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Development and Implementation of a Criteria-based Radiology Imaging Selection Platform

Nicholas Mynarski, MD, Northwell Health; Othria Ahmed, MD; Ritesh Patel, MD

Introduction/Background

Utilization of radiological imaging has increased exponentially over the past few decades, with advancing imaging such as CT, MR, and US volumes continuing to rise at 1-5% annually. However, the overutilization and/or inappropriate ordering of imaging contributes to rising healthcare costs, potential patient harm, and workflow inefficiencies. To address this, the American College of Radiology (ACR) has developed evidence-based guidelines for selecting appropriate imaging exams, but practical application is challenging for time-constrained physicians. Therefore, our team developed a Criteria-based Radiology Imaging Selection Platform (CRISP-AI) to provide real-time contextually relevant clinical decision support.

Methods/Intervention

Our team developed CRISP-AI, a large language model (LLM)-chatbot, designed to assist ordering providers in selecting the most appropriate imaging studies based on evidence-based criteria. Through our institution's AI Hub, the chatbot was provided context on the ACR Appropriateness Criteria for ordering neuroradiological imaging. CRISP-AI interprets user-provided clinical information, asks relevant clarification questions, and recommends imaging accordingly. It will also provide direct links to supporting evidence (Figure 2). For example, when a provider enters "red, swollen eye," the chatbot may ask clarifying questions such as "Is there vision loss?" or "Is the swelling localized or diffuse?" before generating its recommendation. The tool is designed to be intuitive and seamlessly integrate into existing clinical workflows, assessable via web browser and mobile device.

Results/Outcome

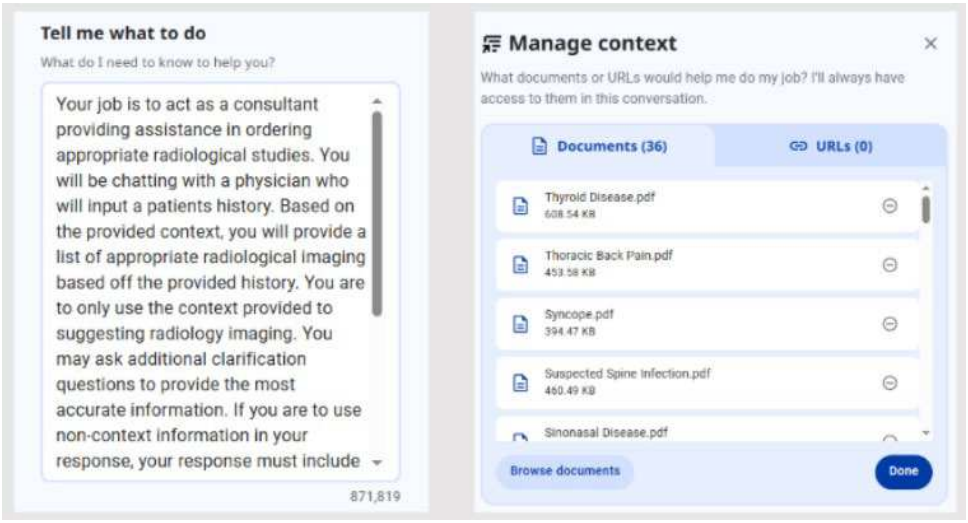
A simulated test environment demonstrated high user satisfaction with ease of use, prompting clinicians to request additional information, and relevance of recommendations. Real-world outcomes will be assessed following incorporating other subspecialties and full deployment.

Conclusion

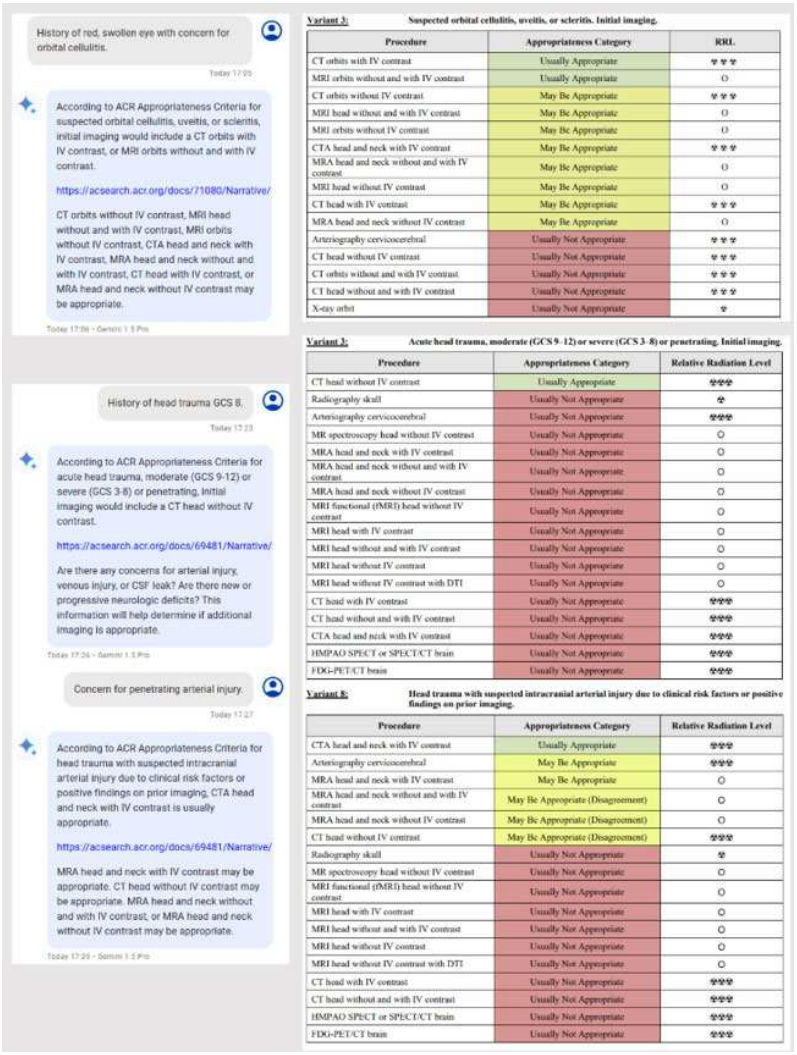
CRISP AI, an LLM-based tool, has the potential to provide effective, real-time, clinical decision support to guide physicians with ordering radiological studies. This intervention provides an opportunity to reduce imaging overutilization, optimize resource allocation, and improve patient care.

Statement of Impact

This project demonstrates the integration of AI to promote evidence-based imaging ordering practices and reduce healthcare costs. By making the ACR Appropriateness Criteria more readily accessible to physicians through our platform, CRISP-AI empowers users to make informed decisions, ultimately reducing inappropriate imaging and improving patient care.



Brief sampling of the prompt and dataset of ACR Appropriateness Criteria narratives in which the chatbot was trained. LLM model: Gemini 2.5 Flash.



Variant 3: Suspected orbital cellulitis, uveitis, or scleritis. Initial imaging.

Procedure	Appropriateness Category	RRL
CT orbits with IV contrast	Usually Appropriate	☢☢☢
MRI orbits without and with IV contrast	Usually Appropriate	O
CT orbits without IV contrast	May Be Appropriate	☢☢☢
MRI head without and with IV contrast	May Be Appropriate	O
MRI orbits without IV contrast	May Be Appropriate	O
CTA head and neck with IV contrast	May Be Appropriate	☢☢☢
MRA head and neck without and with IV contrast	May Be Appropriate	O
MRI head without IV contrast	May Be Appropriate	O
CT head with IV contrast	May Be Appropriate	☢☢☢
MRA head and neck without IV contrast	May Be Appropriate	O
Arteriography cervicocerebral	Usually Not Appropriate	☢☢☢
CT head without IV contrast	Usually Not Appropriate	☢☢☢
CT orbits without and with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
X-ray orbit	Usually Not Appropriate	☢

Variant 2: Acute head trauma, moderate (GCS 9-12) or severe (GCS 3-8) or penetrating. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT head without IV contrast	Usually Appropriate	☢☢☢
Radiography skull	Usually Not Appropriate	☢
Arteriography cervicocerebral	Usually Not Appropriate	☢☢☢
MR spectroscopy head without IV contrast	Usually Not Appropriate	O
MRA head and neck with IV contrast	Usually Not Appropriate	O
MRA head and neck without and with IV contrast	Usually Not Appropriate	O
MRA head and neck without IV contrast	Usually Not Appropriate	O
MRI functional (fMRI) head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without and with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI head without IV contrast with DTI	Usually Not Appropriate	O
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
CTA head and neck with IV contrast	Usually Not Appropriate	☢☢☢
HMPAO SPECT or SPECT/CT brain	Usually Not Appropriate	☢☢☢
FDG-PET/CT brain	Usually Not Appropriate	☢☢☢

Variant 8: Head trauma with suspected intracranial arterial injury due to clinical risk factors or positive findings on prior imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CTA head and neck with IV contrast	Usually Appropriate	☢☢☢
Arteriography cervicocerebral	May Be Appropriate	☢☢☢
MRA head and neck with IV contrast	May Be Appropriate	O
MRA head and neck without and with IV contrast	May Be Appropriate (Disagreement)	O
MRA head and neck without IV contrast	May Be Appropriate (Disagreement)	O
CT head without IV contrast	May Be Appropriate (Disagreement)	☢☢☢
Radiography skull	Usually Not Appropriate	☢
MR spectroscopy head without IV contrast	Usually Not Appropriate	O
MRI functional (fMRI) head without IV contrast	Usually Not Appropriate	O
MRI head with IV contrast	Usually Not Appropriate	O
MRI head without and with IV contrast	Usually Not Appropriate	O
MRI head without IV contrast	Usually Not Appropriate	O
MRI head without IV contrast with DTI	Usually Not Appropriate	O
CT head with IV contrast	Usually Not Appropriate	☢☢☢
CT head without and with IV contrast	Usually Not Appropriate	☢☢☢
HMPAO SPECT or SPECT/CT brain	Usually Not Appropriate	☢☢☢
FDG-PET/CT brain	Usually Not Appropriate	☢☢☢

Sample of prompts and responses which highlights the chatbot's effectiveness in providing accurate and appropriate radiological imaging recommendations. ACR Appropriateness Criteria recommendations are provided for comparison.

Keywords

Artificial Intelligence; Large Language Models (LLMs); ACR Appropriateness Criteria; Overutilization; Cost Reduction; Patient Safety