ChatClinic in Pharmacy Education: AI-Simulated Renal Cases for Enhanced Clinical Learning

Nathan Wolfrath, MD; Nathaniel B. Verhagen, MD; Shefali N. Bhatt, BS; Eric Elftmann, BS; Caleb Tomlin, BS; Kaitlyn Nimmer, BA; Anastasia Boutris, BS; Zachary Pape, PharmD; Rachel Kavanaugh, PharmD; Anai N. Kothari, MD, MS; Bonnie LaTourette, PharmD

ABSTRACT

Background: Artificial intelligence (AI)-driven simulations can address limitations of traditional standardized patient programs in health care education.

Methods: We integrated ChatClinic, a large language model-based virtual patient platform, into a renal workshop for second-year pharmacy students. Students engaged in simulated clinical cases and completed surveys, and their interactions were analyzed for diagnostic accuracy and use patterns.

Results: Students completed 4 virtual patient encounters related to renal pathology. Of 39 students, 19 completed surveys, and all strongly agreed the tool enhanced their understanding and application of workshop content. In 82 analyzed interactions, 75.61% resulted in correct diagnoses. Common student actions included ordering laboratory tests and taking medical histories.

Discussion: Students found ChatClinic valuable and easy to use. Initial findings support AI simulations as effective, scalable additions to health education.

BACKGROUND

Advancements in artificial intelligence (AI) and natural language processing—particularly through large language models (LLMs)—are transforming health sciences education. These technologies enable innovative teaching methods, providing educators with tools to deliver realistic, personalized, and scalable educational experiences.[1] AI-based simulations are a particularly promising use case in health care education.[2] These simulations can help students develop critical skills such as taking medical history, diagnostic reasoning, and patient communication.[3] Early implementations have demonstrated beneficial results across medical and pharmacy education contexts.[3,4] Virtual patients address significant limitations of traditional standardized patient programs, which can be costly, resource-intensive, and difficult to scale. AI-driven platforms can offer improved accessibility, particularly in resource-limited or disrupted educational environments.[5]

Despite their potential, practical demonstrations of AI educational tools remain limited. Previous studies often highlight feasibility and theoretical benefits rather than reporting concrete use cases or outcomes, and evidence around benefits and deployment best practices is still evolving.[6,7] To address these gaps, the overarching objective of this study was to measure the feasibility and utility of an AI-based tool (ChatClinic) during an educational workshop for pharmacy students. This study provides important insights into student perspectives and offers a concrete example of how this technology can be effectively integrated into a health sciences curriculum.

METHODS

ChatClinic

ChatClinic (www.chatclinic.ai) is a web-based tool for simulating standardized patient interactions developed by students at the Medical College of Wisconsin (MCW). The platform uses LLMs combined with realistic patient vignettes to provide on-demand access to high-quality simulated encounters via a chat interface.

Author affiliations: Department of Surgery, Division of Surgical Oncology, Medical College of Wisconsin (MCW), Milwaukee, Wisconsin (Wolfrath, Verhagen, Elftmann, Nimmer, Kothari); School of Pharmacy, MCW, Milwaukee, Wisconsin (Boutris, Pape, Kavanaugh, LaTourette); independent researcher, Milwaukee, Wisconsin (Bhatt).

Corresponding author: Anai N. Kothari, MD, MS, FSSO, Medical College of Wisconsin, Division of Surgical Oncology, 8701 W Watertown Plank Rd, Milwaukee, WI 53226; email akothari@mcw.edu; ORCID ID 0000-0001-6544-8832

Figure 1. ChatClinic Cases Overview

	Case 1. Pre-renal AKI Secondary to Septic Shock	Case 2. Pre-renal AKI Secondary to Crystalluria	Case 3. Acute Interstitial Nephritis Secondary to Beta-Lactam Antibiotic	Case 4. Pre-renal AKI on Chronic Kidney Disease Secondary to Viral GastroenteritisAntibiotic
Patient Details	47-year-old African American female (5'5, 175 lb) patient who is in the ED with complaints of 3 days of fever, cough, shortness of breath, and vomiting. Physicians started her on antibiotics in the clinic 2 days ago for pneumonia.	Patient presents to ED with severe flank pain	A patient is currently on day 16 of a 21-day course of amoxicillin/clavulanate. He presents to clinic today with complaints of a rash all over and fever.	JK, a 57-year-old female presents to the ED today with complaints of N/V/D for 4 days and fevers. PE: dry mucous membranes, pallor, diaphoretic, lethargic, low-grade temperature
Clinical Findings	Vitals: blood pressure 80/45 mm Hg, heart rate 95 beats/min, temp 39 °C Labs in clinic 2 days ago: Na 124 mEq/L, BUN 22 mg/dL, SCr 1.1 mg/dL Labs today: Na 137 mEq/L, BUN 59 mg/dL, SCr 2.6 mg/dL, FENa 0.4% U/A: pH 5.0, trace protein, few hyaline casts	SCr 2.6 mg/dL, BUN 30 mg/dL; baseline SCr 0.8 mg/dL, no history of renal disease, afebrile; U/A = crystalluria	Labs indicate he may have AKI	Current labs: SCr 2.9 mg/dL, BUN 67 mg/dL, Na 139 mEq/L, K 4.8 mEq/L, chloride 101 mEq/L, HCO_3 19 mEq/L, glucose 201 mg/dL, WBC 204; Hgb 10.5 g/dL, Hct, 30.3% Baseline labs: SCr 1.38 mg/dL, eCrCil ~42.1 mL/min, eGFR ~45 mL/min per clinic notes
Medications	Lisinopril, ibuoprofen as needed, atorvastatin, levothyroxine	Acyclovir, lisinopril, amlodipine, acetaminophen	Beta-lactam antibiotic	Metformin, lisinopril, empagliflozin, simvastatin, multivitamin

Abbreviations: AKI, acute kidney injury; Na, sodium; BUN, blood urea nitrogen, SCr, serum creatinine; FENa, fractional excretion of sodium; U/A, urinalysis; K, potassium; WBC, white blood cell count; HCO_3, bicarbonate; eCrCl, estimated creatinine clearance; eGFR, estimated glomerular filtration rate.

Within the platform, students take medical histories, order imaging and diagnostic labs with realistic results, and receive AI-generated feedback on their diagnoses and treatment plan.

Workshop

Second-year Doctor of Pharmacy students at MCW participated in a renal pathology and pharmacotherapy workshop as part of the Renal and Cardiovascular didactic course. The workshop and associated data collection were conducted under the oversight of MCW's Institutional Review Board (IRB# PRO00051112).

The workshop was carried out in 3 sessions: (1) lecture-based didactic content, (2) interactive case-based learning, (3) ChatClinic cases. ChatClinic was utilized individually or in small groups to perform simulated encounters with virtual patients to reinforce concepts surrounding the disease processes and treatment modalities taught throughout the workshop. Students received brief instructions on using ChatClinic and were told to interact with the program as they would with a real patient.

Four AI-generated patients were developed, each reflecting distinct types of acute kidney injury (AKI): pre-renal AKI caused by sepsis and dehydration; intrinsic AKI resulting from crystal-induced tubular obstruction associated with acyclovir; intrinsic AKI due to acute interstitial nephritis related to beta-lactam antibiotics; and acute-on-chronic kidney disease with a pre-renal AKI component (Figure 1).

Analysis

Data collection following workshop completion included post-workshop surveys and conversation transcripts generated during chat-based interactions using ChatClinic simulated clinical encounters. Surveys were administered to assess workshop satisfaction, perspectives on the use of AI-based educational tools, and self-reflection on performance. Conversation transcripts were anonymized prior to analysis, with some interactions excluded based on the following criteria:

1. Student experimentation with AI without asking clinical questions
2. Incomplete cases or no diagnosis given
3. System or user technical issues

Survey responses were analyzed using descriptive statistics to quantify participants' prior experience with AI tools, self-reported diagnostic performance, and Likert-scale ratings of the educational utility of ChatClinic.

To analyze conversation transcripts, user inputs were categorized into 15 possible interaction types: history of present illness, past medical history, lab orders, physical exam, surgical history, family history, past or baseline labs, medication review, allergy review, radiology order, immunization history, social/lifestyle history, general conversation, providing diagnosis and treatment plan, and other. AI-generated feedback—both positive and constructive—was coded into 6 categories: thoroughness of medical history taking, empa-

thy and communication, appropriateness of orders, appropriateness of treatment plan, diagnostic reasoning, and other. An LLM (ChatGPT-4o) was used to generate initial codes for each response, and each label was then manually verified by a human reviewer. Descriptive statistics (frequency distributions, percentages, and measures of central tendency) were used to summarize survey and transcript data.

Table. Survey Data

Use of Artificial Intelligence (AI)	n (% of class[a])	Yes, n (%)
Have you used an AI-based educational tool before?	19 (48.7)	8 (42)
Did you use the ChatClinic program during the Renal Workshop?	18 (46.2)	18 (100)
Usability of ChatClinic	**n (% of class[a])**	**Avg performance (scale 1-5[b])**
ChatClinic helped identify and address gaps in my knowledge or understanding.	17 (43.6)	5.00[c]
The ChatClinic program enhanced my understanding of the concepts covered during this course.	17 (43.6)	5.00[c]
The ChatClinic program improved my ability to apply the learned concepts in practical scenarios.	17 (43.6)	5.00[c]
The information provided by ChatClinic was appropriate and relevant for the question asked.	17 (43.6)	5.00[c]
It was easy to navigate/use the various features of the ChatClinic program.	17 (43.6)	4.94[d]
Overall, I felt the ChatClinic program performed well when answering my questions.	17 (43.6)	4.94[d]

Free-text responses to "What did you like most about using ChatClinic for educational purposes?"

- It was easy to use and descriptive with instant feedback.
- I absolutely loved this!! I was able to play "pharmacist," which was a helpful way to study.
- Working through patient cases.
- It simulated patient/provider encounters well.
- Let's use this for all our classes!
- It was nice getting instant feedback.
- Coming up with targeted questions to get clues.
- The answers to questions were very in-depth.
- It solidified concepts from class.

[a]Total number of enrolled students, N = 39.
[b]1 = strongly disagree, 5 = strongly agree.
[c]100% of respondents strongly agree.
[d]16 respondents = 5 (strongly agree); 1 respondent = 4.

RESULTS

A total of 39 pharmacy students participated in the workshop. Following completion, 19 students (48.72%) responded to the postworkshop survey. Survey results are summarized in the Table. Among the respondents, 11 (57.89%) reported never having used an AI-based education tool prior to the workshop. Responses regarding ChatClinic's utility were overwhelmingly positive. All respondents "strongly agreed" with representative statements such as: "The ChatClinic program enhanced my understanding of the concepts covered," "ChatClinic improved my ability to apply the concepts learned during the workshop," "The information provided by ChatClinic was appropriate and relevant for the workshop," and "ChatClinic helped me identify and address gaps in my knowledge or understanding."

For the performance self-assessment, students reported the number of cases they correctly diagnosed: 8 diagnosed all 4 cases, 7 diagnosed 3 cases, and 2 diagnosed 2 cases. No respondents reported diagnosing fewer than 2 cases.

A total of 109 interactions with AI patients were collected. (See Appendix for example.) After applying exclusion criteria, 82 remained for analysis. Of these, 62 (75.61%) resulted in a correct diagnosis, and 51 (62.20%) included correct treatment plans. Correct diagnosis and management suggestions did not vary significantly across the 4 cases. The average encounter length was 8.62 question-and-answer pairs (SD, 3.24; range, 3-19).

The most common student input was requesting orders (21.50% of all inputs); followed by medication review (17.43%); giving the patient's diagnosis or discussing treatment plan (15.96%); history of present illness (11.07%); and physical exam (10.42%) (Figure 2). The most frequently ordered labs were basic metabolic panel (20.37% of all orders), urinalysis (13.89%), and baseline creatinine (12.04%).

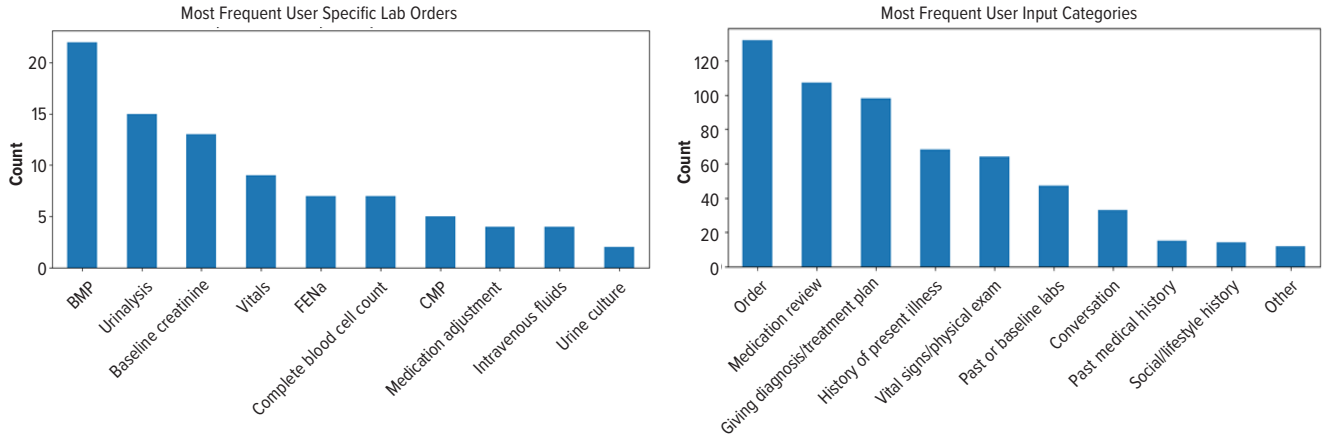
AI-generated feedback most commonly included positive feedback on students' diagnostic reasoning (89.23% of all conversations), suggested management (44.61%), and appropriate use of labs and imaging (15.38%). Constructive feedback was most frequently given on history-taking thoroughness (53.85% of all conversations), treatment recommendations (41.54%), and empathy/communication skills (20.00%).

DISCUSSION

This experience highlights several key findings regarding AI-based technologies in health sciences education. Despite most students lacking prior experience with AI tools, they reported high satisfaction with ChatClinic and quickly adopted the technology. Students found it valuable for reinforcing concepts and applying them to clinical scenarios, complementing lecture-based curricula. Most students arrived at correct diagnoses in 3 of 4 cases, with ordered labs and question types aligning well with case scenarios. Overall, students viewed ChatClinic as a beneficial and enjoyable addition to traditional teaching methods.

These results are consistent with existing works regarding student perceptions of AI tools in health care education.[8,9] However, this study contributes uniquely by providing practical insights into student engagement and interaction patterns within an applied educational context. Unlike predominantly theoretical discussions

Figure 2. Top 10 Lab Orders And Question Types Utilized by Students



Abbreviations: BMP, basic metabolic panel; FENa, fractional excretion of sodium; CMP, comprehensive metabolic panel.

in existing research, this analysis offers concrete data from real-world implementation.

Our results support the utility of AI-driven patient simulations to address common logistical challenges, such as standardized patient availability and resource constraints. Although this pilot involved pharmacy students, the educational advantages may extend to other health care professions, including medicine, nursing, physician assistant training, and allied health fields.

However, the integration of AI into medical education must be carried out in a careful, responsible way. Rollout challenges of LLM-based tools include retrospective and real-time validation by human experts, data security, and privacy considerations. Additionally, while AI tools offer significant advantages in terms of accessibility and flexibility, they must complement rather than replace essential hands-on training. Physical examination skills and direct patient interactions remain irreplaceable components of health care education.

This work also raises further questions regarding generative AI in patient simulation. Methods for validating patient presentations and recommended clinical treatments are crucial for safe adoption. Comparative studies assessing AI-based simulations versus traditional teaching methods, as well as larger-scale investigations into faculty and student perspectives, will help further define AI's role in health care education.

Limitations

This study describes an educational approach with a single student cohort, focusing on their experiences with AI-based patients. Therefore, generalizability of these findings is limited.

CONCLUSIONS

Generative AI shows substantial promise to enhance health care education, particularly as an adjunct to existing methods of teaching. This study demonstrates student acceptance and perceived educational value of integrating AI-simulated clinical interactions into a workshop format. Further investigation into AI's educational efficacy and long-term outcomes in health care training is warranted.

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Appendix: Available at www.wmjonline.org

REFERENCES

1. Zhui L, Yhap N, Liping L, et al. Impact of large language models on medical education and teaching adaptations. *JMIR Med Inform*. 2024;12(1):e55933. doi:10.2196/55933

2. Chan KY, Yuen TH, Co M. Using ChatGPT for medical education: the technical perspective. *BMC Med Educ*. 2025;25(1):201. doi:10.1186/s12909-025-06785-9

3. Sezer B, Sezer TA, Teker GT, Elcin M. Developing a virtual patient: design, usability, and learning effect in communication skills training. *BMC Med Educ*. 2023;23(1):891. doi:10.1186/s12909-023-04860-7

4. Cameron K, Cicinelli E, Natsheh C, So M, Tait G, Halapy H. Implementation of virtual interactive cases for pharmacy education: a single-center experience. *J Pharm Technol*. 2024;40(2):100-107. doi:10.1177/87551225231224627

5. Safranek CW, Sidamon-Eristoff AE, Gilson A, Chartash D. The role of large language models in medical education: applications and implications. *JMIR Med Educ*. 2023;9(1):e50945. doi:10.2196/50945

6. Plackett R, Kassianos AP, Mylan S, Kambouri M, Raine R, Sheringham J. The effectiveness of using virtual patient educational tools to improve medical students' clinical reasoning skills: a systematic review. *BMC Med Educ*. 2022;22(1):365. doi:10.1186/s12909-022-03410-x

7. Svendsen K, Askar M, Umer D, Halvorsen KH. Short-term learning effect of ChatGPT on pharmacy students' learning. *Explor Res Clin Soc Pharm*. 2024;15:100478. doi:10.1016/j.rcsop.2024.100478

8. Hamilton A. Artificial intelligence and healthcare simulation: the shifting landscape of medical education. *Cureus*. 2024;16(5):e59747. doi:10.7759/cureus.59747

9. Sun L, Yin C, Xu Q, Zhao W. Artificial intelligence for healthcare and medical education: a systematic review. *Am J Transl Res*. 2023;15(7):4820-4828. Accessed April 15, 2025. https://www.ncbi.nlm.nih.gov/pubmed/37560249

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