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ATOMOXETINE: KNOWLEDGE AND PERCEPTION OF ITS RISKS AMONG PHARMACY STUDENTS

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ABSTRACT

Background: Atomoxetine is a non-stimulant medication approved for the treatment of attention-deficit/hyperactivity disorder (ADHD) and carries a boxed warning for increased risk of suicidal ideation in pediatric patients. Because pharmacists play a key role in medication safety and patient counseling, early understanding of medication risks is essential during pharmacy education. The objective of this study was to assess pharmacy students' knowledge and perceptions regarding atomoxetine-associated risks and boxed warnings and to evaluate whether demographic characteristics were associated with differences in knowledge or opinion responses. **Methods:** A cross-sectional survey was administered to first-year pharmacy students enrolled in a Drug Informatics course at a college of pharmacy. The survey included demographic questions, four opinion-based questions, and five knowledge-based questions related to atomoxetine safety. Descriptive statistics were used to summarize responses as frequencies and percentages. Chi-square analyses were performed to assess associations between demographic characteristics and survey responses, with significance defined as $p < 0.05$. **Results:** A total of 56 students completed demographic questions, and 44 completed the survey items. Students demonstrated strong recognition of major atomoxetine risks, including cardiovascular effects (90.9%), but showed lower performance in more nuanced areas such as monitoring requirements and glaucoma risk (61.4% each). No statistically significant associations were observed between demographic characteristics and survey responses (all p-values > 0.05). **Conclusion:** Pharmacy students

demonstrated baseline awareness of major atomoxetine risks but showed knowledge gaps in more nuanced safety considerations. These findings suggest continued reinforcement of medication safety education may improve pharmacy students' preparedness for clinical practice.

KEYWORDS: Atomoxetine, ADHD, Pharmacy Education, Black Box Warning, Medication Safety.

INTRODUCTION

Atomoxetine is a selective norepinephrine reuptake inhibitor commonly prescribed for the treatment of attention-deficit/hyperactivity disorder (ADHD).[1,2] Unlike stimulant medications, atomoxetine is not classified as a controlled substance; however, it carries important safety concerns, including a boxed warning for increased risk of suicidal ideation in children and adolescents.[3,4] In addition to this boxed warning, atomoxetine has been associated with cardiovascular adverse effects, potential ophthalmologic complications, and the need for ongoing monitoring and patient-specific safety considerations.[5,6]

Although concerns regarding suicidality have been raised, large retrospective cohort analyses have not demonstrated a statistically significant increase in suicidal events among pediatric patients treated with atomoxetine compared with stimulant therapy.[7]

Pharmacists play a central role in promoting medication safety through patient counseling, monitoring, and identification of medication-related risks. As frontline medication experts, pharmacists are responsible for communicating boxed warning information, identifying risk factors, and ensuring appropriate use of medications in diverse patient populations. For that reason, pharmacy students must develop competency in understanding boxed warnings and clinically significant adverse effects early in their professional training. Inadequate understanding of these risks may negatively impact patient counseling, risk communication, and clinical decision-making in practice.

While medication safety is a critical component of pharmacy education, there is limited research specifically evaluating pharmacy students' understanding of medication-specific safety considerations early in training. Existing literature has largely focused on general pharmacotherapy knowledge and clinical outcomes rather than detailed evaluation of student-level understanding of individual medication risks and their application in practice. This gap

is particularly important for medications such as atomoxetine, where safe use depends not only on awareness of major adverse effects but also on appropriate monitoring and patient counseling.

Previous studies have evaluated pharmacy students' knowledge of medications associated with boxed warnings and have reported similar patterns of understanding. A study assessing fentanyl knowledge among pharmacy students found that while participants demonstrated general awareness of key drug characteristics and major safety concerns, gaps remained in understanding safe use and risk management, with an overall average knowledge score of approximately 66.6%.[8] Similarly, research evaluating clozapine demonstrated that although students recognized the importance of monitoring and major safety concerns, inconsistencies were observed in their understanding of appropriate clinical application.[9]

In addition, a study examining lithium found that while a high proportion of students correctly identified early signs of toxicity, fewer participants demonstrated understanding of more complex factors such as the impact of dehydration on lithium levels, highlighting gaps in deeper pharmacotherapeutic knowledge.[10] Another research has evaluated pharmacy students' knowledge of medication safety and black box warnings using high-risk medications. For example, a cross-sectional study by Hailemeskel and colleagues, including Agyekum, assessed pharmacy students' understanding of amiodarone safety concerns. The study found that while most students demonstrated strong alignment with recommended clinical practices (83.2%), notable gaps remained, particularly in areas of drug indications and long-term monitoring. Additionally, only 52.3% of students reported definite familiarity with black box warnings prior to entering pharmacy school, indicating variability in baseline knowledge.[11]

These findings suggest that although pharmacy students may have general awareness of medication-related risks, important gaps persist in more detailed clinical knowledge. However, limited research has specifically examined pharmacy students' understanding of atomoxetine safety, including its boxed warning and monitoring requirements. Therefore, this study aims to assess pharmacy students' knowledge and perceptions regarding atomoxetine safety.

Because atomoxetine is a commonly prescribed ADHD medication with multiple clinically relevant safety concerns, assessing student understanding of its boxed warning and broader

safety profile may help identify gaps in foundational medication safety education. Identifying these gaps may inform targeted curricular strategies aimed at improving students' preparedness for patient counseling, risk assessment, and clinical decision-making.

Therefore, the objective of this study was to assess pharmacy students' knowledge and perceptions of atomoxetine-associated risks and boxed warnings and to evaluate whether demographic characteristics were associated with differences in knowledge or opinion responses.

METHODS

Study Design

This study employed a cross-sectional, survey-based design conducted within a first-year Drug Informatics course. This study was conducted as an exploratory, course-based research activity.

Participants and Setting

Participants were first-year pharmacy students enrolled in a Drug Informatics course at a college of pharmacy. As part of a course activity, students were assigned medications to research in groups, and the atomoxetine survey instrument was developed through a collaborative academic process and reviewed for content accuracy by course faculty prior to distribution. The survey was distributed to classmates anonymously, and participation was voluntary.

Survey Instrument

The survey instrument consisted of three sections. The first section collected demographic information, including participant gender, highest level of education attained, years of work experience, prior awareness of boxed warnings, and undergraduate major. The second section included four opinion-based questions measured using a Likert scale, which assessed student perceptions regarding the use of atomoxetine in children with ADHD, its use despite a boxed warning, its safety in pregnancy, and the importance of patient counseling. The third section consisted of five true/false knowledge-based questions designed to evaluate student understanding of atomoxetine-associated risks, including cardiovascular effects, suicidal ideation, monitoring requirements, glaucoma risk, and pregnancy-related safety considerations. Likert-scale responses were coded on a 5-point scale ranging from 1 (strongly agree) to 5 (strongly disagree). These variables were selected to explore potential associations

between prior exposure to medication safety concepts and student knowledge and perceptions.

All survey responses were compiled and organized by Microsoft Excel prior to analysis. The dataset was then imported into IBM SPSS Statistics (IBM Corp., Armonk, NY), where data were coded and analyzed using descriptive statistical methods, including frequencies and percentages. Chi-square analyses were conducted to evaluate associations between demographic characteristics and both opinion- and knowledge-based responses. The survey instrument was developed as part of a course-based activity and was reviewed for content accuracy by course faculty prior to distribution. However, the instrument was not formally validated or tested for reliability.

Statistical Analysis

Descriptive statistics were used to summarize participant characteristics and survey responses as frequencies and percentages. Chi-square analyses were performed to explore potential associations between demographic characteristics and survey responses. Given the small sample size and potential for low expected cell counts, these analyses were interpreted cautiously and considered exploratory rather than definitive.

RESULTS

A total of 56 students completed demographic questions, while 44 completed the opinion- and knowledge-based survey items (Table 1). Among participants, the majority were female (62.5%), while males represented 26.8% of respondents. Most students had completed a four-year undergraduate degree (53.3%), with an additional 20.0% holding a master's degree or higher. In terms of work experience, 46.7% of participants reported more than three years of experience, and 60.9% had worked in pharmacy-related roles. Additionally, 51.1% of respondents reported prior awareness of boxed warnings. Overall, the sample reflects a population with varying levels of educational background and professional experience, with over half of participants demonstrating familiarity with boxed warning concepts prior to the survey. Percentages may not total 100% due to missing responses or rounding.

Table 1: Participant Demographics.

Characteristic	n (%)
GENDER	
Female	35 (62.5)
Male	15 (26.8)

Other/Prefer Not To Answer	6(10.7)
LEVEL OF EDUCATION	
Four-Year Degree (BS/BA)	40 (53.3)
Master's Degree or Higher	15 (20.0)
WORK EXPERIENCE	
>3 Years of Work Experience	21 (46.7)
Pharmacy-Related Work Experience	28 (60.9)
Prior Awareness of Boxed Warnings	24 (51.1)

Table 2 shows the responses for the opinion-based questions**.** Most students agreed or strongly agreed that atomoxetine should be used in children with ADHD (81.8%; mean = 1.86). Additionally, 75.0% agreed or strongly agreed that atomoxetine may still be used despite its boxed warning (mean = 1.93). A higher proportion of students agreed that atomoxetine should be avoided during pregnancy (86.4%; mean = 1.75) and that healthcare professionals should counsel patients regarding atomoxetine warning signs (88.6%; mean = 1.64). Overall, mean Likert scores ranged from 1.64 to 1.93, indicating general agreement across all opinion-based items. The strongest agreement was observed for patient counseling, while comparatively lower agreement was observed for the use of atomoxetine despite its boxed warning. On average, approximately 83.0% of participants agreed or strongly agreed across all opinion-based items.

Table 2: Opinion-Based Responses.

Survey Item	**Agree/Strongly Agree n (%)**	**Mean (Likert Score)**
Atomoxetine should be used in children with ADHD	36 (81.8)	1.86
Atomoxetine should be avoided in pregnancy	38 (86.4)	1.75
Atomoxetine may be used despite boxed warning	33 (75.0)	1.93
Patients should be informed of warning signs	39 (88.6)	1.64
Overall Mean	**-**	**1.80**

The responses for knowledge-based questions were collected (Table 2). Overall, correct response rates for knowledge-based items ranged from 61.4% to 90.9%. The highest level of accuracy was observed for recognition of cardiovascular risk associated with atomoxetine (90.9%). Moderate performance was observed for knowledge of suicidal ideation risk and pregnancy-related safety (70.5% each). The lowest performance was observed for knowledge of monitoring requirements and glaucoma risk (61.4% each), indicating gaps in understanding of more nuanced clinical safety considerations beyond the most emphasized adverse effect

Table 3: Knowledge-Based Responses.

Knowledge Item	Correct n (%)
Major boxed warning/cardiovascular risk identified correctly	40 (90.9)
Knowledge of suicidal ideation risk identified correctly	31 (70.5)
Knowledge of monitoring requirement identified correctly	27 (61.4)
Knowledge of glaucoma risk identified correctly	27 (61.4)
Knowledge of pregnancy/teratogenic risk identified correctly	31 (70.5)
Average Correct	**70.9%**

Chi-square analyses were conducted to evaluate associations between prior awareness of boxed warnings and knowledge-based responses. No statistically significant associations were observed across all knowledge items ($p > 0.05$). Similarly, no significant associations were identified between personal or indirect experience with adverse drug reactions and knowledge responses ($p > 0.05$).

DISCUSSION

This study evaluated first-year pharmacy students' baseline knowledge and perceptions regarding atomoxetine-associated risks and boxed warnings. Overall, participants demonstrated strong awareness of major safety concerns, particularly cardiovascular effects (90.9%) and suicidal ideation risk (70.5%), suggesting that early exposure to medication safety concepts may support foundational understanding of high-risk medication counseling. These findings should be interpreted as exploratory and may serve as preliminary data for future, larger studies.

However, lower performance was observed for knowledge-based questions assessing monitoring requirements (61.4%) and glaucoma risk (61.4%), highlighting gaps in students' understanding of more nuanced clinical considerations beyond recognition of major adverse effects. These findings suggest that while students may be able to identify key safety concerns, they may have difficulty applying this knowledge to clinical decision-making and patient monitoring. The lower performance on monitoring requirements and glaucoma risk is clinically important because these areas require application of safety knowledge rather than simple recognition of a boxed warning. Pharmacists are often responsible for identifying patient-specific risk factors, counseling patients on warning symptoms, and recommending appropriate follow-up. If students recognize that atomoxetine carries major risks but are less familiar with monitoring needs or less commonly emphasized adverse effects, they may be less prepared to translate drug safety information into patient-centered care.

Similar patterns have been reported in previous studies evaluating pharmacy students' knowledge of high-risk medications. Studies assessing fentanyl, clozapine, and lithium demonstrated that while students showed strong recognition of major risks, performance declined when evaluating more complex safety considerations and clinical application.[8–10]

In addition, a cross-sectional study by Hailemeskel and colleagues, including Agyekum, reported that students demonstrated strong overall awareness of amiodarone safety practices (83.2%), but gaps remained in areas such as drug indications and monitoring frequency.[11] The findings of the present study align with these results, reinforcing the trend that pharmacy students may develop early awareness of medication risks but require further reinforcement of drug-specific clinical knowledge.

No statistically significant associations were observed between demographic characteristics, prior awareness of boxed warnings, or experience with adverse drug reactions and knowledge-based responses. These findings suggest that baseline exposure alone may not be sufficient to ensure competency in medication-specific risk assessment and clinical application. However, these results should be interpreted with caution given the relatively small sample size and limited statistical power. The lack of statistically significant associations should not be interpreted as evidence of no relationship, as the study may have been underpowered to detect meaningful differences.

Overall, the findings indicate that while students demonstrate strong awareness of major safety concerns and the importance of patient counseling, knowledge of more detailed pharmacotherapeutic considerations remains moderate. This gap between recognition and application highlights an opportunity for targeted educational interventions within pharmacy curricula.

Limitations

This study has several limitations. First, the relatively small sample size and limited statistical power may have reduced the ability to detect meaningful associations between variables. Second, the study was conducted at a single institution among first-year pharmacy students, limiting generalizability to other pharmacy programs or healthcare trainees. Additionally, the survey instrument was developed for educational purposes and was not formally validated, which may limit the reliability and generalizability of the findings.

CONCLUSION

Pharmacy students demonstrated baseline awareness of major atomoxetine-associated risks but showed variability in understanding of more nuanced safety considerations. These findings highlight the importance of preparing student pharmacists not only to recognize boxed warnings but also to apply this information in clinical decision-making and patient counseling. These findings suggest that boxed warning education should not focus only on memorizing major risks. Pharmacy students should also be trained to apply safety information through monitoring recommendations, patient-specific risk assessment, and counseling scenarios. This approach may better prepare future pharmacists to recognize medication-related risks and communicate them effectively in practice.

REFERENCES

1. Pliszka SR. Pharmacologic treatment of attention-deficit/hyperactivity disorder. *J Clin Psychiatry.* Available at: https://pubmed.ncbi.nlm.nih.gov/17242993/
2. Fedder D, Kline M, Waddle E. Atomoxetine. *StatPearls.* Available at: https://www.ncbi.nlm.nih.gov/books/NBK493234/
3. U.S. Food and Drug Administration. Strattera (atomoxetine) prescribing information. Available at: https://www.accessdata.fda.gov/drugsatfda_docs/label/2022/021411s050lbl.pdf
4. Wooltorton E. Suicidal ideation among children taking atomoxetine (Strattera). *CMAJ.* Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC1316159/
5. Kasi PM, Mounzer R, Gleason PP. Cardiovascular side effects of atomoxetine and its interactions with inhibitors of the cytochrome P450 system. Available at: https://pubmed.ncbi.nlm.nih.gov/21765848/
6. Bröms G, et al. Atomoxetine in early pregnancy and the prevalence of major congenital malformations. Available at: https://pubmed.ncbi.nlm.nih.gov/36652686/
7. Linden S, et al. Risk of suicidal events with atomoxetine compared to stimulant treatment: a cohort study. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC4845870/
8. Beltran DM, Hailemeskel B, Fullas F. Fentanyl and pharmacy students' knowledge and attitude about the uses, safety, and black box warnings. *Int J Sch Res Biol Pharm.* 2025;6(1):001-008. https://doi.org/10.56781/ijsrbp.2025.6.1.0023

9. Acquah F, Boateng NK, Hailemeskel B, Fullas F. Clozapine black box warnings: Enhancing safety and knowledge in antipsychotic therapy. *Int J Sch Res Biol Pharm.* 2025;6(1):009-019. https://doi.org/10.56781/ijsrbp.2025.6.1.0024
10. Andrevill N, Boateng E, Hailemeskel B, Fullas F. Lithium: Understanding its therapeutic benefits and black box warning risks among pharmacy students. *WJPPR.* 2025;2(3):01-17. Available at: https://www.wjppr.com/myimgup/457305706WJPPR%20167.pdf
11. Hailemeskel B, Turnquest T, Williams J, Agyekum A. **Amiodarone safety concerns: a cross-sectional study**. *World Journal of Pharmacy and Pharmaceutical Research*. 2025;2(5):122–124. Available from: https://www.wjppr.com/myimgup/81344797711%20WJPPR%20203.pdf