Journal of Young Pharmacists, 2026; 18(3):938-944.
https://www.jyoungpharm.org

Original Article

Knowledge-Practice Gap in Household Medication Safety: Insights from Pharm. D Academia in South India

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ABSTRACT

Background: The safety of medications used in households and the problem of polypharmacy are becoming increasingly important public health issues in India, especially in environments where informal practices, a lack of awareness, and unregulated access to medications continue to exist, even among those with formal healthcare training. **Purpose:** This research sought to examine the safety practices associated with household medications and to evaluate the understanding of polypharmacy among Pharm. D students and faculty in the Guntur District of Andhra Pradesh. **Materials and Methods:** Community-oriented cross-sectional research was carried out utilising an online semi-structured questionnaire, employing purposive and snowball sampling techniques. Data collection occurred over two weeks in June 2025, involving 490 participants. The instrument evaluated awareness, practices, and beliefs related to medication storage, disposal, self-medication, and polypharmacy. **Results:** Faculty members exhibited markedly greater awareness scores compared to students (p<0.001). A robust correlation (r=0.88) was identified between awareness and safe practices. Nevertheless, only 55.7% consistently verified expiry dates, while 46% did not acknowledge the risks associated with reusing outdated prescriptions. Almost half of the participants harboured misconceptions about herbal-drug interactions and the dangers of over-the-counter medications, underscoring the prevalence of unsafe beliefs. **Conclusion:** Despite the academic training received, there were clear gaps between knowledge and practice, influenced by behavioural norms, limitations within the curriculum, and various environmental factors. Targeted interventions such as the integration of curriculum, hands-on training, the use of digital tools, and involvement with the community are essential for enhancing medication safety and tackling polypharmacy in household environments.

Keywords: Awareness-Practice Gap, Household Practices, Medication Safety, Pharm. D. Self-Medication, Polypharmacy.

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Received: 21-05-2026;
Revised: 18-07-2026;
Accepted: 02-09-2026.

INTRODUCTION

Ensuring medication safety is a crucial component of high-quality healthcare globally; however, medication errors and unsafe practices related to medications remain a significant challenge to global health (Institute of Medicine, 2000). The World Health Organisation (WHO) has emphasised the importance of this pressing matter by initiating programs like the "Medication Without Harm" Global Patient Safety Challenge, which aims to decrease significant and preventable harm associated with medication (World Health Organisation WHO, 2025). Despite dedicated initiatives within clinical environments, medication errors continue to be a primary source of avoidable patient injury, significantly impacting morbidity, mortality and imposing a substantial economic strain on healthcare systems worldwide (de Bienassis *et al*., 2022). Each year, it is estimated that medication errors result in costs exceeding USD 42 billion for health systems and are associated with 2 million patient fatalities globally (Pharmapod, 2025). Although significant focus is frequently placed on maintaining safety in hospitals and clinics, an essential, albeit less-examined, area for medication safety exists within the home environment (DosePacker, 2025).

The domestic environment offers a unique and intricate context for the management of medications, marked by a specific array of challenges that may jeopardise patient safety. In contrast to controlled clinical settings, residential spaces frequently lack professional supervision, resulting in various unsafe practices, including improper storage of medications,

DOI: 10.5530/jyp.20260083

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erroneous self-administration, the sharing of medications, and insufficient disposal of unused or expired pharmaceuticals (Ghezeljeh *et al.*, 2025). Vulnerable populations, such as young children who are prone to accidental ingestions and the elderly who frequently navigate intricate polypharmacy routines, face a significantly heightened risk in these settings (M *et al.*, 2025). The repercussions of hazardous medication practices within the household are extensive, including negative drug reactions, failures in therapy, unintentional poisonings, worsening of chronic illnesses, and potential environmental pollution resulting from improper disposal (Kashyap *et al.*, 2025). Consequently, it is essential to comprehend and tackle medication safety within both the community and household contexts to ensure thorough public health safeguarding.

In India, the obstacles to ensuring medication safety are heightened by a distinctive healthcare environment characterised by prevalent self-medication, diverse degrees of health literacy, and frequently informal healthcare engagements (Lavanya and Kalpana, 2023). A study by K. Juneja (Juneja *et al.*, 2024) suggests a significant prevalence of self-medication in various regions of India, frequently motivated by factors such as convenience, time constraints, and the belief in cost-effectiveness, which may result in the misuse of medications. In a cross-sectional study conducted in India, which included more than 600 elderly participants from six urban areas, it was discovered that 33.7% were involved in polypharmacy, while 19.7% engaged in self-medication without sufficient awareness. Importantly, 65% of these individuals were found to be lacking fundamental knowledge regarding medication usage, underscoring a significant deficiency in health literacy and the necessity for targeted interventions to promote medication safety (Das *et al.*, 2025).

In this wider framework, Andhra Pradesh, located in Southern India, faces similar challenges. The Guntur district, which exemplifies a region with both urban and rural demographics, serves as an important environment to explore actual household medication practices, given that community interactions and the availability of formal healthcare can greatly affect the management of medications within households. Previous studies (D *et al.*, 2020; Manocha *et al.*, 2019) emphasise the deficiencies in awareness and practices regarding the proper disposal of medicines in India. A significant number of unused or expired pharmaceuticals are being thrown away with regular waste, which presents dangers of unintentional exposure and contributes to environmental contamination.

Despite the recognised significance of medication safety, extensive community-oriented research investigating household medication safety practices in India is still scarce (Cherian *et al.*, 2024). A significant portion of the current literature originating from India predominantly emphasises medication errors occurring in hospital environments or depends on self-reported information, which could be influenced by recall bias or social desirability bias.

There exists a significant lack of research that systematically integrates quantitative survey techniques with direct observational insights regarding household medication practices.

While a multitude of studies throughout India have investigated various facets of medication safety, including self-medication, polypharmacy, and drug disposal, most of these studies depend on self-reported data and do not incorporate direct observations at the household level. In the context of Andhra Pradesh, existing research, such as investigations conducted among students and rural communities in Anantapur (Susheela *et al.*, 2018), Srikakulam (Yadav *et al.*, 2024), and Chittoor (Priya, 2024), has largely concentrated on Knowledge, Attitudes, and Practices (KAP) about self-medication, offering limited understanding of actual behaviours related to household drug storage, sharing, and disposal. A recent cross-sectional observational study in Nandyal (Jayasree *et al.*, 2024) evaluated the awareness and practices concerning the disposal of expired medications among hospital doctors, indicating that merely 37% were knowledgeable about colour-coded bins. This finding emphasises the broader deficiency of studies that examine real household-level practices beyond clinical settings. Together, these results underscore a notable research gap in the thorough assessment of household medication safety in Andhra Pradesh. This deficiency hinders the capacity to formulate targeted and effective public health interventions that are specifically designed to meet the unique needs and practices of the local community.

To tackle the deficiency of region-specific information regarding the safety of household medications, we undertook a community-based cross-sectional study in the Guntur District of Andhra Pradesh. The study utilised an online survey that garnered over 500 responses, in addition to direct observations conducted by trained faculty and student researchers. It investigated the prevalence and characteristics of unsafe storage, disposal methods, self-medication, and the sharing of medications among households. This study aimed to evaluate the knowledge-practice gap in medication safety among pharmacy students and faculty in India, providing region-specific evidence on unsafe household medication behaviours, often neglected in public health research. This study suggests curriculum-integrated and community-based strategies to improve medication safety awareness, and also adds to global medication safety literature by documenting behavioural determinants of unsafe practices in trained health professionals.

MATERIALS AND METHODS

Study Design and Setting

This study employed a community-oriented, cross-sectional observational framework to evaluate the safety practices related to household medication in the Guntur District of Andhra

Pradesh, India. The area was intentionally chosen because of its varied combination of urban and semi-urban demographics, as well as its reflection of standard domestic medication practices in the state. Data collection took place over two weeks in June 2025, strategically scheduled to enhance participation from faculty and students in academic institutions.

Sample Size and Rationale

This study focused on the Pharm. D academic community comprising students and faculty from pharmacy institutions in Guntur District, due to their expertise in pharmacology and hands-on experience with medication-related challenges, such as household medication safety and polypharmacy. Their roles as current or prospective healthcare professionals render them pivotal in influencing medication practices within domestic settings. Participants were selected through purposive and snowball sampling methods via academic networks. Although the data collection period was limited to a brief two weeks, a total of 490 valid responses were gathered. As the study was exploratory and community-oriented in nature, a formal power-based sample size calculation was not undertaken. However, the obtained sample size of 490 participants was considered adequate for descriptive cross-sectional assessment and comparable to similar exploratory studies conducted in healthcare education settings

Development of Study Tool

A semi-structured questionnaire was created in English following a thorough examination of the literature concerning medication safety, which encompassed WHO guidelines and available household medication audit tools (World Health Organisation WHO, 2009). The questionnaire was divided into several domains: demographics, medication storage, medication disposal, self-medication and sharing practices, as well as knowledge and perceptions related to medication safety. The tool underwent face validation by a group of academic pharmacists and community health specialists to guarantee clarity, content relevance, and suitability for the study's objectives.

Data Collection Procedure

The survey was disseminated online using Google Forms, with the link shared through institutional email lists, student communication platforms, and WhatsApp groups. Participants received an explanation of the study's objectives and were required to give their digital informed consent before submitting their responses.

Study Workflow and Execution

The research adhered to a well-defined and methodical process to guarantee methodological integrity and transparency. It commenced with a comprehensive review of existing literature to inform the creation of a semi-structured questionnaire, which received validation from both academic and community health professionals and was distributed through Google Forms. Given that the study posed minimal risk and involved non-clinical academic participants, Participation was voluntary and anonymous, and digital informed consent was obtained from all participants before survey completion; participation was completely voluntary and anonymous. Data collection occurred over a concentrated two-week timeframe utilising purposive and snowball sampling techniques within the Pharm. D academic community in Guntur.

Inclusion Criteria

Pharm. D students and faculty members who are either residing in or affiliated with institutions located in the Guntur District, and the individuals who are 18 years of age or older

Exclusion Criteria

Incomplete responses were not considered, and participants who were from areas outside of Guntur were excluded.

Data Analysis

Data were exported to Microsoft Excel and analysed using descriptive and inferential statistical methods. Frequencies, percentages, means, and standard deviations were calculated where appropriate. An independent *t*-test was performed to compare awareness scores between faculty and students, while correlation analysis was used to assess the relationship between awareness and practice scores. Tables were used to summarise key findings related to medication storage, disposal practices, self-medication, and polypharmacy awareness.

Justification for Regional Focus

The selection of Guntur District was intentional, due to the lack of localised data examining household-level medication safety from both behavioural and observational perspectives. With a significant concentration of pharmacy institutions in the district, this area offered a convenient and pertinent environment for evaluating real-world practices within an academically connected population. The results are intended to guide local policy formulation and educational initiatives designed to meet the specific needs of the region.

Table 1: Gender wise Distribution of Study Participants (*n*=490).

Variable	Category	Frequency (*n*)	Percentage (%)
Gender	Male	134	27.3
	Female	356	72.7

RESULTS

As presented in Table 1, a total of 490 participants were included in the study. Female participants constituted the majority of the study population (72.7%), while males accounted for 27.3% of the respondents. This distribution reflects the commonly observed gender pattern in Pharm. D academic programs and indicates adequate participation from the targeted academic community.

Table 2 illustrates the findings of an independent *t*-test that compares awareness scores between faculty members and students. Faculty participants exhibited a notably higher level of awareness regarding polypharmacy (mean=12.32) in contrast to students (mean=9.76), with the observed difference being statistically significant ($p<0.001$). This suggests that one's academic position and professional experience have a beneficial effect on awareness levels concerning the risks and safety associated with polypharmacy.

Table 3 illustrates a significant positive correlation ($r=0.88$) between awareness and practice scores. This indicates that individuals with a greater understanding of polypharmacy are more likely to engage in safer medication practices at home. Nevertheless, the moderate average practice score (4.98 out of 10) suggests that awareness by itself may not reliably lead to optimal behaviour, underscoring an important knowledge-practice gap.

Table 4 presents a summary of participant responses regarding critical medication safety scenarios. While more than half of the respondents (55.7%) indicated that they always verify expiry dates before using medications, a significant number confessed to checking them only occasionally or infrequently, which points to inconsistent safety practices. Approximately 54% accurately recognised that reusing old prescriptions could result in resistance and dosing errors; however, nearly half either misinterpreted or downplayed the associated risks. Likewise, although 57.9% acknowledged the hazards of consulting multiple physicians simultaneously, a considerable minority did not share this understanding. Misunderstandings were also apparent in the perceptions surrounding herbal-allopathic drug interactions and Over-The-Counter (OTC) medications, with nearly half of the participants either uncertain or mistakenly believing these practices to be without risk. These results highlight

Table 2: Comparison of Polypharmacy Awareness Scores Between Faculty and Students.

t-Test: Two-Sample Assuming Unequal Variances	Faculty (*n*=96)	Students (*n*=394)
Mean	12.32	9.76
Variance	35.20	30.22
Observations	91	399
Hypothesized Mean Difference	0	
d_f	128	
t Stat	3.756	
p (T<=t) one-tail	0.00013	
t Critical one-tailed	1.657	
p (T<=t) two-tailed	0.00026	
t Critical two-tailed	1.979	

Table 3: Correlation between awareness scores and practice scores regarding polypharmacy.

Practice Scores		Awareness Scores	
Mean	4.978	Mean	10.24
Standard Error	0.1167	Standard Error	0.256
Median	5	Median	10
Mode	5	Mode	7
Standard Deviation	2.583078909	Standard Deviation	5.67
Sample Variance	6.672296649	Sample Variance	32.06
Kurtosis	-1.083625379	Kurtosis	-1.135
Skewness	0.03630669	Skewness	0.079
Range	10	Range	20
Minimum	0	Minimum	0
Maximum	10	Maximum	20
Sum	2439	Sum	5017
Count	490	Count	490
Largest (1)	10	Largest (1)	20
Smallest (1)	0	Smallest (1)	0
Confidence Level (95.0%)	0.229278836	Confidence Level (95.0%)	0.502579
Awareness-Practice Correlation Coefficient (*r*=0.87997513)			

Table 4: Summary of key household medication beliefs and behaviours among the study participants.

Sl. No.	Study Item	Response Options	Frequency (*n*=490)
1.	Do you or your family verify the expiry date before taking medicines?	Always	273 (55.7%)
		Never	14 (2.8%)
		Often	65 (13.26%)
		Rarely	30 (6.12%)
		Sometimes	118 (24.08%)
2.	In many Indian families, old prescriptions are reused. What's the key risk?	It avoids unnecessary doctor visits	64 (13.0%)
		It causes resistance and dosing errors	265 (54.0%)
		It saves money	107 (21.3%)
		It supports self-confidence	54 (11.2%)
3.	A senior citizen takes prescriptions from multiple doctors without informing them. What is the main risk?	As long as symptoms are controlled, there's no major issue	24 (4.89%)
		Consulting multiple specialists ensures comprehensive care	69 (14.0%)
		It reduces waiting time and avoids the need for referrals	113 (23.0%)
		There is a high risk of therapeutic duplication and drug interactions	284 (57.9%)
4.	Herbal medicines, if taken with allopathy, always reduce side effects.	True	120 (24.4%)
		False	235 (47.9%)
		Maybe, not sure	135 (27.5%)
5.	Over-the-counter drugs sold in India do not contribute to polypharmacy.	True	135 (27.5%)
		False	267 (54.4%)
		Maybe, not sure	88 (17.9%)

ongoing knowledge deficiencies and unsafe beliefs, even among individuals with a medical education.

DISCUSSION

Our research indicates that faculty members possess significantly higher awareness scores than students ($p<0.001$), which aligns with the findings of Bhagavathula *et al.* in 2021 (Bhagavathula *et al.*, 2021). They noted that healthcare professionals typically demonstrate a better understanding of medication interactions when compared to the general population; nevertheless, even among Pharm. D students, the moderate average awareness score (~9.8/20) implies a limited understanding of essential polypharmacy risks. A study conducted by (Mohammed *et al.* 2023) in Chennai similarly revealed that only 51% of final-year pharmacy students were able to accurately define therapeutic duplication or articulate the implications of concurrent multi-doctor prescribing (Mohammed *et al.*, 2023).

The robust correlation (r=0.88) observed between awareness and practice scores in our research is promising; however, the moderate average practice score of approximately 5 out of 10 highlights a significant disparity between knowledge and its application. This observation aligns with the findings of Rashmi *et al.* in 2022, which indicated that 87% of households retained unused medications, despite 90% recognising the risks involved (Rashmi *et al.*, 2022). Similarly, a study conducted in urban Hyderabad revealed that more than 60% of postgraduate medical students confessed to self-prescribing antibiotics, even while being cognizant of the risks of resistance (Mahmoud *et al.*, 2020).

More than 45% of the participants in our study did not regularly verify expiry dates, and 46% were unable to accurately recognise the dangers associated with the reuse of outdated prescriptions. These results align with the findings of Badiger S, which indicated that 36% of rural households acknowledged using leftover antibiotics without seeking professional advice (Badiger *et al.*, 2012). Furthermore, Gupta *et al.* in 2019 noted that more than half of households kept unused medications, with almost all discarding them in regular trash, highlighting a prevalent acceptance of these practices even within knowledgeable communities (Gupta *et al.*, 2019).

Despite 57.9% of our study participants recognising the danger of therapeutic duplication when consulting various physicians, the remaining 42.1% either misinterpreted or undervalued this risk. This outcome aligns with the research conducted by Das *et al.* in 2025, which indicated that 40.7% of older adults in urban Indian environments participated in hazardous practices, including

uncoordinated consultations with multiple specialists without notifying each provider (Das *et al*., 2025). Such actions heighten the likelihood of polypharmacy and negative drug interactions, especially in households containing elderly or chronically ill individuals.

Over fifty per cent of the participants in our study (52%) either believed or were uncertain about the efficacy of combining herbal and allopathic medicines in minimising side effects. This aligns with the research conducted by (Bhat, *et al* 2019), which indicated that 48% of pharmacy students in Udupi viewed herbal remedies as fundamentally safe when utilised in conjunction with prescribed medications (Bhat *et al*., 2019). Such misconceptions highlight a deficiency in pharmacovigilance education concerning integrative medicine in pharmacy training programs.

While 54.4% of the participants in our study acknowledged that Over-The-Counter (OTC) medications play a role in polypharmacy, 45.6% were either unsure or misinformed. This finding is consistent with a study conducted by A. Panda *et al.* in 2017 in Odisha, which revealed that 43% of educated adults did not connect the use of OTC medications with the risk of polypharmacy (Panda *et al*., 2017). In a nation such as India, where access to OTC drugs is predominantly unregulated, it is imperative to enhance both public and professional awareness.

Despite their academic education in pharmacology and clinical therapeutics, Pharm. D students and faculty involved in this study demonstrated significant discrepancies between their knowledge and the practical implementation of safe medication practices. This disconnect between knowledge and practice is influenced by various contextual and behavioural elements. Firstly, the normalisation of risk within Indian households, such as the reuse of old prescriptions or the retention of surplus medications, frequently takes precedence over formal knowledge, even among healthcare professionals. Secondly, there is a tendency towards a perceived sense of professional immunity, where individuals with academic training may downplay their risk and believe that their theoretical understanding can compensate for shortcomings in everyday safety practices. Additionally, time constraints resulting from academic responsibilities further diminish the priority given to routine practices such as verifying expiry dates, ensuring proper storage, or safe disposal.

Moreover, the curriculum's primary emphasis on theoretical education regarding polypharmacy and drug interactions rarely translates into practical applications at home. Lastly, the absence of experiential reinforcement, such as assignments related to household practices or community audits, means that students and faculty seldom engage with medication safety in real-world domestic environments, which restricts their ability to integrate what is taught in the classroom into their behaviour. Collectively, these factors contribute to the ongoing prevalence of unsafe medication practices, even among those educated in healthcare.

CONCLUSION

Although the Pharm. D academic community possesses an understanding of medication safety and the risks associated with polypharmacy, effectively translating this knowledge into safe household practices requires organised, behaviour-oriented interventions. Approaches including curriculum-integrated training, practical experiences in real-world settings, outreach initiatives led by pharmacies, digital resources, and collaboration across disciplines can significantly contribute to closing this gap. Customising these efforts to fit both academic and community environments will be crucial for realising lasting enhancements in medication safety at the household level.

This research underscores a significant disparity between the awareness and actual practices concerning medication safety and polypharmacy among Pharm. D students and faculty in Guntur. Although faculty members exhibited a greater level of awareness, unsafe practices, including improper storage, the reuse of prescriptions, and misunderstandings regarding over-the-counter and herbal medications, were widespread within the group. These results indicate that academic knowledge alone does not guarantee safe practices in household settings.

To bridge these gaps, it is imperative to implement targeted, practice-focused interventions that may include enhancements to the curriculum, audits of household medications, and initiatives to promote community engagement. It is crucial to bolster the practical application of pharmacological knowledge to encourage rational medication use and mitigate the risks of polypharmacy in home settings. This study offers essential evidence to inform future strategies aimed at enhancing medication safety among populations educated in healthcare.

LIMITATIONS AND STRENGTHS OF THE STUDY

This study focused exclusively on Pharm. D students and faculty within one district, which may limit the generalizability of the findings to other regions or the broader population. Additionally, the use of purposive and snowball sampling techniques may have introduced selection bias. The data were self-reported, potentially leading to recall or social desirability bias. Furthermore, the brief duration of data collection may restrict the observation of seasonal variations in household medication behaviours.

This study addresses a significant gap by evaluating actual household medication behaviours within a population that is academically informed, utilising both awareness and practice-oriented metrics. The substantial sample size, along with the participation of both students and faculty, enriches the significance and applicability of the results.

ACKNOWLEDGEMENT

The authors express their heartfelt gratitude to all the Pharm. D students and faculty members who took part in this study and provided invaluable insights through their feedback. The authors also wish to extend their sincere thanks to Dr. Hepzibah Rani Gidla for her unwavering support and expertise in facilitating the statistical analysis and interpretation of the findings. Her involvement greatly enhanced the analytical robustness of this study.

ABBREVIATIONS

WHO: World Health Organization; **USD:** United States Dollar; **KAP:** Knowledge, Attitudes, and Practices; **Pharm. D:** Doctor of Pharmacy; **OTC:** Over-The-Counter; **n:** Number of Participants; **df:** Degrees of Freedom; **p:** Probability Value (Statistical Significance Level); **r:** Pearson Correlation Coefficient.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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Cite this article: Yanamadala PK, Konda SKR, Kantati HS, Kanaparthi J, Malisetty CLSS, Jinka D, *et al*. Knowledge-Practice Gap in Household Medication Safety: Insights from Pharm. D Academia in South India. J Young Pharm. 2026;18(3):938-44.