Preceptor Guide to Critical Assessment of Medical Literature

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Purpose

This document provides a resource and guide to help preceptors actively teach pharmacy learners how to critically evaluate medical literature.

***Critical thinking definition*:** the act or practice of thinking (as by applying reason and questioning assumptions) in order to solve problems, evaluate information, discern biases, etc.[1]

Goals of the learning opportunity:

- **General Points/Goals**
  - Peer-reviewed or Guidelines of a Professional Organization or Impact Journal does not mean correct
  - Read efficiently and with a specific goal
  - Supporting evidence is not a citation alone, always look at the original data
  - Analytical thinking is not quoting
  - Do the Math, especially with non-pharmacists talking about drug therapy
  - How would you save this publication, addressing setting up filing systems

- **Clinical points (could be in the literature reviewed (e.g., case report) or case that is being presented)**
  - Differential diagnosis
  - Appropriate med history
  - Timeline
  - Value of the publication
  - Is the conclusion right or wrong and why
  - Focus on how to read to answer questions for a specific patient case

- **Task for the learner**
  - Search for medical literature including case reports/case series/letters to the editor/comments using terms such as iatrogenic, misdiagnosed, surreptitious, malicious, dosing error, compounding, pump malfunction, etc.
  - Take a core rotation topic and provide the most readable review and or the review with the best figures, on the topic they like.

- Find an article noted to have contradictory information/support/evidence
- Find an article noted to have missing information
- Share what the learned/found with the preceptor, how did it impact their view of the literature

- **Creating a preceptor library of resources/examples (see Appendix A)**
  - Consider including:
  - Case reports
  - Case series
  - Letters to the editor
  - Comments
  - Primary literature
  - Clinical guidelines
  - Personal clinical practice cases (consider learners to write)

Appendix A- Resources with notes

1. **Ensuring calculations are correct/reasonable**
   a. Article: Arbour R, Esparis B. Osmolar gap metabolic acidosis in a 60-year-old man treated for hypoxemic respiratory failure. Chest. 2000 Aug;118(2):545-6. doi: 10.1378/chest.118.2.545. PMID: 10936154.[2]
   b. Link to article: https://www.sciencedirect.com/science/article/pii/S0012369215518217?via%3Dihub
   c. Summary (if do not have access to full article)
      i. The case describes a 60-year-0ld man who is hospitalized for fever and SOB. After two days, he worsens and is transferred to the ICU, intubated and ventilated for worsening hypoxia. Lorazepam is bolused and followed by an infusion. Five days later a worsening osmolar anion gap acidosis is noted. The laboratory confirmation of elevated lactic acid, propylene glycol and serum osmolarity resulted in a diagnosis of propylene glycol toxicity from the prolonged lorazepam infusion.
      ii. The article discusses pathophysiology, identifies a partial list of potentially responsible medications to include in the workup of similar cases. It even does an elegant but unnecessary workup of the amount of propylene glycol provided by the compounded infusion.
      iii. The casual reader could read the entirety of the article and note many things that are appropriate and show good critical analysis but spending more than a few minutes to merely compare the stated conclusion that infusions as low as 6mg/hr. can cause this without calculating how much that should be and how much more was giving (the central premise being checked first) is inefficient.

iv. Trainees should be lauded for independently noting the lack of consideration of other causes, the lack of details on bolus dosing, the presence of other meds identified in the discussion that the patient also received as potential contributors. And even the possibility of new medical diagnoses.

v. The article demonstrates the value of not reading to memorize nor read completely but begins a process of learning to read more efficiently.

d. Teaching Points

i. The stated total dose of 1302mg of lorazepam is nearly twice the rate of 6mg/hr. and is in fact when given over 5 days (or 120hrs) is actually > 10mg/hr.

ii. After that it should be easy to note that multiple boluses were given (and in the last couple days increasing amounts---was this withdrawal too) and the boluses added to the total but were ignored when discussing the rate.

2. Critically assessing values used justify writers' conclusions

a. Article: Imam SH, Landry K, Kaul V, Gambhir H, John D, Kloss B. Free phenytoin toxicity. Am J Emerg Med. 2014 Oct;32(10):1301.e3-4. doi: 10.1016/j.ajem.2014.03.036. Epub 2014 Apr 1. PMID: 24768668.[3]

b. Link to article: https://www.sciencedirect.com/science/article/abs/pii/S0735675714002241?via%3Dihub

c. Summary: (if do not have access to full article)

i. This short article describes a case of a 69-year-old male admitted for increasing drowsiness, mental status changes and gait disturbance with a PMH of Type II DM, hyperlipidemia, CKD and a recently diagnoses right orbital squamous cell carcinoma with intercranial extension. On presentation a total serum phenytoin of 18 ng/dl (inappropriate units) and hypoalbuminemia is noted. The authors then perform the Sheiner-Tozer calculation to correct for free phenytoin estimation in the presence of hypoalbuminemia.

ii. Trainees universally read from beginning to end and note any of the following: improper units, consider the CT confirmed frontal lobe mass extending into the temporal lobe, timing of concentration in relation to recent doses or any discussion of acute changes in liver function panel from three weeks prior.

iii. A trainee could then be prompted to do a PUB Med search for the article and then be directed to the "Comment In" section beneath the citation and find an article detailing the problems noted above in their entirety. Another process that can speed the efficiency of reading , while also acquiring new critical evaluation perspectives.

d. Teaching Points

i. Medical professionals demonstrate how to use the correction equation for estimating true "free " phenytoin concentrations in the presence of hypoalbuminemia.
ii. Unfortunately, this was done by using the total phenytoin concentration to calculate a new "calculated" total, which was then greater than what was measured. They need to use the 10% normal free fraction and calculated an estimated "free" phenytoin of 1.8mg/l .
iii. Some values to note:
    1. A P4APPE student and a PGY2EM resident with mentoring from a preceptor submitted a letter to the editor within 2 weeks of publication and it was accepted and published with 2 months. Both trainees then had a publication.
    2. It demonstrates the value of doing lit search on assigned or recommended articles to say what if anything else individuals with practice expertise had to say in letters to the editors, comments, and subsequent citations et al.

3. **Estimating Renal Function in Paraplegia**
    a. Article: Lee, Jennifer Pai. 'Estimating Renal Function in Paraplegia'. Topics in Paraplegia, InTech, 2 July 2014. Crossref, doi:10.5772/57231.[4]
    b. Link (open access): https://www.intechopen.com/chapters/46003
    c. Teaching Points
        i. Research the issue before looking for a black & white answer from your preceptor in a gray area.
        ii. Do the different calculations for your patient and compare them to each other and to the standard CrCl equation to see what final doses are and how large the differences.
        iii. Discuss when you have a range, what dose do you pick? All early learners go with midpoint – choose higher for critically ill or lower if not sure we need it at all.
        iv. Could also discuss nuances of CrCl estimations in all patients – physical activity, liver function, diet.
        v. Look into the studies where these calculations originated to recognize the flaws/small numbers. Could turn this into a pearl/education for all pharmacists.
        vi. Follow-up on the patient to see how the vancomycin level resulted as a learning experience.
        vii. Recognize the transition from student to resident – take the next steps!
        viii. How would you save this information for the next time?
4. **Utilizing DOACs in patients with liver dysfunction**
    a. Article: Lawal OD, Aronow HD, Shobayo F, Hume AL, Taveira TH, Matson KL, Zhang Y, Wen X. Comparative Effectiveness and Safety of Direct Oral Anticoagulants and

Warfarin in Patients With Atrial Fibrillation and Chronic Liver Disease: A Nationwide Cohort Study. Circulation. 2023 Mar 7;147(10):782-794. doi: 10.1161/CIRCULATIONAHA.122.060687. Epub 2023 Feb 10. PMID: 36762560.[5]

b. Link (open access): https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.122.060687?rfr_dat=cr_pub++0pubmed&url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org)

c. Teaching Points
   i. Authors draw broad conclusion indicating that DOACs are effective at preventing stroke in patients with atrial fibrillation and chronic liver disease while also having less major bleeding when compared to warfarin. Learners can be prompted to determine applicability to patient case related to these disease states.
   ii. However, the paper and the supplement do not include any information related to the level of liver impairment the included patients had (such as a Child Pugh score).
   iii. The authors do address why they did not include it but if a learner only utilizes the published results and conclusions drawn by the authors, they would miss that they do not have key information to know if the study is applicable to practice.

5. **Assessing a Case Report**
   a. Article: Sankhla N, Schneider P, Ghosh P. Accidental ethanol ingestion in a 32-day-old infant. *J Clin Toxicol*. 2017;7(2):341. doi:10.4172/2161-0495.1000341.[6]
   b. Link (Open Access): https://www.longdom.org/open-access/accidental-ethanol-ingestion-in-a-32-day-old-infant-51631.html
   c. Teaching Points:
      i. Scenario: Your preceptor hands this to you review as a draft manuscript for a medical journal for practice (the preceptor is the actual invited reviewer). Would you accept the manuscript with essentially no changes, ask for a revision for minor changes and no further review, ask for major revisions with another review following the author's response and changes or reject as unworthy for publication.

References:

1. Merriam-Webster Dictionary. https://www.merriam-webster.com/dictionary/critical%20thinking. Accessed 2/17/2025.
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5. Lawal OD, Aronow HD, Shobayo F, Hume AL, Taveira TH, Matson KL, Zhang Y, Wen X. Comparative Effectiveness and Safety of Direct Oral Anticoagulants and Warfarin in Patients With Atrial Fibrillation and Chronic Liver Disease: A Nationwide Cohort Study. Circulation. 2023 Mar 7;147(10):782-794. doi: 10.1161/CIRCULATIONAHA.122.060687. Epub 2023 Feb 10. PMID: 36762560.
6. Sankhla N, Schneider P, Ghosh P. Accidental ethanol ingestion in a 32-day-old infant. *J Clin Toxicol*. 2017;7(2):341. doi:10.4172/2161-0495.1000341.

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