Strategies for Teaching the Chem 7 to Pre-clinical Medical Students

Elan Baskir AB[1], Sarah Stumbar MD MPH[1], Chloe Gould MPH[1], Thomas Newlin MPS[1]
[1]Herbert Wertheim College of Medicine, Miami, FL

Background

Understanding normal and abnormal lab values is integral to clinical medicine. However, one study showed that even experienced clinicians report uncertainty in interpreting laboratory test results [1]. Furthermore, one in five medical graduates identified themselves as being 'less than competent' in using laboratory testing [2]. Familiarity with normal ranges can help students save time in clinical experiences and save time on exams.

The first step in interpreting laboratory values is recognition of normal and, in turn, abnormal values. Our literature search revealed no curricula geared toward educating students about abnormal or normal lab values. As such, we developed a session to educate second year medical students about normal lab values in the "Basic Metabolic Panel" (BMP), which is among the most frequently ordered set of lab values and is often formatted into the "fishbone" structure (Figure 1)

Study Aims

Goal: To educate and familiarize medical students with the Basic Metabolic Panel and instill lasting memory hooks that will impart long-term ease with clinical use.

Hypothesis: We hypothesize that introduction to the Chem 7 Mnemonic will increase accuracy in identifying abnormal BMP lab values on a post-session survey in comparison to pre-session survey.

Learning objectives:

1. Identify the components of Chem 7
2. Identify the range of normal values of the Chem 7
3. Recognize abnormal values of the Chem 7
4. Participate in mnemonics to recognize the abnormal values of the Chem 7

Methods

A 4th-year medical student gave a 20-minute interactive presentation to 2nd year medical students recruited by the Family Medicine Interest Group. Students completed an optional, paper-based 5-question pre- and post-session quiz, which asked them to identify abnormal BMP lab values based off brief clinical scenarios. The first three questions had one abnormal value, the fourth and fifth questions had multiple abnormal values. There was one additional post-session question that assessed satisfaction with the session.

Following the pre-quiz, there was a 20-minute interactive presentation, which reviewed components of the Chem 7 (Figure 1), ranges of normal lab values (Figure 2), mnemonics to remember these normal ranges (Figure 3), and how to recognize abnormal lab values. The students did three practice questions as a group.

Descriptive statistics were analyzed with Microsoft Excel. FIU Health Sciences IRB exemption was obtained.

As labs have different "normal" values, the ranges published by the National Board of Medical Examiners [3] were rounded for ease of memory. For BUN/creatinine, elevated levels are more clinically significant than decreased values [4, 5]; thus, the upper level was emphasized (Fig 2).

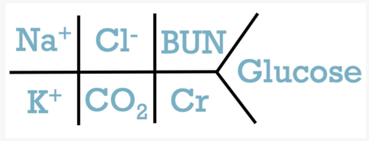

Figure 1: The "fishbone" structure for reporting values in the BMP/Chem 7

Figure 2: The normal ranges of the BMP/Chem 7, with rounded values for ease of memory

Figure 3: Chem 7 Mnemonic

- **Sodium:** Normal values 135-145, represented by one bottle of liquor, commonly termed a "40", give or "Take 5"
- **Potassium:** Normal values 3.5-5, represented by the median nerve distribution that controls sensation in your first 3.5 fingers: thumb, pointer, middle and half of the ring
- **Chloride**: Normal values 95-105, represented by 100, give or take 5 (the Take 5 candy bar)
- **Bicarbonate:** Normal values 22-28, the average age of medical students, represented by the well-known First Aid book
- **BUN**: Normal values 7-18, represented by the maximum age of someone taking the SAT
- **Creatinine**: Normal values <= 1.1, represented by 1/1 on calendar
- **Glucose**: Normal values 70-100, represented by a passing score on an exam

Results

- 26 students attended the session and filled out the pre-session and post-session quiz (100% response rate); 18 students (69% response rate) filled out the post-session 1-question survey.
- 100% of students agreed or strongly agreed that "This session was an effective use of time." Using the 5-point Likert scale, the mean response was 4.84.

Question	# abnormal values	Pre	Post
1. Patient presents with an arrhythmia	1	35%	92%
2. Severely dehydrated patient	1	29%	100%
3. Small cell lung cancer	1	12%	100%
4. Patient vomited 20 times	3	4%	95%
5. Diabetic patient with suspected diabetic ketoacidosis	4	0%	88%

Table 1: Performance of the pre and post session quizzes by question (As shown in Tables n=26)

	Pre	Post
Mean	14%	95%
Median	20%	100%
Mode	0%	100%
Standard Deviation	0.16	0.08
Lowest Score	0%	80%
Highest Score	60%	100%

Table 2: Comparison of descriptive statistics of the pre and post session quizzes (n=26)

References

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Conclusion

The session utilized mnemonics and brief cases to assist students in retaining the presented knowledge on BMP lab values. Low scores (mean 14% correct) on the pre-session quiz may indicate lack of familiarity with either BMP normal ranges, the "fishbone" structure, or both.

However, after the session, students performed significantly better (mean 95% correct) on all quiz questions. our findings indicate that even a very brief lecture on the structure of the fishbone, normal ranges for the lab values, and mnemonics to remember those ranges was very effective in improving the students' ability to identify one or more abnormal lab values.

Further investigation is needed to assess the students' long-term recall, such as on exams. Because the surveys were completely anonymously, there is no mechanism to re-identify students. However, long-term recall of abnormal lab values is important for clinical practice and success on exams.