

Application of MATEC (Multi-AI Agent Team Care) Framework in Sepsis



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Introduction

- Sepsis is a life-threatening condition requiring timely, specialized medical intervention.
- Rural and under-resourced hospitals often lack access to specialists, negatively impacting sepsis outcomes.
- AI-based medical tools offer potential solutions but are limited by accuracy and reliability concerns.
- We developed the MATEC (Multi-AI Agent Team Care) framework to support clinical decision-making in sepsis care using multiple specialized AI agents.
- This pilot study evaluates MATEC's clinical usefulness, accuracy, and potential to assist healthcare providers, particularly in resource-limited settings.

Methods

- We developed specialized AI Agents using Large Language Models (LLM), prompt engineering, Chain of Thought (CoT) Reasoning, Reasoning and Action (ReAct), and Retriever-Augmented Generation (RAG).

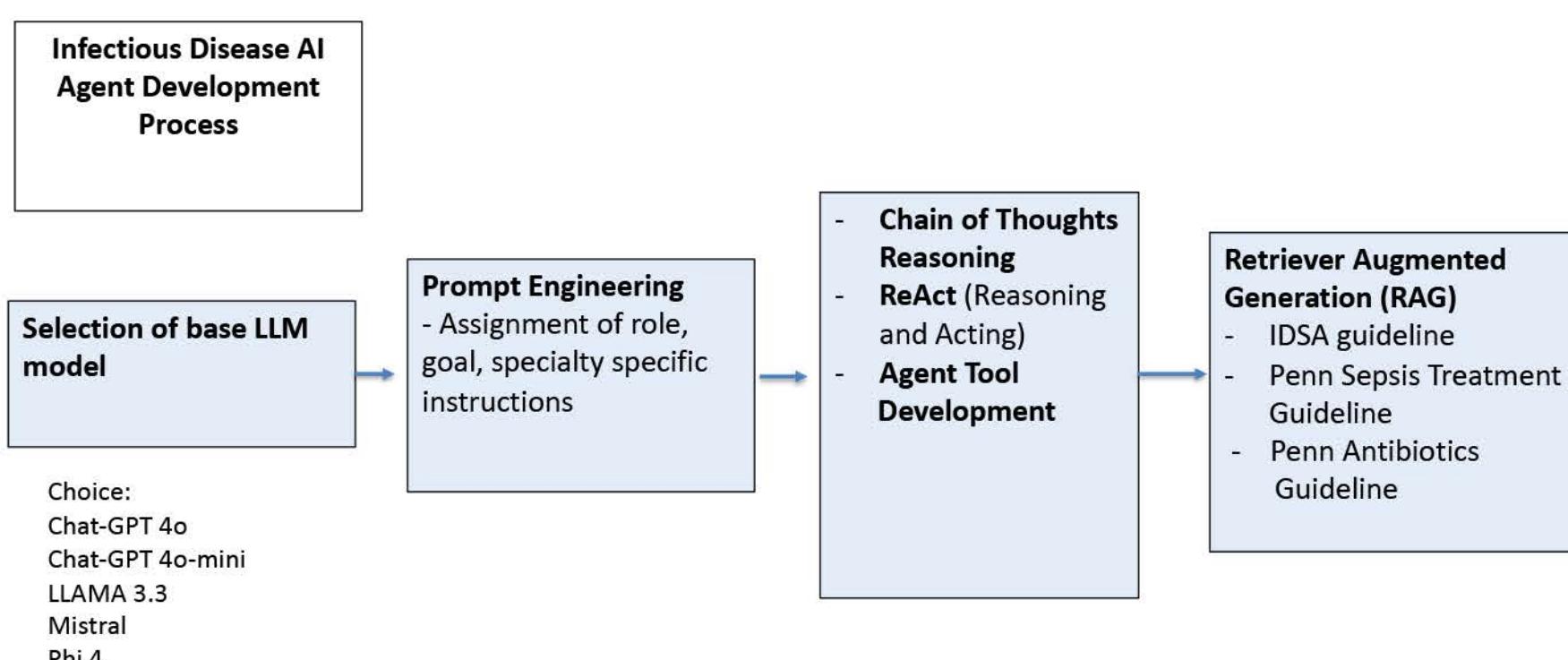


Figure 1: Example Development of Infectious Disease AI Agent.

- We built the MATEC framework integrating over 40 AI Agents specializing in various important medical fields.

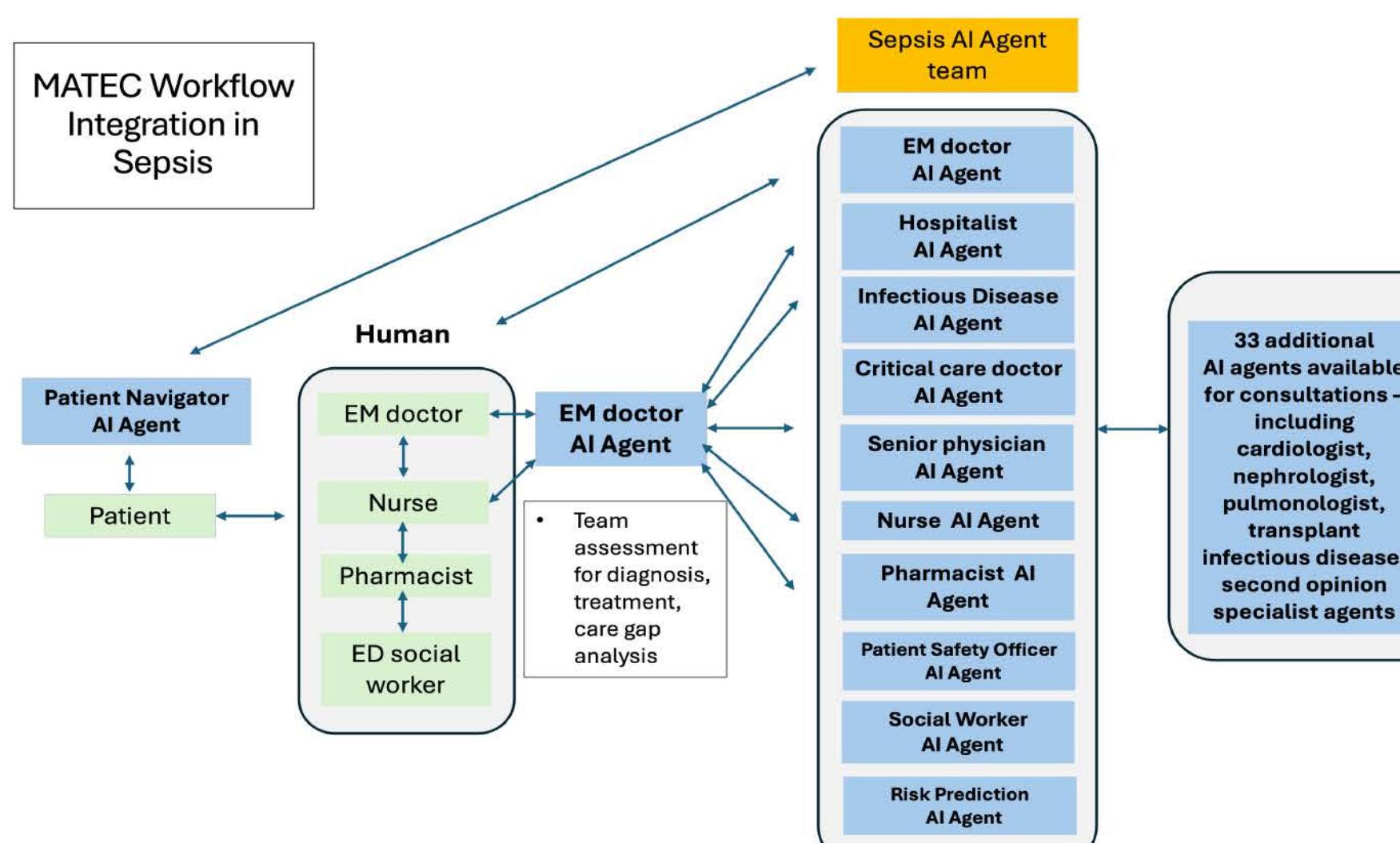


Figure 2: AI Agents work collaboratively to diagnose sepsis and develop treatment plans.

Methods

- We conducted a pilot study with 10 attending physicians interacting with our web-based MATEC interface for about 1 hour.
- Physicians assessed MATEC's usefulness, accuracy, and consistency through a survey using a 5-point scale (1 = unfavorable, 5 = favorable).
- We performed statistical analysis of survey responses using a one-sample Wilcoxon signed-rank test (R software).

Results

- A user submits patient information and a question using our interface.
- Users can also select predefined question templates to perform care gap analysis.
- Figure 3 displays the Senior Physician Agent's output which incorporates a final diagnosis, areas of consensus/divergence, comprehensive care plan, and next steps based on inputs of four other doctor agents in the sepsis care team.

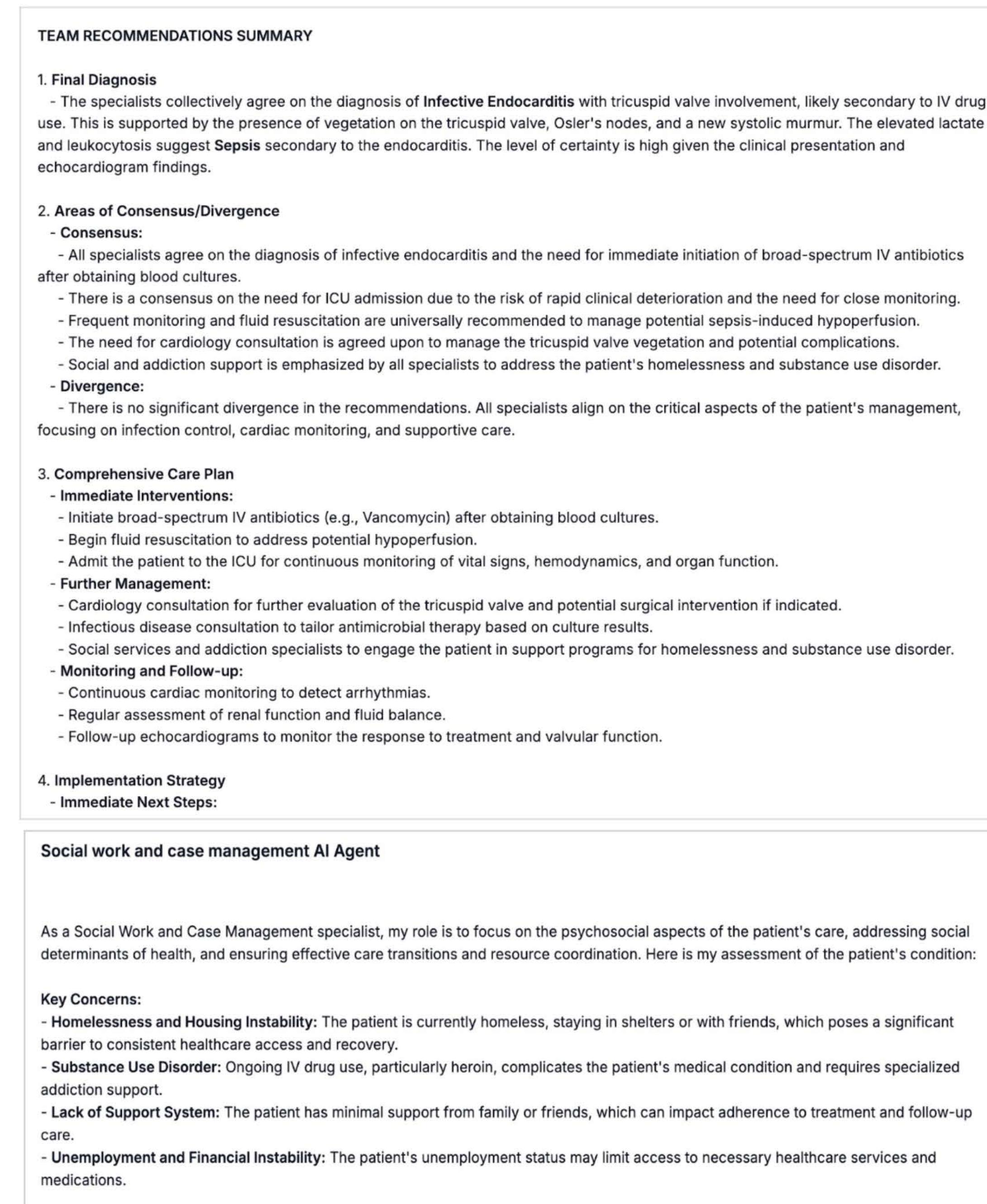


Figure 3: Example output from sepsis medical team and social worker AI agent. A case with sepsis due to endocarditis.

Results

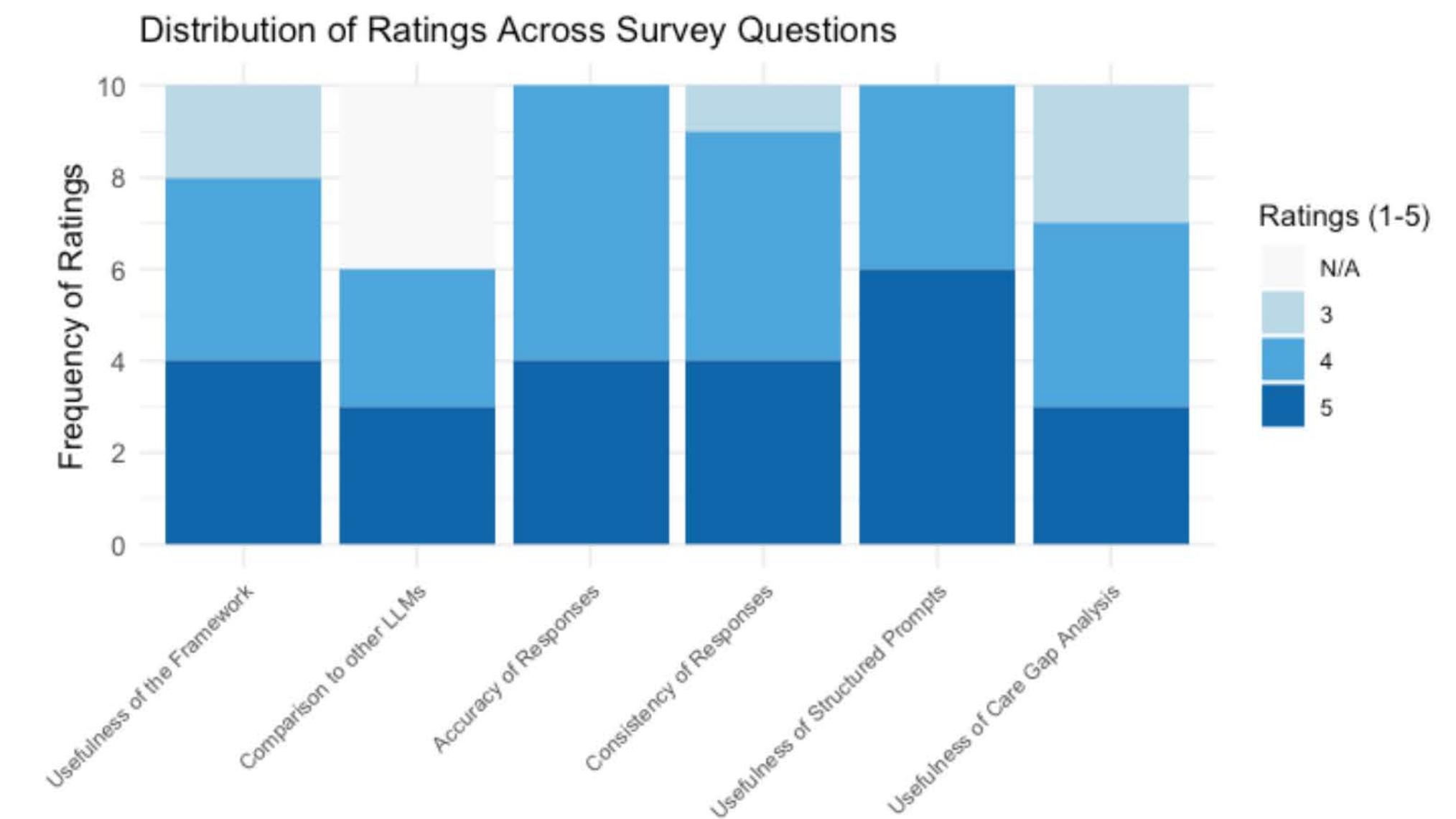


Figure 4: Survey results based on 5-point scale from 1 to 5.

Discussion

- Physicians rated MATEC highly useful (Median=4, p=0.01) and accurate (Median=4, p=0.005) in supporting clinical decisions for sepsis care.
- Those experienced with existing LLM tools found MATEC comparatively more useful (Median=4.5, p=0.03).
- Structured prompts significantly improved usability (Median=5, p=0.005), streamlining clinical interactions.
- Care gap analyses were considered beneficial (Median=4, p=0.02) for identifying critical treatment deficiencies.
- Multi-agent collaboration effectively addressed reliability concerns by reducing hallucinations and enhancing accuracy through cross-verification.
- Integration of social determinants of health via the Social Worker AI agent improved comprehensive patient care by addressing real-world barriers.
- MATEC offers potential to bridge specialist gaps in under-resourced hospitals, improving patient outcomes and healthcare delivery.

Conclusion

- This pilot study demonstrates that the Multi-AI Agent Team Care (MATEC) framework can potentially be used to assist medical professionals, particularly in under-resourced hospital settings.
- More studies are necessary for applications of the multi-agent framework in clinical settings.