Developing and Testing a Competency Program to Standardize Pharmacist Education and Training on Aminoglycoside Use in the Home Infusion Setting

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Background

Aminoglycosides are broad-spectrum antibiotics that are primarily used in combination with other antibiotics as part of an empiric regimen against gram-negative organisms. They can also be used synergistically with beta-lactams or vancomycin for some gram-positive infections.[1-4] Select aminoglycosides are also used as second-line treatments for Mycobacterial infections, highlighting their wide range of use.[5] Their broad spectrum of activity, low resistance, and low drug cost are just a few of the many advantageous characteristics that aminoglycosides possess.[1,2]

There are two dosing strategies for aminoglycosides: traditional dosing and extended interval dosing (EID).[1,2] Traditional dosing uses lower doses and more frequent administration. Pharmacokinetic parameters are used to determine the dose and frequency to achieve target peak and trough levels. EID uses higher doses and less frequent administration to attain higher peaks. Aminoglycosides demonstrate concentration-dependent activity and have a post-antibiotic effect.[6,7] EID maximizes the concentration above the minimum inhibitory concentration (MIC).[6,7] The higher the peak/MIC ratio, the greater the rate of bacterial kill.[6,7] Furthermore, saturable aminoglycoside uptake suggests that higher peaks do not result in a greater risk of toxicities.[8] EID nomograms are most often used to determine the appropriate dosing interval. This dosing strategy is often favored as there is less accumulation of the drug and a lower risk of side effects.

Aminoglycosides require close monitoring due to their significant toxicities, including renal damage and ototoxicity.[1,2] By taking advantage of their concentration-dependent kinetics, EID gives the body time to recover between doses.[1,2] When dosing aminoglycosides, it is important to maximize bacterial killing (by obtaining a high peak) and minimize toxicities (by obtaining a low trough). The goal of this program is to standardize baseline aminoglycoside dosing knowledge throughout the organization by requiring pharmacists to successfully complete a comprehensive review program.

Purpose

The primary purpose of this pretest-posttest study is to develop and test an educational intervention focused on aminoglycoside use in the home infusion setting.

Methods

A pharmacist-focused aminoglycoside dosing competency program was developed and implemented across 14 sites within the organization. The program format included a presentation with voice-over, pre-test to assess baseline knowledge, and post-test to assess knowledge gained. The presentation with voice-over was approximately 20 minutes in length. The pre- and post-test were created to align with the program content and consisted of 15 questions.

Survey results were anonymous, and questions were categorized into 3 different competency objectives: (1) understand the basic drug properties that guide therapy selection, (2) compare the differences between traditional vs. extended interval dosing strategies, and (3) standardize the monitoring parameters used to assess therapy appropriateness. Training impact was assessed by comparing overall percentage scores before and after program completion. Statistical comparisons were conducted using a paired samples t-test and the statistical significance was set at $p < 0.05$.

Results

Of the 50 pharmacists who participated in the competency program, 47 completed the pre-test, and 41 completed the post-test. A total of 38 pharmacists completed the competency program in its entirety by obtaining both pre-test and post-test scores. A majority of pharmacists who participated have been with the organization for 0-2 years *(Figure 1)*.

Figure 2A and *Table 1* summarize the pre- and post-learning test scores. For the pre-test scores, a majority of pharmacists obtained 50-74% (N=14), followed by 25-49% (N=13) *(Figure 2A)*. For the post-test scores, a majority of pharmacists obtained 75-100% (N=37), and one pharmacist obtained 50-74% (N=1) *(Figure 2A)*. Approximately 37% of pharmacists achieved a post-test score of 100% (Figure 2B). The lowest pre- and post-test scores were 6% and 58%, while the highest pre- and post-test scores were 100% *(Table 1)*. There was a statistically significant increase from the average pre-test (55.5%) to post-test (92.3%) score ($p < 0.01$) *(Table 1)*.

Overall, 21.1% of pharmacists passed the pre-test, while 94.7% of pharmacists passed the post-test *(Table 2)*.

Figure 1: Cohort Practice Experience

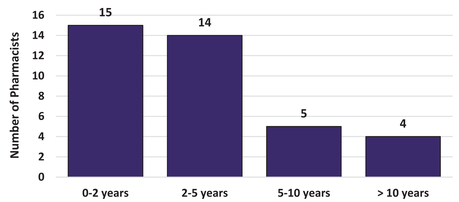

Figure 2A: Pre-Test vs Post-Test Score Breakdown

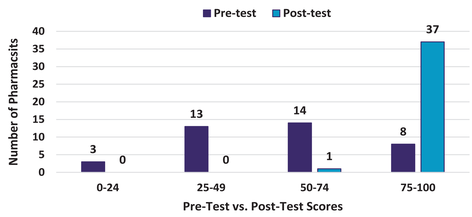

Figure 2B: Post-Test Score Breakdown

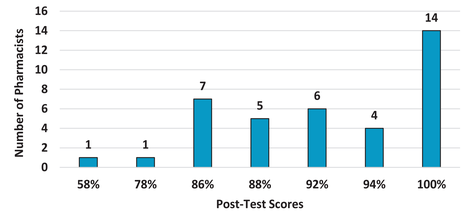

Table 1: Pre-Test and Post-Test Score Breakdown

	Pre-Learning Test	Post-Learning Test	P-Value
Lowest Score	6%	58%	--
Highest Score	100%	100%	--
Average Score	55.5%	92.3%	< 0.01*

*Statistical significance $p < 0.05$ using a paired samples t-test.

Table 2: Pre-Test and Post-Test Pass Rate

Test	% of Passing Pharmacists
Pre-Test	21.1%
Post-Test	94.7%

Percentages based on a passing score of 80%.

Discussion

Although there was a small participant cohort (N=38), a majority of those who completed the program demonstrated an increase in scores and improved knowledge base.

Future expansions of this study should consider decreasing the length of the program to encourage full completion. Additional sites within the organization should be targeted for participation to increase cohort size. An analysis of scores by competency objective would also aid in determining categories that were sufficiently covered by the program vs. categories that should serve as ongoing training focus areas. A long-term assessment may also be developed to evaluate knowledge retention.

It is important to note that *Figure 1* does not reflect participants' total practice or home infusion experience, as the data does not include potential experience acquired prior to joining the organization.

Conclusions

This project has created a strategy for standardizing pharmacist education and training on aminoglycoside use within the organization. Completion of this aminoglycoside competency program led to significant improvements in the baseline knowledge of participating pharmacists. It is hypothesized that improving pharmacist knowledge on the dosing and monitoring of aminoglycosides will optimize the care provided to patients on aminoglycoside therapy and potentially mitigate medication-related errors and adverse events.

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Disclosures

Authors of this presentation have the following to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation: Madeline Kravitz; Maria Giannakos; Christopher Roy; Suzanne Kluge: Nothing to disclose.