

# Med-R<sup>2</sup>: Crafting Trustworthy LLM Physicians through Retrieval and Reasoning of Evidence-Based Medicine

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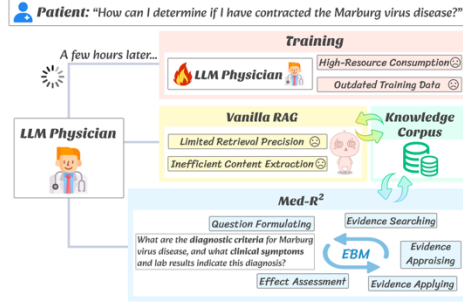


Figure 1: Comparison of Med-R<sup>2</sup> with existing strategies for medical problem solving.

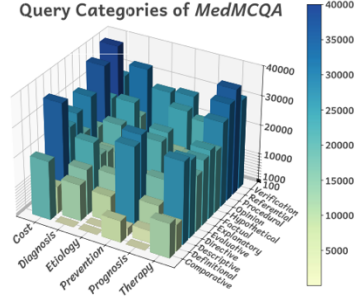


Figure 3: Query category of MedMCQA. We employ a logarithmic scale (base 10) on the z-axis, ranging from 1 to 40000, to represent the wide range of values.

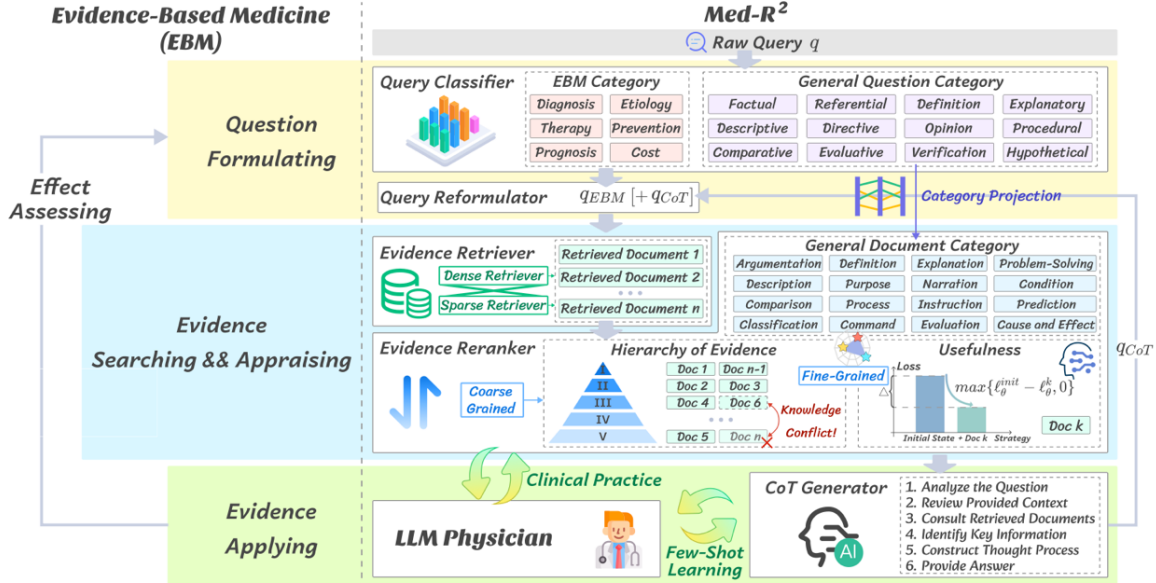


Figure 2: An illustration of Med-R<sup>2</sup>'s process, adhering to the Evidence-Based Medicine (EBM) workflow. We first categorize the query by EBM and general question types. Queries are then reformulated according to established EBM classification templates to ensure precision and relevance. In the evidence searching and appraising stages, we employ a coarse-to-fine strategy to retrieve, filter, and re-rank the evidence documents within the knowledge base. CoT sequences are then generated from processed evidence to refine retrieval space, iterating to ensure robustness.

Category	Instructions for Query Reformulation
<b>Diagnosis</b>	Specify the condition you need to diagnose and ask about the accuracy, sensitivity, or specificity of specific diagnostic tests.
<b>Therapy</b>	Specify the disease or symptom along with the therapy being considered, and inquire about its effectiveness, safety, or comparison with other therapies.
<b>Prognosis</b>	Specify the disease or condition and ask about long-term outcomes such as survival rates, recovery chances, or disease progression.
<b>Etiology</b>	Describe the health issue and ask about potential causes, including risk factors, pathogens, or genetic background.
<b>Prevention</b>	Specify the disease or health issue and ask about the effectiveness of preventive measures or recommendations.
<b>Cost</b>	Specify the medical intervention or service and ask about cost-effectiveness analyses, including direct and indirect costs and cost-effectiveness ratios.

Table 4: Prompts for query reformulation of each category within the Evidence-Based Medicine (EBM) categories.

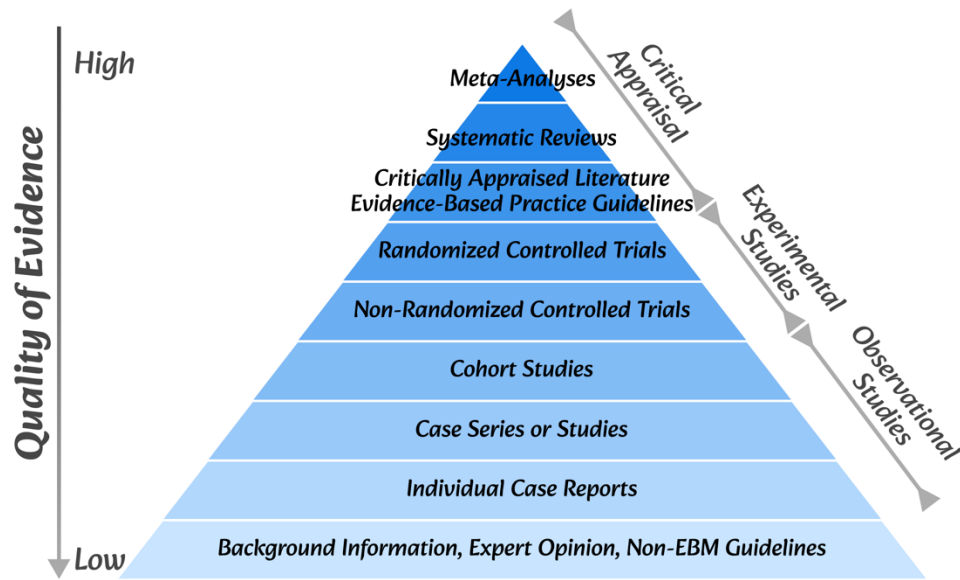


Figure 6: Illustration for **Hierarchy of evidence**. The base of the pyramid represents the lowest quality and highest risk of bias in research design, while the apex signifies the highest quality and lowest risk of bias.

Category	Details of Description
<b>Argumentation</b>	Presenting a viewpoint or argument, potentially accompanied by supporting evidence.
<b>Definition</b>	Providing a clear definition of a term or concept.
<b>Description</b>	Describing the characteristics or attributes of an object or event.
<b>Explanation</b>	Explaining a concept, process, or cause.
<b>Purpose</b>	Elucidating the purpose or intent behind a particular action or event.
<b>Narration</b>	Providing a narrative account of an event, experience, or story.
<b>Process</b>	Describing a process or a sequence of steps.
<b>Instruction</b>	Providing steps or guidance for executing a task or operation.
<b>Command</b>	Conveying a request that requires the listener to take action.
<b>Problem-Solving</b>	Proposing methods or strategies for addressing specific issues.
<b>Comparison</b>	Comparing the similarities or differences between two or more entities.
<b>Evaluation</b>	Articulating a judgment on a particular subject or behavior.
<b>Classification</b>	Categorizing objects or concepts into specific categories systems.
<b>Condition</b>	Describing the assumptions under which a particular event occurs.
<b>Prediction</b>	Forecasting future events or trends.
<b>Cause and Effect</b>	Describing the causal relationships between events.

Table 5: Explanations and descriptions for each category within the general document classification.

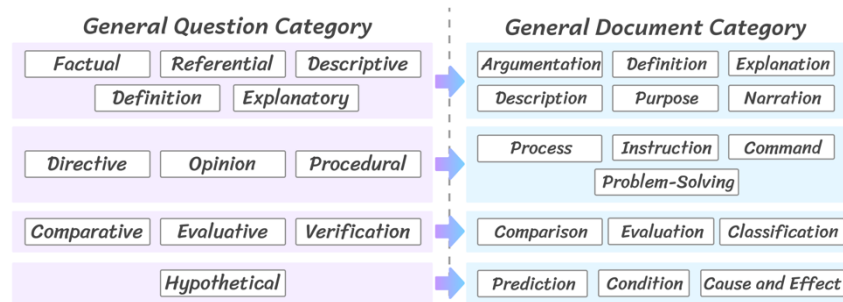


Figure 8: Query Document Projection.