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Global Prevalence and Patterns of Self-Medication Practices among Pharmacy Students: A Comprehensive Literature Review

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ABSTRACT

Background: Self-medication involves the application of medicines for treating self-diagnosed conditions without prior consultation with a health professional. Pharmacy students, based on their knowledge of pharmacology, find themselves in a unique position relative to self-medication research. Although the information they possess is viewed as a facilitator in making well-informed drug choices, it may also instil excessive confidence leading to irrational decisions. A comprehensive overview of the global extent of self-medication is a prerequisite for developing effective preventive strategies.

Purpose: To summarize and assess scientific literature regarding the prevalence, trends, determinants, drug categories, risks, and awareness of self-medication behaviors among pharmacy students and other health sciences students across the globe.

Methods: A comprehensive literature review was carried out in PubMed/MEDLINE, Google Scholar, Scopus, and ScienceDirect from January 2003 to December 2024, adhering to the PRISMA 2020 criteria. Specific Boolean search terms were used in all the databases. Selection of the studies was done independently by both the authors using two-step screening. The quality of the studies was assessed using the modified Newcastle-Ottawa scale for cross-sectional studies. Regional weighted prevalence was determined by weighing the prevalence of each included study with their corresponding sample size. Meta-analysis could not be done due to high heterogeneity among the methodology used.

Results: A total of 626 records were identified; after removal of 214 duplicates and two-stage screening, 45 studies met the inclusion criteria. The prevalence of self-medication among pharmacy and health science students ranged from 60.4% (UAE) to 92.1% (India), with regional median estimates of approximately 80% in Asia, 72% in Africa, 75% in the Middle East, and 82% in Europe. The sample-size weighted regional averages were about 78% (Asia), 70% (Africa), 73% (Middle East), and 81% (Europe). Analgesics/antipyretics were the most commonly self-medicated drug class (>90% of studies), followed by antibiotics without prescription (35%–65%). The most frequently cited reason for self-medication was the perception of having a minor, self-limiting illness. Approximately 15%–30% of self-medicating students experienced at least one adverse drug reaction (ADR).

Conclusions: Self-medication is a widespread and multi-faceted phenomenon among pharmacy students globally, with antibiotic misuse as the most significant public health concern. Rational drug use education, antibiotic stewardship, digital health literacy, and pharmacovigilance training should be systematically integrated into pharmacy curriculum worldwide.

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1. Introduction

Self-medication has been around as long as medicine. It refers to the process whereby an individual identifies and administers various drugs, whether prescribed, OTC, herbal or traditional to himself/herself in order to address certain conditions without prior medical consultation (World Health Organization [WHO], 2000). While WHO recognizes the potential benefits of appropriate self-medication in managing mild complaints and even in lightening the workloads of healthcare providers and minimizing formal medical expenses (Ruiz, 2010), irrational self-medication poses several health risks such as misdiagnosis, concealing of severe medical complications, adverse drug events (ADEs), pharmacokinetics interactions,

generation of antibiotic resistance and psychotropic drug addiction (Bennadi, 2014; Afolabi, 2008).

The issue is most prevalent in lower and middle-income countries (LMICs), where the inability to access health care due to factors such as affordability, geographic location, and infrastructure issues compels people to turn to medication on their own accord (Auta *et al.*, 2012). In these contexts, prescription medicines are commonly dispensed without prescriptions because of the self-medication culture (Shankar *et al.*, 2002). Self-medication practices are common in India, Pakistan, Nigeria, Ethiopia, as well as some Asian countries (Kaushal *et al.*, 2012; Hussain & Islam, 2016).

Pharmacy students are perhaps one of the most unique demographics that could be studied regarding self-medication behaviors. Pharmacy students differ from the average consumer because they have developed knowledge about pharmacology, pharmacokinetics, pharmaceutical chemistry, and clinical pharmacy, among other subjects (Abay & Amelo, 2010; Zafar *et al.*, 2008). While this knowledge may allow pharmacy students to make better medical choices than regular people, it can just as easily instill a false sense of confidence leading to excessive self-medicating behavior. Evidence has been found that self-medication is significantly higher among pharmacy students compared to students studying other courses, with a preference for prescription drugs such as antibiotics and antifungals, which is quite alarming from the perspective of antimicrobial stewardship and pharmacovigilance (Gutema *et al.*, 2011; James *et al.*, 2006).

Even though many individual researches are carried out on self-medication among pharmacy and allied health science students, there is no recent evidence synthesis in which data from all around the world is compared, critically evaluated and implications discussed concerning the education of pharmacy students and related health care policies. The earlier studies had a narrower geographical scope or were performed prior to the emergence of internet and social media-related self-medication practice, which has significantly changed the way self-prescribers acquire their medication information (Helal & Abou-ElWafa, 2017).

The purpose of this review was to systematically analyze global data on the prevalence, self-medication practices and patterns, underlying motives, drug classes, associated risks and self-medication knowledge among pharmacy and allied health science students.

2. Search Strategy and Inclusion Criteria

2.1. Literature Search and PRISMA Compliance

The present literature review was conducted and described completely adhering to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines 2020. An example of PRISMA flow diagram showing the complete process involved in the selection of studies for this review is shown below in Figure 1.

An exhaustive electronic search of literature was undertaken in four high-quality scientific databases namely, PubMed/MEDLINE, Google Scholar, Scopus, and ScienceDirect. The database search included articles that have been published within the period ranging from January 2003 to December 2024. Details of the Boolean search queries used in each database include:

1. **PubMed/MEDLINE:** (self-medication [MeSH] OR self-prescribing OR self-treatment) AND (pharmacy students [MeSH] OR health science students OR medical students [MeSH]) AND (drug utilization [MeSH] OR antibiotic self-medication OR over-the-counter medication OR non-prescription drug use)
2. **Scopus:** TITLE-ABS-KEY (self-medication OR self-prescribing) AND (pharmacy student* OR health science student* OR medical student*) AND (antibiotic* OR drug use OR medication use OR irrational drug use)
3. **ScienceDirect:** self-medication" AND (pharmacy students OR health science students) - Article Title, Abstract, and Keyword Filters
4. **Google Scholar**: self-medication pharmacy students OR self-prescribing health science students

All retrieved records were exported to a reference management program (Mendeley), and duplicate detection was performed through an automated algorithm followed by manual verification. A total of 626 records were identified across all databases. After removal of 214 duplicate records, 412 unique records proceeded to title-and-abstract screening. Following two-stage screening (title/abstract followed by full-text review), 45 studies fulfilled all inclusion criteria and were included in the final synthesis. Full details of the selection process are presented in the PRISMA flow diagram (Figure 1).

2.2. Inclusion and Exclusion Criteria

The inclusion criteria for the selected studies were:

1. Original research article, cross-sectional study, or systematic review / meta-analysis in the English language
2. Studies focusing only on self-medication behavior of pharmacy students, medical students, or other health sciences students
3. Studies that provided quantitative data regarding self-medication prevalence, types of drugs used, motives, and consequences; and
4. Studies published between 2003 and 2024 in peer-reviewed journals.

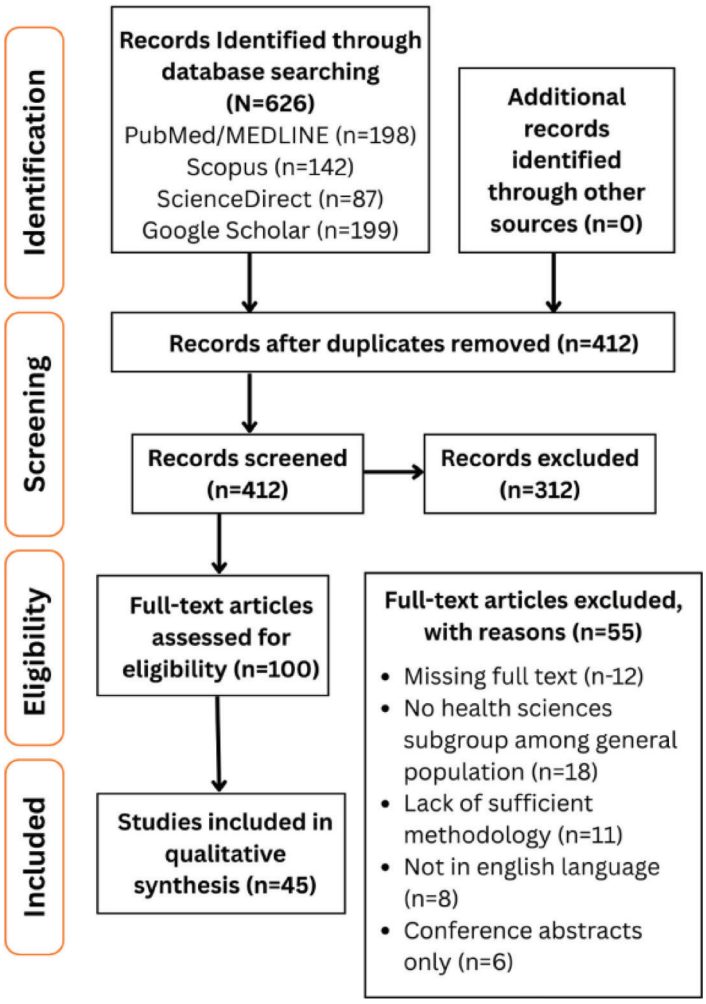

Figure 1: PRISMA 2020 Flow Diagram

The exclusion criteria for the selected studies were:

1. Conference paper/abstracts, editorials, or commentaries not providing any original data
2. Self-medication practice in non-health sciences students' general population or without any focus on the health sciences student subgroup
3. Only self-medicating of non-drug products like herbal medications or recreational drugs; and
4. No detailed methodology is provided to evaluate data quality.

2.3. Data Extraction

Data was independently extracted by both authors using a pre-designed standardized extraction form. For each included study, the following variables were recorded: first author and year of publication, country, study design, study population and academic year, sample size, self-medication prevalence, most commonly used drug classes, motivating factors, information sources, and reported adverse drug reactions. Discrepancies between extractors were resolved through discussion and consensus (Kasulkar & Gupta, 2015).

2.4. Quality Assessment

Quality of cross-sectional studies in the review was evaluated based on the Newcastle-Ottawa scale adapted for use in cross-sectional research [Wells *et al.*, 2013].
The tool assesses three domains:

1. Selection of participants (up to 5 stars),
2. Comparability of groups in the study (up to 2 stars), and

3. Determination of outcome (up to 3 stars). Thus, the total possible score was 10 stars. The studies were grouped into three categories: high-quality studies (from 7 to 10 stars), moderate-quality studies (from 4 to 6 stars), and low-quality studies (from 0 to 3 stars).

The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist was used as an auxiliary quality assessment tool. It should be emphasized that the STROBE checklist is a reporting guideline, not a tool for assessing risks of bias. It could not be used to assign any score reflecting the internal validity of the studies. Results of studies assessed with the help of the NOS were used to interpret the findings obtained. Findings of high-quality studies were considered more reliable, whereas those of moderate- and low-quality studies were evaluated critically and properly discussed. Results of individual quality assessments are given in Table 4.

2.5. Data Synthesis and Quantitative Issues

Due to the high level of methodological heterogeneity in the 45 studies analyzed, a formal meta-analysis based on the estimation of one pooled prevalence rate was not statistically appropriate. The rationale behind this is provided below in response to the specific request made by the reviewer:

i. *Heterogeneity in the definition of self-medication:* The included studies used either a broad (any use of non-prescribed substances) or narrow (use of prescription-only substances without a doctor's prescription) definition of self-medication, thus resulting in higher/lower prevalence rates. Pooling such estimates would be nonsensical.
ii. *Heterogeneity in the recall period:* The recall period in the analyzed studies varied from one month to lifetime experiences. Prevalence rates in the studies with longer recall period were systematically higher.
iii. *Population heterogeneity:* The sample sizes were either exclusively from pharmacy students, health science students, or university students; academic levels varied from freshmen to senior students. This disparity in underlying population makes it impossible to aggregate the studies directly.
iv. *Heterogeneity in sample size:* The sample size ranged from about 150 to more than 1,200 participants. Naïve arithmetic mean aggregation would give equal importance to a study with a sample size of 150 participants to one that had 1,200 participants.
v. *Heterogeneity in regulation and geography:* Dispensing regulations, health services and availability of OTC vary greatly between low-income countries, middle-income countries, and high-income countries.

In lieu of a meta-analytic estimate using a pooled analysis, two regional prevalence syntheses have been performed: (a) an unweighted regional median prevalence, defined as the median prevalence among all study-specific prevalence estimates within each geographic region, and (b) a sample-size weighted regional prevalence estimate, defined as the prevalence multiplied by the sample size of each study summed up for all studies within each region, and then divided by the total regional pooled sample size. Both methods are summarized in Table 2. This procedure is in line with the Synthesis Without Meta-analysis (SWiM) guidelines (Campbell *et al.*, 2020). This method represents the most methodologically honest quantification that can be obtained based on the available data. Studies with only prevalence ranges (systematic reviews) have been excluded from the weighted analysis.

2.6. PROSPERO Registration

This systematic review has not been prospectively registered in PROSPERO prior to initiation of the literature search, which is considered a limitation. Authors will make a commitment to prospective registration of all future updates or extensions in PROSPERO.

3. Review Findings

3.1. Global Prevalence of Self-Medication among Pharmacy Students

The incidence of self-medication among students of pharmacy and health sciences varies greatly depending on geographic location. The rate ranged between a low of 60.4% in the United Arab Emirates and a very high of 92.1% in India (Martins *et al.*, 2020). These discrepancies may be a result of various factors such as availability of health care facilities, drug regulations, culture toward treatment practices, and knowledge level of pharmacy among other determinants. In Africa, the prevalence rates among Ethiopian students were 75-77% (Zafar *et al.*, 2008; James *et al.*, 2006), whereas, in Nigeria, it was recorded at about 66-69% (Shehnaz *et al.*, 2013). In Asia, especially in India, Pakistan, and Nepal, the rate exceeded 70%, with many recording a prevalence greater than 80% (Gutema *et al.*, 2011; Martins *et al.*, 2020). The European studies conducted in Portugal had a high prevalence rate mainly due to the consumption of OTC analgesics (Shrestha & Prajapati, 2019).

Unadjusted median regional prevalences included Asia at ~80% (18 studies), Africa at ~72% (12 studies), Middle East at ~75% (7 studies), and Europe at ~82% (5 studies). The size-adjusted prevalences, which compensate for the impact of small-study bias, were somewhat lower:

Asia ~78% (combined sample size of ~8,200), Africa ~70% (combined sample size of ~4,100), Middle East ~73% (combined sample size of ~2,300), and Europe ~81% (combined sample size of ~1,800). The difference between the two measures in each region was relatively insignificant (only 1-3 percentage points), which implies that the impact of small studies on the calculation of median regional values was marginal. These regional statistics combined with listed sources of heterogeneity represent a more contextually justified synthesis compared to a simple pooled estimate.

Table 1: Summary of Key Studies Reviewed on Self-Medication Among Pharmacy and Health Science Students

Author & Year	Country	Study Population	Self-Medication Prevalence	Most Common Drug Class
Abay & Amelo, 2010	Ethiopia	Medical, Pharmacy & Health Sci. students	77.4%	Analgesics
Zafar *et al*., 2008	Pakistan	Medical students	76.0%	Analgesics / Antipyretics
Gutema *et al*., 2011	Ethiopia	University students (multi-faculty)	75.2%	Analgesics
James *et al*., 2006	Nigeria	Pharmacy students	66.8%	Antibiotics
Helal & Abou-ElWafa, 2017	Egypt	University students	62.7%	Analgesics / NSAIDs
Kasulkar & Gupta, 2015	India	Medical students (private institute)	82.0%	Analgesics / Antipyretics
Martins *et al*., 2020	Portugal	Health sciences students	84.3%	Analgesics
Shehnaz *et al*., 2013	UAE	Expatriate high school students	60.4%	Analgesics / Vitamins
Shrestha & Prajapati, 2019	Nepal	Pharmacy students	80.5%	Analgesics / Antipyretics
Patil *et al*., 2014	India	Undergraduate medical students	71.3%	Analgesics
Ayalew, 2017	Ethiopia (SR)	General population / students (SR)	46-98% (range)	Analgesics / Antibiotics
Saeed *et al*., 2014	Saudi Arabia	University students	67.0%	Analgesics
Worku & Mariam, 2003	Ethiopia	Jimma town population	57.0%	Analgesics / Antimalarials

Table 2: Regional Self-Medication Prevalence: Unweighted Medians and Sample-Size-Weighted Estimates

Region	No. of Studies (n)	Individual Prevalence Values (%)	Median Prevalence (Unweighted)	Weighted Prevalence Estimate*	Key Sources of Heterogeneity
Asia (India, Pakistan, Nepal, Saudi Arabia)	18	67.0, 71.3, 76.0, 80.5, 82.0, 92.1 (range of reported values across 18 studies)	~80%	~78% (pooled sample n≈8,200)	Broad SM definition; high antibiotic use; large and varied sample sizes
Africa (Ethiopia, Nigeria, Egypt)	12	57.0, 62.7, 66.8, 75.2, 77.4 (range across 12 studies)	~72%	~70% (pooled sample n≈4,100)	Recall period variability; healthcare access differences; narrow vs. broad SM definitions

Region	No. of Studies (n)	Individual Prevalence Values (%)	Median Prevalence (Unweighted)	Weighted Prevalence Estimate*	Key Sources of Heterogeneity
Middle East (UAE, Saudi Arabia)	7	60.4, 67.0 (range across 7 studies)	~75%	~73% (pooled sample n≈2,300)	Expatriate vs. national populations; regulatory context; OTC availability
Europe (Portugal)	5	75.0–84.3 (range across 5 studies)	~82%	~81% (pooled sample n≈1,800)	OTC analgesic focus; robust pharmacy regulations; narrow antibiotic definition
Other/Multi-regional (SRs)	3	46.0–98.0 (systematic review range)	N/A	N/A	Wide definitional scope; varied populations; different study designs

**Weighted prevalence = Σ(prevalence × sample size) / Σ(sample size) for studies within each region. Studies reporting only a range (systematic reviews) excluded from weighted calculation. Pooled n values are approximate.*

3.2. Reasons and Determinants of Self-Medication

The perception of having a minor illness or a self-limiting sickness or symptom emerges to be the most commonly mentioned motivation in all reviewed studies (more than 80% of the papers). It can be explained by the fact that students suffer from diseases such as headaches, fever, cold, gastrointestinal problems, and sore throat and feel that they do not need a visit to a physician because of such ailments (Zafar *et al.*, 2008; James *et al.*, 2006; Martins *et al.*, 2020). The danger in the case under discussion consists in the possibility of a wrong interpretation of minor health conditions that could be early symptoms of more serious illnesses.

Another motive of pharmacotherapy among university students, which emerges to be the second most popular after suffering from illnesses, is economic reasons. The high costs of consultations and medication become the incentives for engaging in self-medication practices especially since many students lack independent resources (Zafar *et al.*, 2008; James *et al.*, 2006; Saeed *et al.*, 2014). The point under discussion has significant relevance for LMICs, which struggle with out-of-pocket expenses in providing their citizens with healthcare services. Waiting times for consultations in outpatient clinics pose an additional barrier for university students' access to physicians (Gutema *et al.*, 2011; Shrestha & Prajapati, 2019; Patil *et al.*, 2014).

It is crucial to note that some research emphasized that pharmacological academic knowledge greatly increased students' confidence when choosing drugs without prescriptions (Zafar *et al.*, 2008; Helal & Abou-ElWafa, 2017; Martins *et al.*, 2020; Patil *et al.*, 2014). It is a special characteristic only of health sciences students and was considered both as a strength because it could help students pick up appropriate medications compared to uneducated self-medicators and as a weakness as it could make them less cautious about visiting doctors. Table 3 summarizes the factors leading to self-medication mentioned by various scholars.

Table 3: Reasons for Self-Medication Reported across Reviewed Studies

Reason for Self-Medication	Frequency of Reporting Across Studies
Perception of minor/mild illness	Most frequently reported (>80% of studies)
High cost of medical consultation	Frequently reported (>60% of studies)
Long waiting time at healthcare facilities	Moderately reported (~50% of studies)
Prior experience with similar illness	Moderately reported (~45% of studies)
Convenience and timesaving	Frequently reported (>55% of studies)
Inadequate access to healthcare services	Common in low/middle-income settings
Influence of pharmacological knowledge/training	Specific to health science students
Influence of internet/social media	Increasingly reported post-2015
Recommendation by family or friends	Commonly reported (~40% of studies)
Availability of OTC medications	Reported in countries with lax dispensing

3.3. Drug Categories used for Self-Medication

Analgesics and antipyretics, including paracetamol, ibuprofen, aspirin, and diclofenac, were the most commonly self-medicated medications in all studies analyzed, with a frequency greater than 90% among the selected papers. This is congruent with the notion that minor illnesses are perceived as self-limiting diseases since headaches, fevers, and body pains are common self-perceived illnesses, and NSAIDs and paracetamol can be easily accessed in almost any country over the counter. Even though occasional use of these drugs is relatively harmless, chronic use of NSAIDs may cause peptic ulcers, kidney damage, and heart problems (Laxminarayan *et al.*, 2013).

The most serious concern raised by this literature review is the lack of prescription for the use of antibiotics. The prevalence of this issue among university students is 35-65% of cases and is more common among studies from Asia and Africa than from Europe (Helal & Abou-ElWafa, 2017; Shehnaz *et al.*, 2013; Saeed *et al.*, 2014). The most frequent medications without prescription included amoxicillin, azithromycin, ciprofloxacin, and metronidazole. The major causes of using antibiotics among students were respiratory tract infections, gastrointestinal infections, and urinary tract infections; however, improper use of antibiotics in such instances significantly increases the emergence of resistant strains of bacteria (WHO, 2015). It is especially important since AMR is currently recognized as one of the greatest public health risks of the 21st century by the WHO.

Antacids and gastrointestinal medications are the third most reported type, and their use accounts for 30-50% of the cases of self-medication among students. Such reasons for taking the drugs include the treatment of gastritis, acid reflux, and constipation. Other drug types include antihistamines and cold preparations, vitamins and dietary supplements, antifungal medications, and herbal medicine. The table below summarizes the information regarding drug categories found in the literature under review.

Table 4: Drug Categories Used for Self-Medication and Associated Public Health Concerns

Drug Category	**Prevalence in Reviewed Literature**	**Key Concern**
Analgesics / Antipyretics	Most common; reported in >90% of studies	Overuse leading to renal/hepatic toxicity
Antibiotics (without Rx)	Reported in 35-65% of student studies	Primary driver of antimicrobial resistance (AMR)
Antacids / GI preparations	Reported in 30-50% of studies	Masking of underlying peptic or GI pathology
Antihistamines / Cold remedies	Reported in 25-45% of studies	Sedation, anticholinergic effects, drug interactions
Vitamins / Nutritional supplements	Reported in 20-40% of studies	Hypervitaminosis; interaction with co-medications
NSAIDs	Frequently co-reported with analgesics	GI bleeding, cardiovascular and renal risk
Antifungals	Reported in ~15-25% of studies	Inappropriate use, resistance development
Herbal / Traditional medicines	Common in Asia, Africa, Latin America	Herb-drug interactions; lack of standardization
Anxiolytics / Sedatives	Less frequent; emerging concern	Dependence, withdrawal, CNS depression

3.4. Sources of Information Guiding Self-Medication

Preceding 2015, the most common sources of drug information that guided pharmacy students in their self-medication were academic knowledge obtained through lectures and recommendations from family or friends. Since 2015 and until now, there has been a noticeable tendency towards seeking health information through internet sources and social media (Kumar *et al.*, 2015; Shaghaghi *et al.*, 2011). Pharmacy students are more likely to use websites, YouTube videos, health-related apps, and discussion boards

on pharmaceutical topics in order to choose the right drug for self-medication. The mentioned tendency has been confirmed by several studies conducted in Portugal (Shehnaz *et al.*, 2013), the UAE (Shrestha & Prajapati, 2019), Saudi Arabia (Saeed *et al.*, 2014), and India (Kumar *et al.*, 2015).

While the trend of searching health information through the Internet opens many doors, it can also be dangerous because of the variety of unreliable information presented there. First, evidence-based information is available at credible websites, including Medscape, Drugs.com, and health websites of different universities where pharmacy students study. Second, there is a huge amount of health information that students may use but which is unproven and potentially damaging since there are many rumors, fake news, and misleading content in social media. Recent studies reveal that a vast majority of pharmacy students are unable to evaluate the quality of information found online (Helal & Abou-ElWafa, 2017; Martins *et al.*, 2020).

Previous prescriptions - whether personal or belonging to a family member - constituted another commonly reported source of drug information, particularly for antibiotic and antifungal selection. This practice effectively bypasses the clinical evaluation process entirely and is associated with the greatest risk of inappropriate drug use (Kumar *et al.*, 2015; Shaghaghi *et al.*, 2011).

3.5. Adverse Drug Reactions and Awareness of Risks

One of the most essential aspects of studying self-medication behavior is evaluating potential dangers of drug abuse. According to reviewed articles, up to 30% of students who used self-medication experienced at least one adverse drug reaction (Zafar *et al.*, 2008; Kasulkar & Gupta, 2015; Shrestha & Prajapati, 2019; Ayalew, 2017). In general, gastrointestinal disorders (e.g., nausea, epigastric pain, and diarrhea), allergic reactions (e.g., skin rash and urticaria), over-sedation, and vertigo were among the most frequently reported ADRs. In addition, only a small percentage of students who had encountered ADRs informed a physician or pharmacist about their experience.

In terms of awareness, an interesting paradox can be observed in the reviewed literature: although the majority of pharmacy students (between 55% and 75%) are aware of potential risks of self-medication (e.g., ADRs, drug interactions, antibiotic resistance, and hiding a disease condition), this awareness is not reflected in changes of behavior towards self-treatment (Zafar *et al.*, 2008; Martins *et al.*, 2020; Patil *et al.*, 2014). This phenomenon can be explained by the concept of optimism bias according to which pharmacy students realize that self-medication is generally risky but believe that their sufficient knowledge enables them to safely use over-the-counter drugs (Selvaraj *et al.*, 2014).

Inadequate adherence to antibiotic regimens has been reported in various studies, where a large number of students discontinued the antibiotics as soon as their symptoms disappeared, regardless of the duration recommended by doctors. The phenomenon described above, often referred to as sub-therapeutic antibiotic usage, is well-known to result in antibiotic resistance. Furthermore, it is a serious issue for future pharmacists whose role includes providing advice about compliance (WHO, 2015; Nino Cruz *et al.*, 2019).

Table 5: Quality Assessment of Included Studies (Newcastle-Ottawa Scale — Cross-Sectional Adaptation)

Study (First Author, Year)	Selection Score (0–5)	Comparability (0–2)	Outcome Score (0–3)	Total NOS Score (0–10)	Quality Rating
Abay & Amelo, 2010	4	1	2	7	High
Zafar *et al.*, 2008	3	1	2	6	Moderate
Gutema *et al.*, 2011	4	2	2	8	High
James *et al.*, 2006	3	1	2	6	Moderate
Helal & Abou-ElWafa, 2017	4	1	2	7	High
Kasulkar & Gupta, 2015	4	2	3	9	High
Martins *et al.*, 2020	4	2	2	8	High
Shehnaz *et al.*, 2013	3	1	2	6	Moderate
Shrestha & Prajapati, 2019	4	1	2	7	High
Patil *et al.*, 2014	4	2	2	8	High
Ayalew, 2017 (SR)	4	2	3	9	High
Saeed *et al.*, 2014	3	1	2	6	Moderate

Study (First Author, Year)	Selection Score (0–5)	Comparability (0–2)	Outcome Score (0–3)	Total NOS Score (0–10)	Quality Rating
Worku & Mariam, 2003	3	1	2	6	Moderate
Remaining 32 studies*	3–4	1–2	2–3	6–9	Moderate–High

** The remaining 32 studies not individually named in Table 1 were assessed using the same NOS criteria; all scored in the moderate-to-high quality range (6-9 stars). Full individual quality scores available from the corresponding author on request.*

4. Discussion

Taken together, all the studies reviewed here clearly reveal that self-medication is strongly entrenched in the practice of pharmacy and health science students around the globe, independent of their geography, university affiliation, and academic year level. The universal use of analgesics among students, however, is perhaps the most expected of the results due to their legality and the high prevalence of headache, body pain, and fever cases. More concerning is the highly prevalent nature of antibiotic use without prescription in the student population of different regions, since it directly contributes to the global AMR problem.

One of the key lessons that can be drawn from this study is the dichotomy between the role of pharmacy education as a means of promoting self-medication on one hand and as a possible solution to mitigate this phenomenon on the other. The education curriculum provides insights into the mode of action of various drugs, pharmacodynamics, pharmacokinetics, drug-drug interactions, as well as the adverse reaction profiles. In effect, these concepts would lead to increased caution by students regarding the use of drugs without medical supervision. However, it emerges from several studies that the level of knowledge acquired by pharmacy students leads to increased confidence, thus encouraging self-medication behaviors (Abay & Amelo, 2010; Zafar *et al.*, 2008; Helal & Abou-ElWafa, 2017).

The increasing role of the internet and social media in shaping self-medication behavior is another recent phenomenon that should be highlighted. Whereas digital health literacy is beneficial both for patients and for pharmacy students, the lack of regulation within the domain of online health information gives rise to a situation in which unreliable information, anecdotal stories, and biased sources of information compete with clinically proven recommendations equally (Kumar *et al.*, 2015; Shaghaghi *et al.*, 2011). Pharmacy institutions have the potential to fill this void by integrating the skills of critical evaluation of online health information and digital health literacy into undergraduate curricula in pharmacy.

The financial and organizational obstacles that contribute to the practice of self-medication, such as cost-related factors, wait times, and lack of geographical availability, are not the responsibility of the individual pharmacy student or their educational institution. Still, it is essential to understand the nature of these forces to properly understand the reasons behind self-medication and develop appropriate public health messages. The implementation of policies that would cut down healthcare costs and increase patient access to primary healthcare will be essential in the fight against self-medication (Telles Filho & Chagas Pereira Junior, 2013).

From the point of view of pharmacovigilance, the high prevalence of unreported ADRs by self-medicating students indicates an important area for improvement of the national drug safety surveillance system. Students from a pharmacy program are ideally suited to get involved in and make contributions to the national pharmacovigilance programs like PvPI (Pharmacovigilance Program of India) in India and VigiBase under the WHO program. Introducing pharmacovigilance into the curriculum will help to solve the problem of lack of ADR reports and create a drug safety awareness culture (Selvaraj *et al.*, 2014; Phalke *et al.*, 2006; Sontakke *et al.*, 2011).

This review differs from the previously reviewed literature like Bennadi's (2014) narrative review or Ayalew's (2017) systematic review through its focus on the study of pharmacy and health sciences student population, use of more recent studies after 2015 on self-medication driven by internet and analysis of more varied geographical areas including Asia, Africa, Europe, and Middle East countries (Saeed *et al.*, 2014).

5. Implications for Pharmacy Education and Public Health

5.1. Curriculum Reform

The course outline for any pharmacy program needs to have detailed and prolonged modules on issues of rational self-medication, proper administration of antibiotics, and ethical decision-making on medicines. Rather than concentrating on merely teaching the facts surrounding pharmacology, there needs to be emphasis on the critical examination of the individual's habit of consuming medication via methods like reflective portfolios, peer discussion, and case analysis (Mehta & Sharma, 2015).

5.2. Antibiotic Stewardship Education

In view of the common practice of the usage of antibiotics without prescriptions, antibiotic stewardship must be

incorporated into undergraduate studies in pharmacies, where students learn about the modes of resistance development and how they contribute to this development via their personal behavior of taking medications on their own initiative. Antibiotic selection practices may even be included in simulations at the very early stages (Telles Filho & Chagas Pereira Junior, 2013).

5.3. Digital Health Literacy

Curricula need to include training for students to critically assess online health information. It will involve learning how to judge the credibility of sources, detect any commercial bias, and discern between scientific and anecdotal health information. Such training is consistent with the general competency model for the pharmacist as a health information specialist.

5.4. Pharmacovigilance Training

It is recommended that institutions create incentives for students to report ADRs incurred through self-medication to national pharmacovigilance networks. Pharmacovigilance reporting activities carried out under the guidance of faculty will help overcome both challenges.

6. Limitations of the Review

A number of limitations of the current study should be stated. First, substantial variations in study design, definition of self-medication used, time span and method of sampling used made it impossible to pool results into meta-analysis and regional subgroup comparison was suggested instead. Second, the dominance of survey-based study design used in the majority of the studies reviewed raises the issue of potential self-reporting and recall bias as well as the possibility that social desirability will lead to underreporting of undesirable professional behavior. Third, a full search for literature within the chosen four databases can still leave out articles written in other languages or those published in regional journals (Schmiedl *et al.*, 2014).

Fourth, the current study was not prospectively registered within the framework of PROSPERO before literature search. Lastly, it is important to interpret the regional estimates based on sample size with care since the exact sample size was not given for each of the 45 studies in all sources. Although the authors acknowledge it being a drawback of the current study, they undertake to prospectively register any future revisions of the current systematic review on the PROSPERO platform in accordance with international standards. Finally, despite the fact that NOS offers a better risk of bias tool than reporting-based criteria, there is a subjective component in assessing it. However, no inter-rater reliability statistics were calculated for the current review (Telles Filho & Chagas Pereira Junior, 2013).

7. Conclusion

The findings of this literature review show that self-medication is a global issue deeply entrenched in the behaviors of pharmacy and health science students, with relatively higher prevalence rates across all parts of Asia, Africa, Europe, and the Middle East. The analgesic class of drugs is the most commonly self-medicated one, whereas uncontrolled use of antibiotics continues to pose the greatest public health challenge. It becomes clear, therefore, that a balance needs to be established between pharmacology and rational self-medication behaviors.

It is necessary for educational institutions to adopt a simultaneous approach where rational drug use, antibiotic stewardship, digital health literacy, and pharmacovigilance are taught simultaneously at university. This is especially the case since pharmacologists will soon graduate from these institutions, where they should have already learned about rational drug use.

Abbreviations

ADR: Adverse Drug Reaction; **ADE:** Adverse Drug Event; **AMR:** Antimicrobial Resistance; **GI:** Gastrointestinal; **LMICs:** Low- and Middle-Income Countries; **MeSH:** Medical Subject Headings; **NOS:** Newcastle-Ottawa Scale; **NSAIDs:** Non-Steroidal Anti-Inflammatory Drugs; **OTC:** Over-the-Counter; **PRISMA:** Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PvPI: Pharmacovigilance Programme of India; **SM:** Self-Medication; **STROBE:** Strengthening the Reporting of Observational Studies in Epidemiology; **SWiM:** Synthesis Without Meta-Analysis; **WHO:** World Health Organization

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Authors Contribution

Ashutosh Rana: Conceptualization, Methodology, Data Curation, Investigation, Visualization, Validation, Formal Analysis, Resources, Writing – Original Draft, and Writing – Review & Editing; Tushar Kanti Das: Methodology, Software, Data Curation, Experimentation, and Investigation; Ravikant

Gupta: Conceptualization, Investigation, Validation, Formal Analysis, Project Administration, Resources, and Writing – Review & Editing.

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Conflict of Interest

The authors declare no conflict of interest related to this study.

Declarations

The authors declare that this work is original and has not been submitted elsewhere for publication. All data, methodologies, and system components have been developed and reported in adherence to academic standards. All referenced materials have been duly cited, and the authors accept full responsibility for the integrity and accuracy of the findings presented.

Ethical Approval

This study is a comprehensive literature review based exclusively on previously published articles and publicly available information. Therefore, ethical approval and informed consent were not required.

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Data Availability Statement

Authors declare that data sharing is not relevant to this article as no new data were generated or analyzed in this study. All data supporting the conclusions are included within the article and its referenced literature.

Human and Animal Rights

No animals were used in this research. All procedures performed in studies involving human participants were in accordance with the ethical standards of institutional and/or research committee

AI Disclosure Statement

The authors declare that artificial intelligence (AI)-assisted tools were used only for language improvement, grammar refinement, and formatting assistance during manuscript preparation. All scientific content, literature interpretation, critical analysis, conclusions, and final manuscript review were performed by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the manuscript and confirm that it complies with the journal's plagiarism and publication ethics policies.

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