Assessment of student compounding knowledge in a one semester skills lab course

Abigale T. Matulewicz, Pharm.D.[1], Lauren Caldas, Pharm.D., BCACP[1], Fawaz M. Alotaibi, MS, Pharm.D.[1], Giulia Barlow, Pharm.D.[2], Laura Morgan, Pharm.D., M.Ed., BCPS[1]
[1]Virginia Commonwealth University School of Pharmacy, Richmond, VA, [2]Carolinas Medical Center, Charlotte, NC

BACKGROUND

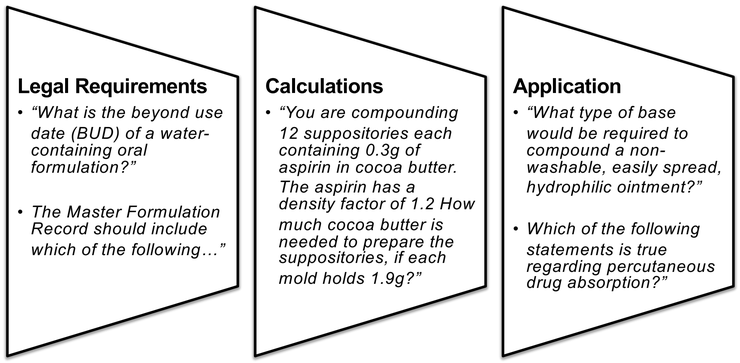
- Methods of educating our future pharmacists in the skill of compounding have been less defined:
  - Curricula have shifted focus towards clinical therapeutics, away from traditional dispensing and compounding roles[1]
  - Both *ACPE 2016 Standards* and the NAPLEX continue to include compounding as part of their expectations[2,3]
- Compounded preparations continue to be prevalent in community practice, with some pharmacies reporting a make up of more than 20% of their total annual prescriptions[4]
- A need remains for student pharmacists to obtain quality instruction on the principles and technique of non-sterile compounding, but few studies examine the best way to deliver the content[5]

OBJECTIVE

- To demonstrate the effect of a stand-alone non-sterile compounding course on student knowledge and assess development of student confidence in non-sterile compounding knowledge and skills

METHODS

- First year students in a required, stand-alone 15-week Foundations of Pharmacy Practice course completed a 15 question pre- and post- knowledge assessment on the first and last day of lab
- The assessment was multiple choice in format and students were given up to 20 minutes to complete – the questions remained identical between the pre- and post-assessment
- Assessment questions were broken down into three categories:



- Confidence questions were included for the three categories and were scored on a 3-point Likert-type scale:
  - *"How confident are you in your ability to assign the correct beyond use date (BUD) to a product you have compounded?*
  - *"How confident are you in your ability to accurately complete calculations necessary to compound suppositories?"*
  - *"How confident are you in your ability to prepare a compounded product for a patient on your Introductory Pharmacy Practice Experience (IPPE) rotation?"*
- Paired T-tests and McNemar's test was utilized for data analysis, with a p-value of <0.05 indicating significance
  - Descriptive statistics were used to analyze overall performance on the assessment

RESULTS

- A total of 122/122 students completed both the pre- and post-assessment (100% response rate)

Demographics of Class of 2020 (n=122)	
Mean Age (years)	22.5 (19-42)
Gender (%)	88 Female (72)
Students with Baccalaureate Degree (%)	118 (97)
Mean Cumulative GPA On Admission	3.3

Comparison of Pre- and Post- Assessment Student Performance by Question Category (n=122)

	Pre-Assessment No. Correct (%)	Post-Assessment No. Correct (%)	*p* value
Legal			
Components of master formulation record	115 (94)	121 (99)	.014
Non-aqueous BUD	70 (57)	100 (82)	<.001
Aqueous BUD	60 (49)	92 (75)	<.001
Calculations			
Active ingredient from ratio strength	33 (27)	91 (75)	<.001
Diluent calculation from solubility ratio	5 (4)	118 (97)	<.001
Weight-based dosing	2 (1)	52 (42)	<.001
Base determination using density factor	48 (39)	85 (70)	<.001
Application			
USP 795 water requirements for liquid preparations	107 (88)	113 (93)	0.13
Active ingredient absorption for topical preparations	95 (78)	113 (93)	<.001
Ointment base selection	47 (39)	30 (25)	.01
Properties of gel-based preparations	53 (43)	90 (74)	<.001
Definition of density factor in suppository preparations	43 (35)	114 (93)	<.001

BUD=beyond use dating; USP=United States Pharmacopeia

Comparison of Pre- and Post- Assessment Student Confidence by Question (n=122)

	Pre-Assessment Frequency (%)			Post-Assessment Frequency (%)			
	Not Confident	Somewhat Confident	Confident	Not Confident	Somewhat Confident	Confident	*p* value
Preparing compound during IPPE rotation	75 (61)	39 (32)	8 (7)	1 (1)	38 (31)	83 (68)	<.001[a]
Assigning BUD	53 (44)	59 (48)	10 (8)	0 (0)	21 (17)	101 (83)	<.001[a]
Completing required calculations	57 (47)	60 (49)	4 (4)	0 (0)	46 (38)	76 (62)	.06

[a] McNemar's test was used to determine significance, defined as $p<0.05$, between composite of *somewhat confident* and *confident* respondents and *not confident* respondents

IPPE=Introductory Pharmacy Practice Experience; BUD=beyond use dating

DISCUSSION

- Significant improvement in performance for the knowledge based material was seen with 75% of the assessment questions
  - All calculations category questions saw significant improvement in performance consistent with the delivery method of the content (continual reinforcement, practice opportunities, high stakes exam)
  - Majority of legal requirements category questions saw significant improvement – crucial knowledge for the higher emphasis and scrutiny placed on compounding pharmacies after recent safety concerns[6]
- Self-reported confidence towards legal requirements increased significantly (83% vs. 8%)
- Self-reported confidence towards compounding ability increased significantly (68% vs. 7%)

LIMITATIONS

- Student performance declined on the post assessment for one question *(Ointment base selection)*, likely due to the lack of hands-on application for that concept during the course
- Students had recently completed a required pharmaceutical calculations course in the preceding semester, which could have impacted their knowledge and confidence on the calculations portion of the assessment
- Because students' performance and confidence was assessed immediately following the completion of a focused semester, performance may not reflect true knowledge retention beyond what is expected for typical performance in this course
- Only one cohort of students was studied which limits generalizability to other years at VCU or to pharmacy students at other schools

CONCLUSION

- A stand-alone, single semester, non-sterile compounding focused laboratory course was successful in increasing first-year students knowledge
- Student confidence in two aspects – *legal requirements and application* – significantly increased between the two assessments
- Future studies are needed to assess retention of knowledge beyond the single semester curriculum, especially as it pertains to compounding practice, APPE experiences, and the *Pharmacy Curriculum Outcomes Assessment (PCOA)*[7]

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Correspondence: Abigale Matulewicz, atmatulewicz@vcu.edu
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