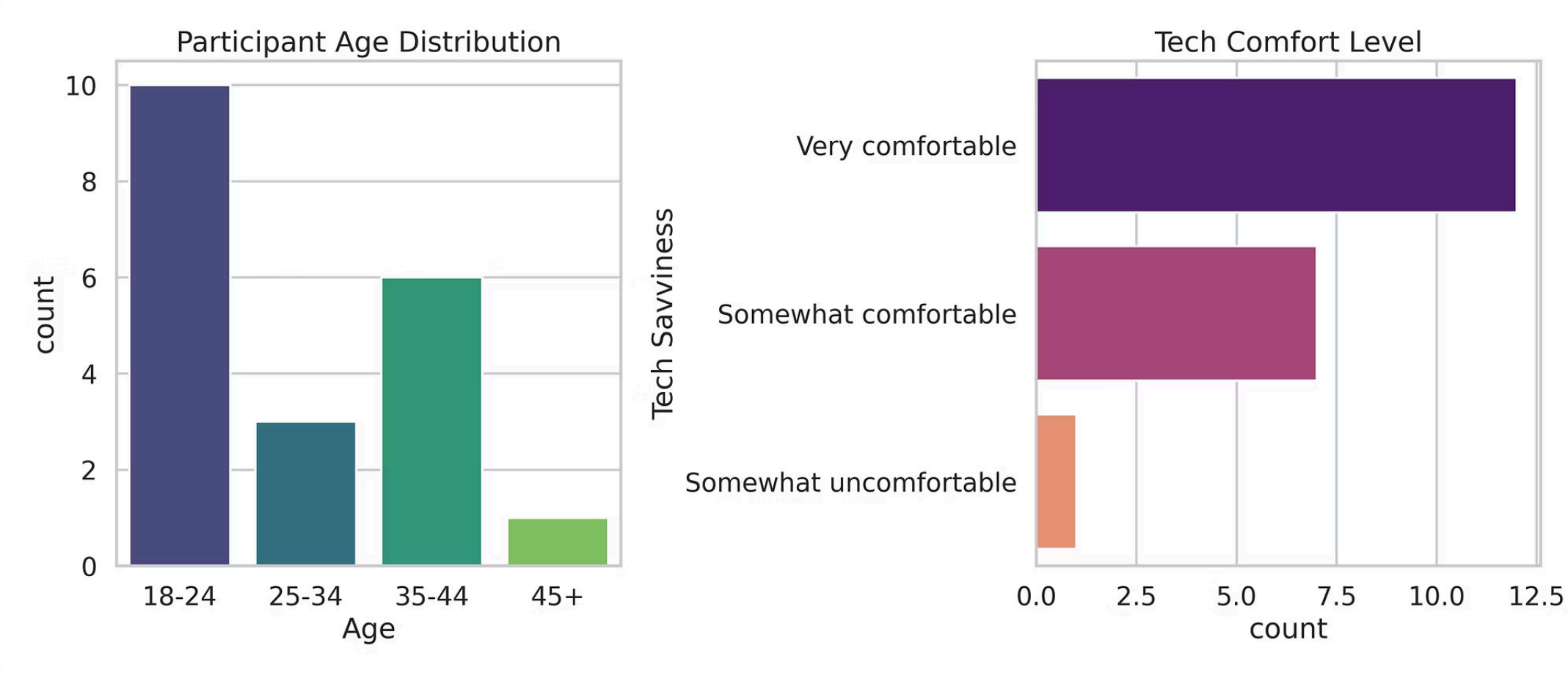
Location Retrieval ("Find Dehradun branch address").

05

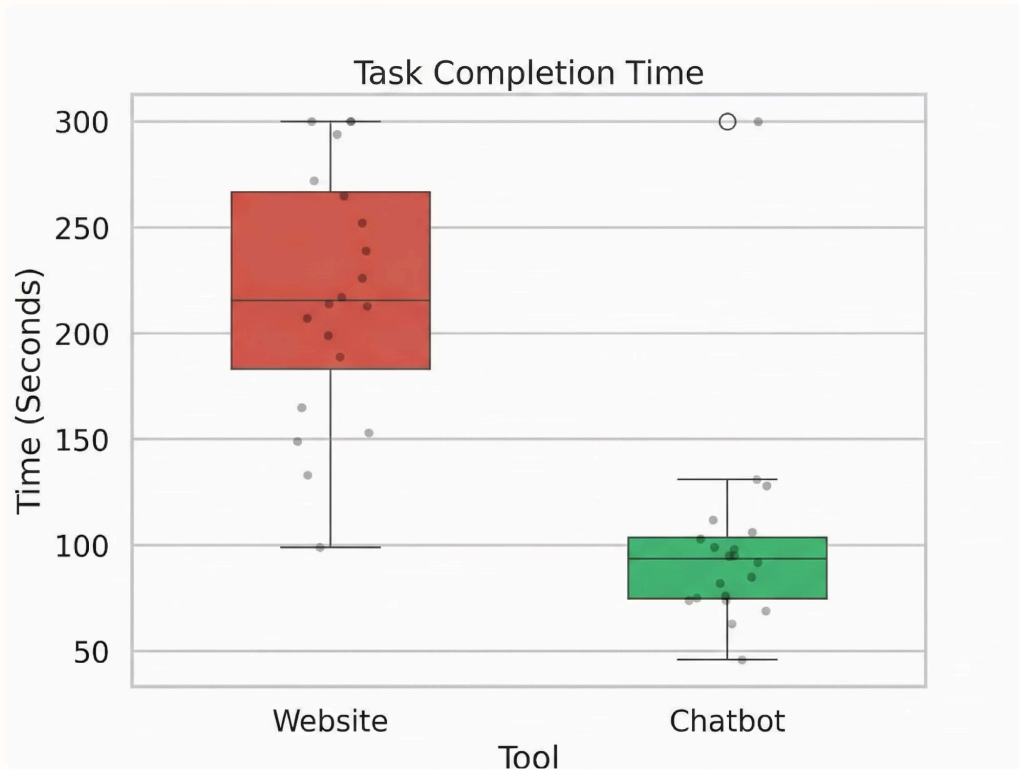
High Complexity Task

Specific Entity Search ("Find about Hair Renewal Doctors).

Participant Demographics



Result 1 - The Efficiency Gap



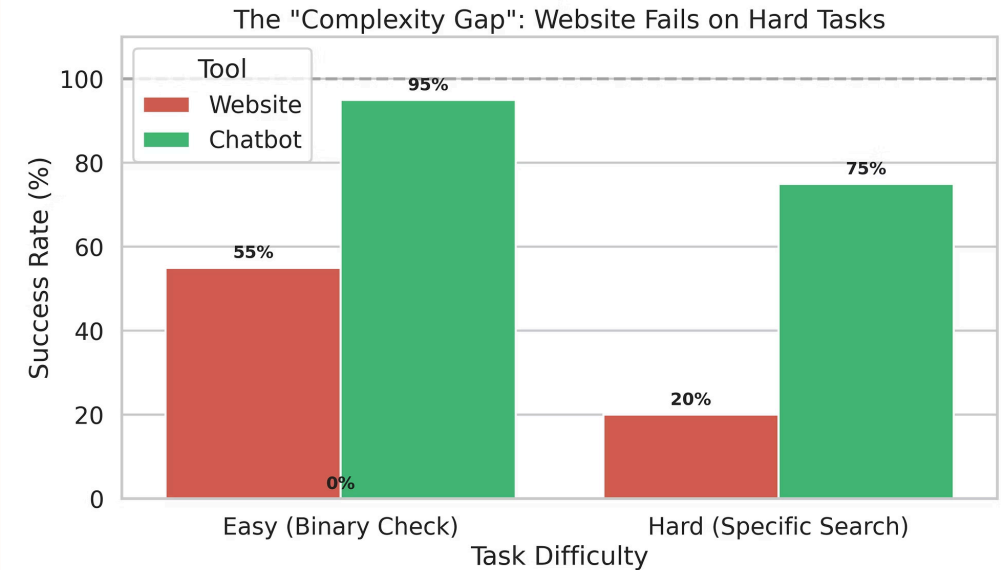
Stats

- **Website Avg Time:** 206s (high variance).
- **Chatbot Avg Time:** 85s (tight variance).
- **Stat:** 120.45 second reduction ($p < 0.00001$).

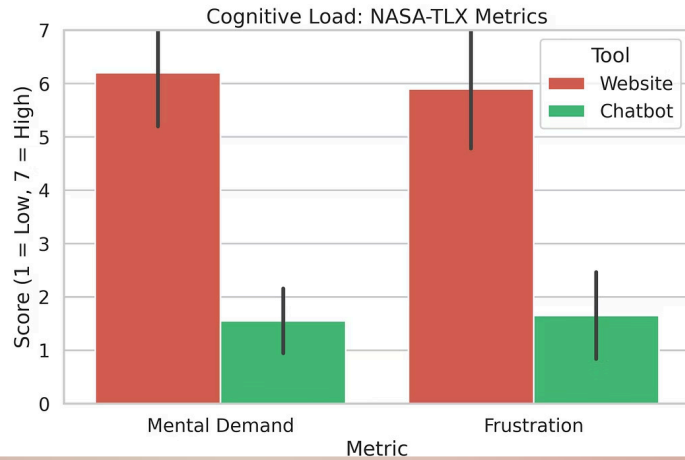
Result 2 - The "Complexity Gap"

Key Insight

- **Easy Tasks (Q1):** Website performs okay & Chatbot perform better.
- **Hard Tasks (Q3):** Website Success drops to ~20%. Chatbot maintains ~75%.



Result 3 - Cognitive Load (NASA-TLX)



Frustration Score

Dropped from 5.85 (High) to 1.55 (Minimal).

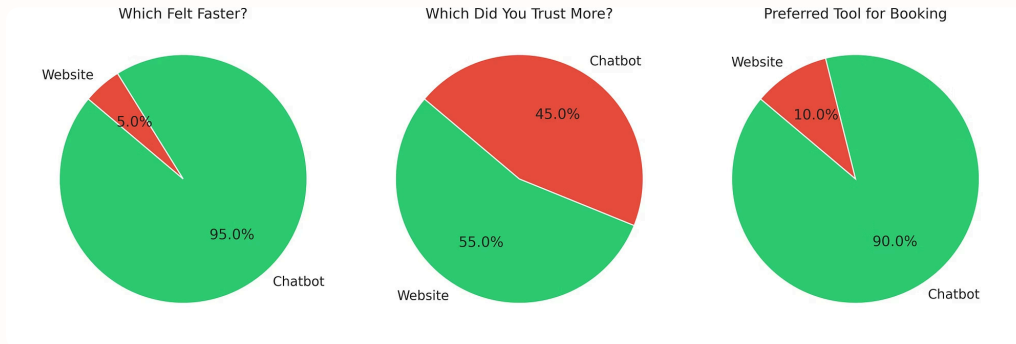
Statistical Significance

Paired T-Test ($p < 0.00001$).

Impact

Successfully offloaded "Search Cost" from user's brain to the AI model.

The Trust Paradox



- **Speed:** Chatbot.
- **Trust:** Mixed. Users felt "unsafe" typing medical symptoms into a bot.

While the bot performs better, the static website feels "safer" for privacy.

Our consideration for future work: Future designs must prioritize visible "Trust Badges" and privacy guarantees.

Discussions

Real-World Deployment: Impact & Conclusion



Patient Impact

Reduces cognitive load & time-to-care.



Hospital Impact

Reduces administrative burden (reception calls).



Societal Impact

Makes healthcare accessible to those with lower digital literacy.

NLP agents are not just "features"; they are essential accessibility tools for complex information systems.

Thank You

Extra Plots

