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Performance of GPT-5.2 in handling pharmaceutical calculations and interpreting medication prescriptions: Implications in pharmacy education and clinical practice

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Abstract

Pharmaceutical calculations and prescription interpretations are two integral components of medical education and responsibilities of healthcare providers, especially pharmacists. Various studies have highlighted the potentials of artificial intelligence-powered chatbots, namely ChatGPT (OpenAI), in various fields of medical and healthcare sciences. Herein, we provide a qualitative assessment of the ability of GPT-5.2 in performing pharmaceutical calculations and interpreting prescriptions. A total of 20 calculation and 5 prescription questions were developed by the authors and used for GPT-5.2 evaluation. Then, GPT-5.2 was assessed on providing feedback and utilized sources. As GPT-5.2 was asked to provide the final answer and then explain the calculation steps, it initially answered 17 out of the 20 calculation questions correctly (85%). When detailing the steps it undertook to find the solutions; however, GPT-5.2 was able to correct itself and thereby answer all questions correctly. In addition, it explained the approach it took, detailed the calculation steps and remained precise to the questions' points. The responses were rapid, concise, accurate, clear and explanatory in nature. Regarding prescription questions, it answered all of them correctly and clarified the meanings of each abbreviation alone. When asked to provide feedback, GPT-5.2 was able to "remember" the number of prompted calculation questions, while providing an accurate rating of their difficulty and list of utilized resources. In conclusion, GPT-5.2 can handle pharmaceutical calculations and interpret prescriptions and medication orders, but is still prone to errors, with significant implications in pharmacy education and clinical practice.

Keywords: Artificial intelligence; ChatGPT; Education; Clinical practice; Pharmacy

1. Introduction

The field of artificial intelligence (AI)-powered chatbots took massive strides in recent years, which gained the public's attention globally [1]. Among the most famous AI-chatbots is ChatGPT (OpenAI), which proved to be a powerful tool that is capable of dealing with complex generational tasks and challenging language understating [2]. Accordingly, numerous studies have highlighted its promising applications in various fields, including health and medical sciences [3].

In December 2025, OpenAI introduced its newest model of ChatGPT, known as GPT-5.2, described as "the most advanced frontier model for professional work and long-running agents" [4]. ChatGPT has found a place in pharmacy with a number of potential applications in drug discovery and development [5], pharmacy education [6,7], medicinal chemistry [8], pharmaceutical industry [9], and scientific research writing [10]. Therefore, AI-powered chatbots hold a promising potential in pharmaceutical sciences and medical practice with various other future applications to be considered.

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Performing pharmaceutical calculations and dealing with medication prescriptions are key skills to be mastered by healthcare providers, particularly pharmacists, in order to provide accurate and effective healthcare services. Pharmacists and nurses are considered the last gatekeepers between the patients and their prescribed medications, and it is their responsibility to prevent any dispensing- or prescription-related errors that may be inflected on patients [11]. Content-related dispensing errors, such as dispensing the wrong medication, wrong strength, wrong dosage form, and wrong quantity, are among the most commonly observed errors [12]. Increased levels of burnout as well as higher workload and volume of prescriptions, are among the factors that could impact the quality of provided pharmaceutical services and increase the rate of dispensing errors [13,14].

Therefore, efforts should be undertaken to develop strategies that promote safe medication dispensing, from integrating more courses in teaching curricula and continuous professional development programs for healthcare providers, to implementing and integrating advanced tools in the dispensing process.

Herein, we qualitatively assess the potential usefulness of GPT-5.2 in performing pharmaceutical calculations and interpreting prescriptions and medication orders, for future consideration in pharmacy education and clinical practice.

2. Methodology

The study was conducted using the GPT-5.2 version of ChatGPT software (OpenAI, L.L.C., San Francisco, CA, USA), and aimed at evaluating its ability to perform pharmaceutical calculations commonly encountered by pharmacists in clinical practice and interpret the abbreviations implemented in prescriptions and medication orders. The paid version of GPT-5.2 was utilized to avoid potential limitations of the free version on the number of inputs allowed or on any other functionality.

In a completely new chat window, the interaction started with the following prompt: "I will give you a series of pharmaceutical calculation questions, and I want you to provide the final answer then show me the steps you undertook to find the solution for each question". Then, after GPT-5.2 responded to the first prompt, a series of 20 pharmaceutical calculation questions were sequentially entered and the response of GPT-5.2 to each was recorded and analyzed. Following the calculation questions, and without other prompts in between, GPT-5.2 was given 5 prescription and medication order questions, which are shown in Table 1, each at a time, evaluating its ability to read and interpret common abbreviations of prescriptions and medication orders.

Table 1 The prescription and medication order questions used to assess GPT-5.2

Number	Question	Correct Answer
1	A pharmacist received the following in a drug prescription, what does it mean? Disp. supp. rect. no. X	Dispense 10 rectal suppositories
2	A pharmacist received the following in a drug prescription, what does it mean? M. et ft. sol. 0.5 g/tsp. Disp. 45 mL	Mix and make a solution containing 0.5 g per teaspoonful and dispense 45 mL
3	I received a drug prescription with the following written in it, what does it mean? Gtt. i each eye q. 6 h. p.r.n. itch	Instill 1 drop in each eye every six (6) hours as needed for itch
4	What does the following medication order mean? Linezolid susp. 2 tbsp p.o. b.i.d. DC after 14 d	Two tablespoons of linezolid suspension by mouth two times a day. Discontinue after 14 days.
5	What does the following medication order mean? Captopril 25 mg tab p.o. t.i.d. a.c.	One 25 mg tablet of captopril by mouth three times a day before meals.

The pharmaceutical calculation questions were grouped into four categories: (1) simple calculations involving unit conversions; (2) prescription quantity and dosage calculations; (3) concentration calculations; and (4) intravenous infusion calculations. Each category included 5 questions leading to a total of 20 calculation questions. The questions within each category varied by difficulty and the methods required to find the solutions. All calculation questions and corresponding categories are shown in Table 2. The answers of GPT-5.2 were evaluated in relation to the correctness

of the final answers, the steps undertaken to solve the questions, and how clearly the steps were presented, which relates to how easily they would be understood by either students or pharmacists.

Table 2 The calculation questions used to assess GPT-5.2

Number	Categories and Questions	Correct Answer
Simple questions involving unit conversions		
1	The following amounts of ingredients are contained in a medication capsule: 0.125 g, 10 mg, 0.0006 g, 14 mg, and 400 mcg. What is the total weight of these ingredients in grams?	0.15 g
2	A drug formulation requires 0.17 g of one ingredient, 4.5 mg of another, and enough of a third ingredient to make 0.6 g. How much should I use of the third ingredient to make the formulation?	0.4255 g
3	An oral solution is prepared by dissolving 0.9 g of the active ingredient in 60 mL pure water. Can you calculate the milligrams of active ingredient that will be contained in each 1 mL of the solution?	15 mg
4	A Ventolin® inhaler contains 20 mg of salbutamol sulfate; how many micrograms are in each inhalation? If the inhaler is sufficient for 200 inhalations.	100 mcg
5	A solution contains 0.4 mg of a drug in each milliliter. How many grams of the drug are in 4 L of the solution?	1.6 g
Prescription quantity and dosage calculations		
6	What is the volume to administer of a drug solution to provide a dose of 0.5 mg, if the solution contains 100 mcg/mL drug?	5 mL
7	A drug is dosed as 800 mg daily for 30 days, then to be reduced by 200 mg daily each week to zero. If the drug is available as 200 mg tablets, how many tablets are required in total?	162 tablets
8	A common adult dose of ambroxol hydrochloride is 60 mg/day divided into two equal doses and administered 12 hours apart. How many milliliters of the 15mg/5mL ambroxol hydrochloride syrup should be administered in each divided dose?	10 mL
9	A patient requires 25 units of insulin glargine every day and he purchased a 5 mL vial containing 100 units per milliliter, how long will the vial last the patient?	20 days
10	A drug is dosed as 400 mcg/kg body weight. How much of the drug should a child who weighs 44 pounds be administered in each dose?	8 mg
Concentration measures calculations		
11	A medication solution is prepared to contain 40 micrograms of drug in 100 microliters, please calculate the percentage concentration of the drug in the solution as w/v%.	0.04% w/v
12	If you have 540 g of a liquid medication that has a specific gravity of 0.9 and you added enough water to make 2 L solution, can you calculate the medication strength in v/v%?	30% v/v
13	A tube contains 75 g of 5% w/w gel of an anti-inflammatory drug. How much drug will be contained in each application of 5 g of the gel?	250 mg
14	A cream contains 0.1% (w/v) of a drug. Can you express its concentration as a ratio strength?	1:1000
15	If a solution contains 25 ppm of metals. What is the percentage of the metals?	0.0025%
Intravenous infusion calculations		
16	A total of 200 mL of a drug is to be administered by IV infusion at 6 AM at a rate of 25 mL/hr. At what time will the infusion be completed?	2 pm
17	A drug is available as 2 mg/mL stock solution. If you needed to dilute a volume from the stock in normal saline to prepare an infusion with a total volume of 200 mL to be delivered	196.4 mL

	over 6 hours and provide 0.02 mg/min of the drug, how many milliliters of normal saline will you need?	
18	An infusion solution contains 12 mg of a drug in 150 mL and should be administered over 30 minutes through a drip that delivers 15 drops/mL. Calculate the infusion rate in drops/min?	75 drops/min
19	If the volume of available normal saline bags is 500 mL/bag and a patient is to receive an IV infusion of normal saline at a rate of 100 mL/h over 20 hours. How many bags of normal saline are needed?	4 bags
20	A physician ordered 300 mL of fluid to be given to a patient over 6 hours by IV infusion. How many mL of fluid will the patient receive over 30 minutes of infusion?	25 mL

Next, GPT-5.2 was prompted to give feedback on the interaction. This was done through asking GPT-5.2 about the number of questions: "How many calculation questions did you answer?", and their difficulty: "From your perspective, how would you rate the difficulty of these calculation questions?". Lastly, GPT-5.2 was requested to provide the sources it utilized to answer the questions: "What sources of information did you use to perform these pharmaceutical calculation questions?". The questions were prepared by the authors and aimed at covering multiple aspects of pharmaceutical calculations and a variety of abbreviations utilized in prescriptions and medication orders.

Representative examples of GPT-5.2 responses are provided as figures in the results section; however, all recorded GPT-5.2 responses to the complete set of calculation and prescription questions are available from the corresponding author upon a reasonable request.

3. Results

GPT-5.2 complied to the first prompt, implied that it understood what was requested and welcomed the first question (Figure 1). The responses of GPT-5.2 to the calculation questions were then sequentially recorded and analyzed.

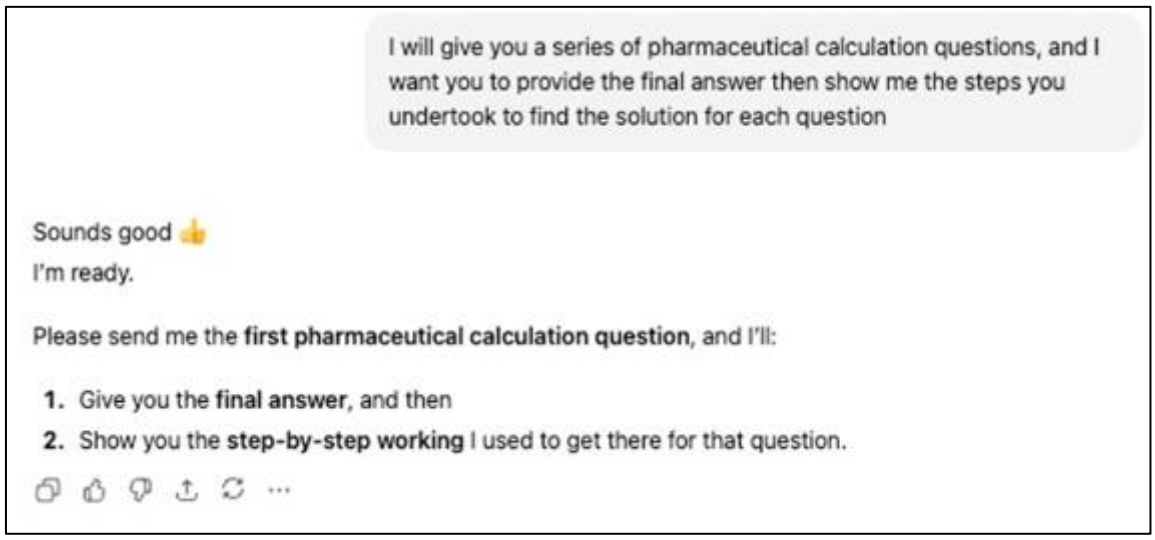

Figure 1 The response of GPT-5.2 to the first prompt requesting it to solve a series of calculation questions

Each of its responses to the calculation questions started with the "Final answer" followed by a "Step-by-step solution", as requested. The latter provided numbered steps to find the solution, explained the aim of each step, showed all the calculations within each step, and concluded with the final answer. In terms of accuracy, when assessing the final answer that was provided first before the solution steps, GPT-5.2 answered 17 out of 20 questions correctly (85%). A representative response of GPT-5.2 to a calculation question, in which it correctly answered in the initial "Final answer" part is shown in Figure 2 (A). Upon providing the "Step-by-step solution" part of the response; however, it was able to answer all 20 questions correctly and, interestingly, it pointed out that the initial answer was incorrect in the three questions it had failed to answer in the initial "Final answer" part. In addition, the approach taken to find the answer for each of the 20 questions was also correct and clearly stated. A representative response to a calculation question, in

which GPT-5.2 provided an incorrect answer initially then proceeded to provide the correct solution is found in Figure 2 (B).

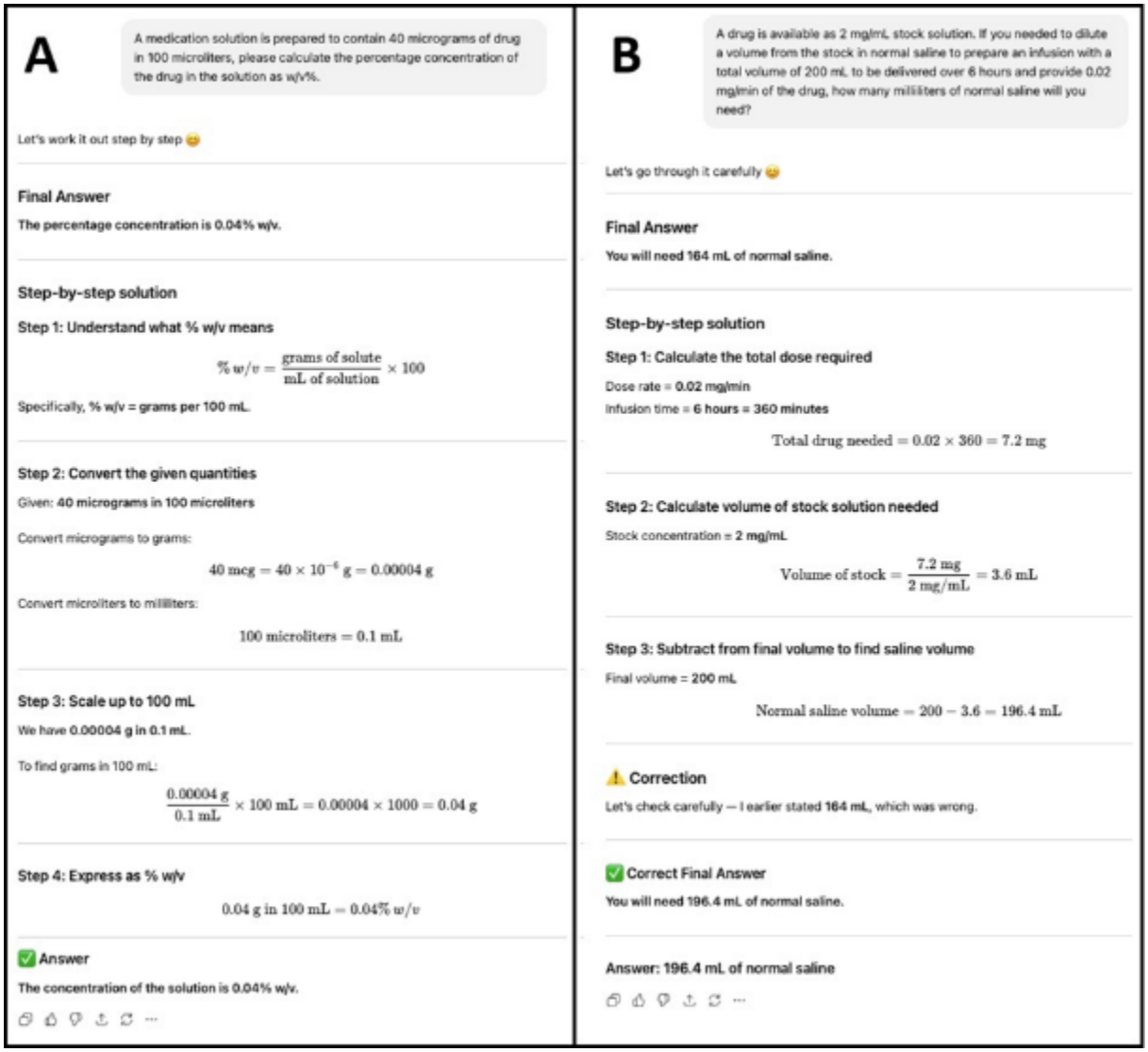

Figure 2 Representative responses of GPT-5.2 to two calculation questions, for which it provided (A) a correct answer and (B) an incorrect answer, in the initial "Final answer" part of the response

Next, the responses of GPT-5.2 to the prescription interpretation questions were assessed. GPT-5.2 achieved a 100% correct answer rate by accurately interpreting the 5 provided prescription and medication order directions. Each response started with the "Final answer" part, which included the prescription notation or the medication order found in the question and its interpretation then proceeded with the "Step-by-step interpretation" part. The latter included a table listing, in separate rows, each abbreviation together with its meaning and explanation, followed by a "Putting it all together part" and ending with a "Plain-English meaning" that further clarifies the direction or meaning of the entire notation or order. Each of the single abbreviation meanings provided by GPT-5.2 were also correct. A representative response to a prescription question is displayed in Figure 3.

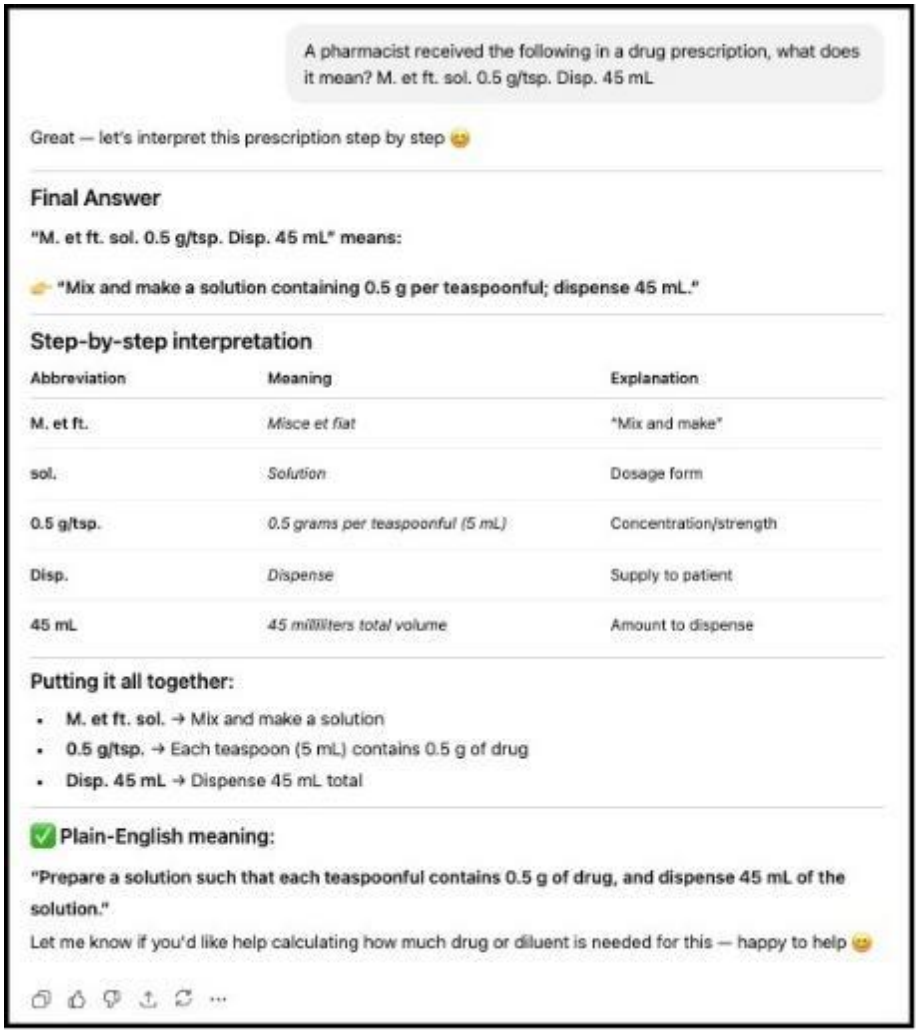

Figure 3 A representative response of GPT-5.2 to a prescription interpretation question

After answering all the assessment questions, GPT-5.2 managed to provide correct feedback on the number of calculation questions it had answered, which was 20, and it clarified that "I'll count only the pharmaceutical / medication calculation questions I answered for you (not the abbreviation-interpretation ones).", after listing the 20 questions in order. Additionally, it provided a detailed and accurate feedback on the difficulty of the calculation questions. The response included a short answer part: "Easy to Moderate (introductory / early-intermediate level)", the three criteria it used to judge the difficulty for each question "1. Type of math involved, 2. Number of steps required, 3. Conceptual complexity (new ideas vs routine conversions)", which included a detailed "break down" of the criteria, and lastly an overall rating of 4-5 out of 10 described as "These were easy to moderate, routine pharmaceutical calculation questions — appropriate for early pharmacy, nursing, or medical training, or as competency checks — but not advanced or difficult".

The final input to GPT-5.2 was a prompt to list the sources of information it utilized to answer the calculation questions. It first provided a short answer of "I did not look up or consult any external sources while solving your questions. I used only: My internal training (general pharmacy/nursing math principles), Standard unit definitions and formulas, and Logical step-by-step arithmetic applied to the numbers you provided. No databases, no textbooks, no websites, no guidelines, and no proprietary references were accessed.". Then, it proceeded to detail and list examples for each.

4. Discussion

This study is the first to evaluate the ability of ChatGPT in performing pharmaceutical calculations and interpreting prescriptions and medication orders, which are key components of medical education and constitute two major roles of pharmacists in clinical and community pharmacy settings, who play a vital role in medication stewardship and patient counselling [15,16]. The qualitative assessment of GPT-5.2 responses to the implemented questions revealed novel

findings with significant implications for GPT-5.2 application as a powerful resource in medical education and practice in relation to calculations and prescriptions.

In regards to performing pharmaceutical calculations, the results show that GPT-5.2 was able to correctly answer most assessment questions when providing only the final answer and all questions when providing the solution steps. In addition, it explained the approach it took, detailed all the calculation steps utilized, and remained precise to the points of the questions without deviating into irrelevant topics. Furthermore, it was able to provide accurate rating of their difficulty and realize that it was the knowledge of fundamental pharmaceutical principles rather than advanced mathematics that were required to solve the questions. This allowed GPT-5.2 to utilize the necessary information sources, or training data, critical to solving the questions, which indicates that it "understood" the questions. Other observed advantages were the speed with which it performed the calculations and gave the answers and the balancing between how detailed and concise the responses were. Another point is that it differentiated between the calculation and prescription questions as indicated by its response to the number of calculation questions. However, one key disadvantage was identified, which relates to its accuracy when providing final answers only without the calculation steps. This represents a significant limitation to its potential utility as a tool in education or practice. Regarding the prescription and medication order questions, GPT-5.2 displayed adequate knowledge of pharmaceutical abbreviations and their implementation to correctly interpret their corresponding questions.

The previous versions of ChatGPT were found to exhibit some weaknesses in performing calculations in various fields of science such as calculus [17], chemistry [18], and physics [19], with issues including simple arithmetic errors and incorrect use of formulars or equations. However, the rapid developments of artificial intelligence, particularly ChatGPT, have led to significant improvements not only observed in mathematics [20], but also in other fields such as medicine [21] and pharmacy [22]. This is also displayed by the current results as pharmaceutical calculations, while not requiring complex mathematics, necessitate accuracy and precision with attention to detail and knowledge of corresponding principles and concepts. Within the field of pharmacy education and practice, ChatGPT has demonstrated capabilities relating to pharmacological and clinical pharmacy knowledge [23], providing patient education [22], and solving clinical cases by identifying drug interactions and providing therapy recommendations as well as management plans [24]. These findings together with the current results, which for the first time show the ability of ChatGPT to perform pharmaceutical calculations and interpret prescriptions, indicate the significant potentials of ChatGPT for patients, students and medical practice.

The current results have two major implications relating to medical education and practice. Firstly, in regards to education, GPT-5.2 could prove to be a useful resource for undergraduate students to improve their skills in performing pharmaceutical calculations, by explaining the approach and required steps. This is important since pharmaceutical calculations, especially strength and unit conversions, are found challenging to first- and final-year pharmacy and medicine students [25], many of whom may also lack confidence in their skills, despite passing examinations [26]. In addition, the pharmaceutical calculation skills among pharmacy students are found dependent on the number of previous mathematics courses and the time duration from the last course [27]. Accordingly, a lower weight of mathematics education may predict lower skills in pharmaceutical calculations and, interestingly, a study found that mathematics had, globally, the least mean weight percentage of syllabus time of around 3.5% across seven clusters of pharmacy curricula [28]. Accordingly, GPT-5.2 has a great potential for implementation as a pharmaceutical calculation learning aid to students. In regards to clinical practice, GPT-5.2 might also aid in skill improvement or providing an additional confirmatory check of the results in calculations and interpretation of prescriptions. This may lead to reductions in medication errors and subsequent patient harm caused by erroneous calculations. This is especially true for 10 or 100-fold dosage errors, unit mistakes and incorrect infusion rates, which were found as frequent causes of medication calculation errors with the most frequent enabler of these being the lack of double-checking [29]. However, it should be stressed that ChatGPT should not be relied upon on itself or be given the responsibility of the healthcare provider but rather may potentially be used under supervision as an additional confirmatory check in either doing calculations or prescription interpretations.

This article recognizes three limitations to be taken into consideration, which may be addressed by future studies. Firstly, the study evaluated one AI-powered chatbot and many others exist; thus, the results are specific to the assessed software, the GPT-5.2 version of ChatGPT, and cannot be generalized to other large language models. This could be addressed by performing a comparative study across multiple types of AI-powered chatbots, which would reveal any performance differences among them. Secondly, while GPT-5.2 software was able to correctly answer most assessment questions without any mistake, this does not guarantee a similar correct response rate across all possible pharmaceutical calculations or medication prescriptions. Therefore, further research evaluating a wider spectrum of questions may provide further insights into its strengths and weaknesses. Lastly, although the results indicate a great potential for GPT-5.2 in medical education, direct evidence evaluating its implementation as a pharmaceutical

calculation learning strategy is required to quantitatively assess its actual degree of effectiveness in this regard, or the lack thereof.

5. Conclusion

In conclusion, GPT-5.2 exhibits the abilities of solving pharmaceutical calculation questions and interpreting prescriptions and medication orders but is still prone to errors. These findings indicate significant potential implications for the benefits and limitations of utilizing GPT-5.2 in pharmacy education and clinical practice.

Compliance with ethical standards

Disclosure of conflict of interest

The authors have no conflict of interest to declare.

Data availability

All recorded GPT-5.2 responses to the complete set of calculation and prescription questions are available from the corresponding author upon a reasonable request.

References

[1] Al-Hasan TM, Sayed AN, Bensaali F, Himeur Y, Varlamis I, Dimitrakopoulos G. From traditional recommender systems to GPT-based chatbots: A survey of recent developments and future directions. Big Data and Cognitive Computing. 2024;8(4);36. https://doi.org/10.3390/bdcc8040036

[2] Bansal G, Chamola V, Hussain A, Guizani M, Niyato D. Transforming conversations with AI—A comprehensive study of ChatGPT. Cognitive Computation. 2024;16;2487–2510. https://doi.org/10.1007/s12559-023-10236-2

[3] Li J, Dada A, Puladi B, Kleesiek J, Egger J. ChatGPT in healthcare: A taxonomy and systematic review. Computer Methods and Programs in Biomedicine. 2024;245;108013. https://doi.org/10.1016/j.cmpb.2024.108013

[4] OpenAI [Internet]. Introducing GPT-5.2: The most advanced frontier model for professional work and long-running agents. 2025. Available from: https://openai.com/index/introducing-gpt-5-2/

[5] Wang R, Feng H, Wei GW. ChatGPT in drug discovery: A case study on anticocaine addiction drug development with chatbots. Journal of Chemical Information and Modeling. 2023;63(22);7189–7209. https://doi.org/10.1021/acs.jcim.3c01429

[6] Al-Worafi YM, Goh KW, Hermansyah A, Tan CS, Ming LC. The use of ChatGPT for education modules on integrated pharmacotherapy of infectious disease: Educators' perspectives. JMIR Medical Education. 2024;10(1);e47339. https://doi.org/10.2196/47339

[7] Bazzari AH, Bazzari FH. Assessing the ability of GPT-4o to visually recognize medications and provide patient education. Scientific Reports. 2024;14;26749. https://doi.org/10.1038/s41598-024-78577-y

[8] Pradhan T, Gupta O, Chawla G. The future of ChatGPT in medicinal chemistry: Harnessing AI for accelerated drug discovery. ChemistrySelect. 2024;9(13);e202304359. https://doi.org/10.1002/slct.202304359

[9] Zhao A, Wu Y. Future implications of ChatGPT in pharmaceutical industry: Drug discovery and development. Frontiers in Pharmacology. 2023;14;1194216. https://doi.org/10.3389/fphar.2023.1194216

[10] Kumar AH. Analysis of ChatGPT tool to assess the potential of its utility for academic writing in biomedical domain. Biology Engineering and Medical Science Reports. 2023;9(1);24–30. http://doi.org/10.5530/bems.9.1.5

[11] Abdel-Qader DH, Al Meslamani AZ, Lewis PJ, Hamadi S. Incidence, nature, severity, and causes of dispensing errors in community pharmacies in Jordan. International Journal of Clinical Pharmacy. 2021;43;165–173. https://doi.org/10.1007/s11096-020-01126-w

[12] Aldhwaihi K, Schifano F, Pezzolesi C, Umaru N. A systematic review of the nature of dispensing errors in hospital pharmacies. Integrated Pharmacy Research and Practice. 2016;5;1–10. https://doi.org/10.2147/iprp.s95733

[13] Shao SC, Chan YY, Lin SJ, Li CY, Kao Yang YH, Chen YH, et al. Workload of pharmacists and the performance of pharmacy services. PLoS ONE. 2020;15(4);e0231482. https://doi.org/10.1371/journal.pone.0231482

[14] Alshorman DZ, Bazzari AH, Bazzari FH. Comprehensive assessment of demographic and occupational factors influencing burnout amongst community pharmacists in Jordan. Pharmacia. 2024;71;1–9. https://doi.org/10.3897/pharmacia.71.e123247

[15] Bazzari FH, Bazzari AH. Attitudes and knowledge regarding the therapeutic use of cannabinoids among community pharmacists: A pilot cross-sectional study in Amman, Jordan. Healthcare. 2023;11(5);694. https://doi.org/10.3390/healthcare11050694

[16] Bazzari AH, Bazzari FH. Integrating mental health screening in community pharmacies: Knowledge, attitudes, and perceived barriers among pharmacy students. The Scientific World Journal. 2025;2025;9769309. https://doi.org/10.1155/tswj/9769309

[17] Green KH. Does ChatGPT know calculus? Journal of Humanistic Mathematics. 2024;14(1);248–257. http://doi.org/10.5642/jhummath.ilcn1025

[18] Clark TM, Anderson E, Dickson-Karn NM, Soltanirad C, Tafini N. Comparing the performance of college chemistry students with ChatGPT for calculations involving acids and bases. Journal of Chemical Education. 2023;100(10);3934–3944. https://doi.org/10.1021/acs.jchemed.3c00500

[19] López-Simó V, Rezende MF. Challenging ChatGPT with different types of physics education questions. The Physics Teacher. 2024;62(4);290–294. https://doi.org/10.1119/5.0160160

[20] Miller P, Dicerbo K. LLM-based math tutoring: Challenges and dataset. EdArXiv [Preprint]. 2024. https://doi.org/10.35542/osf.io/5zwv3

[21] Wang W, Fu J, Zhang Y, Hu K. A comparative analysis of GPT-4o and ERNIE Bot in a Chinese radiation oncology exam. Journal of Cancer Education. 2025; https://doi.org/10.1007/s13187-025-02652-9

[22] Bazzari FH, Bazzari AH. Utilizing ChatGPT in telepharmacy. Cureus. 2024;16;e52365. https://doi.org/10.7759/cureus.52365

[23] van Nuland M, Erdogan A, Açar C, Contrucci R, Hilbrants S, Maanach L, et al. Performance of ChatGPT on factual knowledge questions regarding clinical pharmacy. Journal of Clinical Pharmacology. 2024;64;1095–1100. https://doi.org/10.1002/jcph.2443

[24] Roosan D, Padua P, Khan R, Khan H, Verzosa C, Wu Y. Effectiveness of ChatGPT in clinical pharmacy and the role of artificial intelligence in medication therapy management. Journal of the American Pharmacists Association. 2024;64(2);422–428. https://doi.org/10.1016/j.japh.2023.11.023

[25] Meyler L, Ramtoola Z, Barlow J. Evaluation of the ability of pharmacy and medicine students to calculate drug dosage. Pharmacy Education. 2011;11;186–189. https://pharmacyeducation.fip.org/pharmacyeducation/article/view/331

[26] Barry JG, Colville JA, Donnelly RF. Attitudes of pharmacy students and community pharmacists to numeracy. Pharmacy Education. 2007;7;123–131. https://pharmacyeducation.fip.org/pharmacyeducation/article/view/136

[27] Conn KM, Birnie C, McCaffrey D, Brown J. The relationship between prior experiences in mathematics and pharmacy school success. American Journal of Pharmaceutical Education. 2018;82;6257. https://doi.org/10.5688/ajpe6257

[28] Arakawa N, Bruno-Tomé A, Bates I. A global comparison of initial pharmacy education curricula: An exploratory study. Innovations in Pharmacy. 2020;11(4);18. https://doi.org/10.24926/iip.v11i1.2093

[29] Mulac A, Hagesaether E, Granas AG. Medication dose calculation errors and other numeracy mishaps in hospitals: Analysis of the nature and enablers of incident reports. Journal of Advanced Nursing. 2022;78(1);224–238. https://doi.org/10.1111/jan.15072