

Profile of drugs used by university students for self-medication in times of the COVID-19 pandemic: A scoping review

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A significant increase in self-medication was observed during the SARS-CoV-2 pandemic, especially among university students due to their higher level of knowledge and awareness, making them more prone to self-medication. Therefore, in this scoping review we aimed to understand the profile of medications used for self-medication among university students during the pandemic, both for COVID-19 prevention and other reasons. We followed the PRISMA-ScR guidelines in conducting the review. The PICO guiding question was, "What is the profile of medications used for self-medication during the COVID-19 pandemic among university students?" Searches were conducted in the Scielo, PubMed, Embase, EBSCOhost, Web of Science, Scopus, BVS, Google Scholar, and CAPES databases based on MESH and DeCS descriptors. A total of 35 studies were selected, with eight (22.8%) reporting self-medication for COVID-19 prevention/treatment ranging from 14-83%, four (11.4%) reporting self-medication for specific symptoms ranging from 11-95%, 19 (54.4%) reporting several reasons for students self-medicating with a range of 50-100%, and four (11.4%) studies not specifying the reason for medication use in self-medication varying from 3-93%. The included studies revealed that the irrational use of medications is a common practice among university students, with varied prevalence of self-medication observed in this population during the COVID-19 pandemic.

Keywords: Review. Students. Self-Medication. COVID-19. Drug Utilization.

INTRODUCTION

Self-medication, also known as self-administration, is a worldwide practice (Lei *et al.*, 2018) and can be defined as the selection and use of medications by individuals to treat self-recognized illnesses or symptoms (Brasil, 2012). It is commonly indicated by non-health professionals, such as friends, neighbors, and/or family members, meaning

it occurs without medical, pharmaceutical, dental, or qualified healthcare professional guidance (Tavares, Gomes, Freitas, 2020; Silva *et al.*, 2021b).

It is known that self-medication, often seen as a solution for immediate relief of some symptoms, can have serious consequences, such as delayed diagnosis of diseases, development of comorbidities, incorrect self-diagnosis, allergic reactions, dependence, drug interaction, severe adverse reactions, bacterial resistance, drug poisoning, masking of an underlying disease, and even death (Behzadifar *et al.*, 2020; Brito *et al.*, 2020; Tavares *et al.*, 2020).

During the SARS-CoV-2 virus pandemic, fear of contracting the virus, misinformation, and limited access

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to healthcare services due to the pandemic (Brito *et al.*, 2020; Quincho-Lopez *et al.*, 2021) increased the influence of social media regarding misinformation about medications, leading to confusion, public panic, and increased self-medication, including home remedies without established safety and efficacy (Malik *et al.*, 2020). Self-medication is becoming increasingly common and is considered a serious public health problem in both developing and developed countries (Behzadifar *et al.*, 2020).

The university population has been studied nationally and internationally regarding the practice of self-medication, as they have a higher knowledge and awareness level, making them more prone to self-medicate. For example, an alarming prevalence of self-medication among students was recorded in Saudi Arabia, with approximately 98.2% self-medicating in early February 2020 (Alshammari *et al.*, 2021). In Pakistan, 83% of medical students self-medicated during the COVID-19 pandemic (Yasmin *et al.*, 2022), while 79% of students in Sudan self-medicated with antibiotics during the same pandemic period (Alhaj *et al.*, 2021).

A recently conducted systematic review by Quincho-Lopez *et al.* (2021) assessed the prevalence of self-medication to prevent or manage COVID-19. The authors analyzed the medication profile and the reasons that led the population to self-medicate. Five studies included in this review were directed at the general population, one study at hospitalized patients, one at undergraduate students, and one at workers from five sectors (health, air transportation, police, road transportation, and the informal sector).

In a preliminary literature search, we identified that several studies have been conducted with the aim of assessing the prevalence of self-medication in the university population, as well as the medications used for self-medication during the COVID-19 pandemic, whether for prevention or treatment of the disease or for other reasons (Faria *et al.*, 2020; Maurício, 2022; Santos *et al.*, 2022; Saleem, Butt, Ahmad, 2021; Yasmin *et al.*, 2022; Zeb *et al.*, 2022; Yousaf *et al.*, 2021). Therefore,

it is important and relevant to propose the construction of an integrative review on this topic.

Additionally, to the best of the authors' knowledge, there is currently no integrative, scoping, and/or systematic review that has proposed a synthesis of these findings. Given the above, the objective of this study is to understand the profile of medications used for self-medication among university students during the pandemic for COVID-19 prevention and self-medication for other reasons.

MATERIAL AND METHODS

Study design, protocol and registration

The investigation is a scoping review that followed the recommendations outlined in the PRISMA Extension for Scoping Reviews (PRISMA-ScR) checklist (Tricco *et al.*, 2018) and was added to the scoping review protocol registered on the Open Science Framework on 04 de December 2023 (<https://osf.io/5ymjx/>).

Review question

The research question to guide the present scoping review was: "What is the profile of medications used for self-medication during the COVID-19 pandemic by university students?" Thus, the PICO strategy was employed to address this, with (P) representing university students, (I) representing self-medication, and (Co) representing the COVID-19 pandemic.

Eligibility criteria eligibility

Studies conducted with the university population, those reporting self-medication during the COVID-19 pandemic, and original articles with primary data collection without restrictions on study design were included. Grey literature was also considered, including undergraduate theses, theses, dissertations, and preprints. There was no restriction on language and publication period.

Studies without full access permission and those not granted by authors upon email request, as well as

narrative, integrative, systematic, and scoping reviews, mini-reviews, case studies, author notes, letters to the editor, and brief communications were all excluded.

Information sources and searches

The PiCo strategy was used for developing the search strategy. Descriptors registered in the Medical Subject Headings (MESH) and in the Health Sciences Descriptors (DeCS), which are controlled, as well as synonyms, singular and plural forms, possible different spellings, and free terms taken from titles, abstracts, and keywords were also used to compose the search strategy. A preliminary search on the research topic was conducted to assist in finding these free terms, contributing to the expansion of the search.

The terms were combined using Boolean operators “AND” and “OR”. Collaboration with a generalist librarian was sought in creating the search strategy. The developed search strategy was initially tested on PUBMED/MEDLINE and subsequently on other databases (Supplementary files).

The search for scientific evidence was conducted in the following databases: Scientific Electronic Library Online (SciELO), National Library of Medicine (PubMed), Excerpta Medica Database (Embase), EBSCOhost, Web of Science, Scopus, the Virtual Health Library (BVS), and the Google Scholar search engine. Google Scholar and the CAPES theses and dissertations catalog were also used for searching gray literature. All searches were conducted on September 30, 2022, without the use of filters (Supplementary files).

Two authors (NAF and WGM) independently conducted the search with prior standardization of the search strategy for each database. The results were

subsequently compared, and both authors obtained the same quantity of results in all mentioned databases.

Selection of evidence sources

The analysis of the studies was conducted by two researchers (NAF and LFB) using the Rayyan tool (Ouzzani *et al.*, 2016). After removing duplicates, the title and abstract were reviewed. Studies included at this stage were selected for a full-text reading. The selection of studies was performed independently by the researchers based on pre-established inclusion and exclusion criteria. Any discrepancies that arose at each selection stage were resolved through consensus, where researchers agreed 100% on the inclusion or exclusion of the study.

Data extraction

The data were extracted from the selected studies, organized, and presented in a Microsoft Excel® spreadsheet, with double-checking performed by the authors. The selected studies were characterized with respect to the author and year of publication, country where the study was conducted, study design, sample size, percentage of students who self-medicated during the COVID-19 pandemic, medications used for self-medication, key conclusions, and reasons that led university students to self-medicate.

RESULTS

Selection of studies

After searching databases and research sources as well as gray literature, 35 studies were included in the integrative review, which are shown in Figure 1.

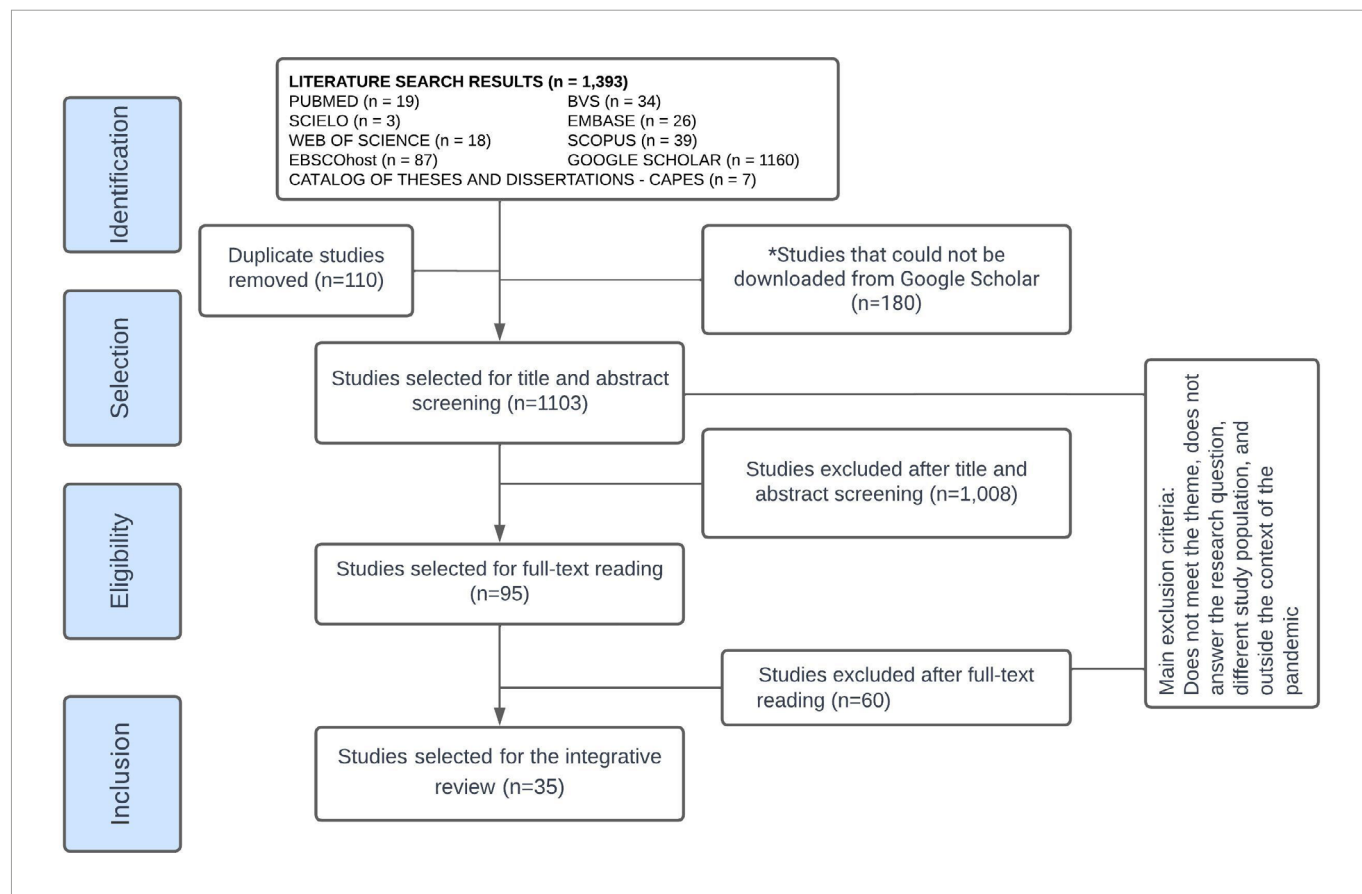


FIGURE 1 - Flowchart for selecting studies for the integrative review.

* 180 studies could not be viewed due to the limitations of Google Scholar, which only allowed access to 980 studies.

Characteristics of the included studies

The characteristics of the included studies with respect to authors, year of publication, country, study

design, sample size, percentage of self-medication, main conclusions, and reasons for self-medication are described in Table I (supplementary material).

TABLE I - Characteristics of the included studies

AUTHOR(S), YEAR	COUNTRY	STUDY DESIGN	N°	SF* (%)	MEDICATIONS	COURSE OF UNIVERSITY STUDENTS	MAIN CONCLUSIONS OF THE STUDIES	REASONS FOR SELF- MEDICATION
Alves, 2022	Brazil	Descriptive and quantitative research	33	27%	Vitamin C (60.6%) Dipyron (48.5%) Paracetamol (48.5%) Ivermectin (36.4%) Zinc (36.4%) Azithromycin (30.3%)	Public Health	During the pandemic, 72.7% of public health undergraduates participated in this study, and they used medications for flu-like syndromes or COVID-19, with 27.3% using them without a prescription. The majority of students reported having knowledge about self-medication	Simple symptoms, difficulty accessing hospitals, ease of purchase, and seeking prevention for COVID-19
Andrade, Moreno, Ortiz, 2021	Brazil	Observational	59	52%	Ivermectin (35.59%) Vitamin D (23.73%) Vitamin C (18.64%) Azithromycin (8.47%) Dexamethasone (3.39%)	Pharmacy, Biomedicine, and Medicine	The students engaged in self-medication during the pandemic and reported having this practice outside of this context with: analgesics, anti-inflammatories, antipyretics, and antibiotics	Seeking prevention for COVID-19
Faria <i>et al.</i> , 2020	Brazil	Cross-sectional study	226	93%	Analgesics/ antiemetics (72.1%) NSAIDs (49.1%) Antiallergics and antihistamines (40.3%) Corticosteroids (12%)	Medicine	There is a high prevalence of students who self-medicate. When compared to the student's academic year, it was observed that all third, fourth, and seventh-semester students self-medicate, followed by fifth and first-semester students	NI
Mauricio, 2022	Brazil	Cross-sectional study	160	63%	Vitamin C (32.6%) Medicinal plants and herbal medicines (21.2%) Mineral and vitamin supplements (16.5%) Ivermectin (9.8%) Azithromycin (8.9%) Vitamin D (8.5%) Analgesics and antipyretics (30.6%) Anti-inflammatories (16.6%) Antihistamines (12%)	Physics, Mathematics, Chemistry, Biology, Nursing, Pharmacy, and Nutrition	Among the medications listed in the questionnaire, vitamin C was the most commonly described. Those not included in the questionnaire were analgesics and antipyretics, anti-inflammatories, systemic antihistamines, and muscle relaxants. Headache was the most reported symptom that prompted the use of medications (14.9%). According to the respondents, the medications were already being used before the pandemic (80.4%)	Prior knowledge, family recommendations, the health issue does not require a visit to the doctor
Santos <i>et al.</i> , 2022	Brazil	Cross-sectional study	193	53%	Analgesics/ Antipyretics (62.1%) Cold remedies (87.0%) Anti- inflammatories (15.5%) Antiallergic (12.9%) Vitamins (4.1%) Antacids/ Digestives (59.5%) Antibiotics (4.1%)	Biomedicine, Biological Sciences (Bachelor's), Pharmacy, Nutrition, Dentistry, and Psychology	A self-medication prevalence of 53.0% was observed among the respondents. The main symptoms reported for practicing self-medication were: cold/flu (89.1%), followed by menstrual cramps (69.9%), stomachache/indigestion (62.1%), and headache/fever (61.1%)	Previous experience with the medication used, mild symptoms, considered it unnecessary to see a doctor, the need for immediate improvement, and the ease of going to the pharmacy and purchasing the medication
Silva <i>et al.</i> , 2021a	Brazil	Cross-sectional study	83	95%	Analgesic (72.1%) Antibiotic (13.9%)	Nursing, Physiotherapy, Biomedicine, Physical Education, Esthetics and Cosmetics, Pharmacy, Nutrition, Psychology, and Social Work	It was observed that the relationships between the level of knowledge and self-medication are interconnected	Influence of the media, knowledge of the drug, recommendations from neighbors, family, colleagues, and difficulty accessing health services

AUTHOR(S), YEAR	COUNTRY	STUDY DESIGN	N°	SF* (%)	MEDICATIONS	COURSE OF UNIVERSITY STUDENTS	MAIN CONCLUSIONS OF THE STUDIES	REASONS FOR SELF- MEDICATION
Souza, 2022	Brazil	Cross-sectional study	1553	14%	Ivermectin (4.24%) Vitamin C (1.60%) Vitamin D (1.48%) Azithromycin (0.3%) Zinc (0.25%)	Medicine, Dentistry, Pharmacy, Nursing, Nutrition, Public Health, Speech Therapy, Physiotherapy, Occupational Therapy, and Physical Education	The study shows that 14.9% of health area students practice self-medication with the aim of preventing or treating COVID-19 infection. Medication consumption has changed during the pandemic, with several drugs gaining focus, such as ivermectin, azithromycin, and vitamin C/D	Prevent or treat a coronavirus infection
Cienfuegos <i>et al.</i> , 2022	Peru	Observational	2401	88%	Paracetamol, NSAIDs (anti-inflammatory drugs), amoxicillin, and antihistamines	Medicine	Fourth-year students are the most likely to self-medicate, with 85.8%. The main complaints were pain, cold/flu, and allergies. It was observed that students believe that advertising influences self-medication (71.31%) and that they had relatives or friends who sometimes bought these medications (73.77%)	Reasons include economic factors, over-the-counter availability, and considering having sufficient knowledge about the use of medications
Tapia <i>et al.</i> , 2020	Peru	Cross-sectional study	718	51%	Paracetamol (41.4%) Ibuprofen (21.1%) Azithromycin (4.9%) Clarithromycin (1.1%) Erythromycin (1.4%) Prednisone (4.2%) Dexamethasone (10.7%) Methylprednisolone (0.7%) Warfarin (0.4%) Enoxaparin (0.6%) Hydroxychloroquine (1.1%) Chloroquine (0.9%) Ivermectin (0.9%)	Health Science	The study shows that students often self-medicate in the context of COVID-19, largely motivated by respiratory symptoms, and experience side effects. One in ten students who self-medicated reported having side effects, occurring frequently in those who self-medicated with macrolides (clarithromycin) and ivermectin, both medications used and recommended in the health protocols of Peru in the context of the COVID-19 pandemic	Believing that the symptoms were not severe enough to warrant a doctor's visit, reporting having relatives/friends who are healthcare professionals, and economic reasons
Rojas-Miliano <i>et al.</i> , 2022	Peru	Cross-sectional study	166	14%	Paracetamol (70.8%) Aspirin (62.3%) Cold remedies (62.5%) Naproxen (41.7%) Ivermectin (37.5%) Ibuprofen (37.5%) Dexamethasone (25%) Cetirizine (16.7%) Azithromycin (16.4%) Penicillin (12.5%) Chlorine dioxide (8.3%) Hydroxychloroquine (4.2%)	Health Sciences, Architecture and Engineering, Administrative Sciences, Accounting and Economics, Social Sciences and Education, and Agricultural Sciences	A self-medication for COVID-19 among students in the health field and those not in the health field in this study is low. The most commonly used medications were paracetamol, aspirin, and cold remedies. Those who self-medicated with aspirin, ivermectin, dexamethasone, and chlorine dioxide reported experiencing side effects after consumption. The perception that self-medication is harmful to health and having doctors as a source of information about medications is associated with lower self-medication due to COVID-19	Sore throat, fever, and prevention of COVID-19
Escobar <i>et al.</i> , 2022	Peru	Cross-sectional study	388	77%	Cold remedies (33.77%) Analgesics (37.79%) NSAIDs (24.17%) Antimicrobials (4.30%) Antacids (2.65%) Antidiarrheal (1.66%) Antihistamines (0.99%) Antidepressants (0.66%)	Nursing, Pharmacy and Biochemistry, Obstetrics, Dental Medicine, and Psychology	We found that self-medication is a common practice among university students in the health field. Among the characteristics of self-medication, the majority of students who self-medicate (75.50%) do so for 2 to 4 months; 50.67% self-medicate for pain, with headache being the most frequent (33.77%). Additionally, according to our findings, 53.97% of those who self-medicated indicated some improvement	Did not have time to see a doctor

AUTHOR(S), YEAR	COUNTRY	STUDY DESIGN	N°	SF* (%)	MEDICATIONS	COURSE OF UNIVERSITY STUDENTS	MAIN CONCLUSIONS OF THE STUDIES	REASONS FOR SELF- MEDICATION
Sapana <i>et al.</i> , 2021	Peru	Cross-sectional study	168	89%	Analgesics/ anti-inflammatories (76.3%) Analgesics/ antipyretics (54.5%) Vitamins (38.5%) Antihistamines (30.7%)	Medicine	An associated factor evaluated in the study is the increase in self-medication according to the academic year, ranging from 86.2% in the first year to 100% in the sixth year, except for the fourth year, which showed a self-medication rate of 75.9%. The symptoms that most led to self-medication were fever, abdominal pain, and headache	Lack of time for a medical appointment, adequate knowledge of medications, and difficulty accessing a medical consultation
Sallem, Butt, Ahmad, 2021	Pakistan	Cross-sectional study	520	58%	Analgesics (55.96%) Antipyretic (34.44%) Antibiotic (38.74%) Antihistamine (20.86%) Antidiarrheal (8.28%) Antiemetic (9.27%) Antacids (5.96%) Vitamins (17.55%)	Medical and non-medical	The practice of self-medication is relatively higher among undergraduate medical students compared to non-medical university students during the COVID-19 pandemic. However, the prevalence of self-medication was high in both groups	The symptoms are minor, past experience, saving time, pharmacist advice, and saving money
Yasmin <i>et al.</i> , 2022	Pakistan	Cross-sectional study	489	83%	Paracetamol (65.2%), Multivitamins (56.0%), Ibuprofen (29.0%), Cetirizine (27.8%), Azithromycin (25.6%)	Medicine	The incidence of self-medication revealed is around 83%. The study showed that being in the 3rd year of the medical course or having already been infected with COVID-19 were the factors associated with respondents who were more likely to self-medicate	Preventive measures for COVID-19 or self-medication for COVID-19 symptoms
Zeb <i>et al.</i> , 2022	Pakistan	NI	1250	NI	Antimicrobials (50.4%), Anti-inflammatories (26.4%), Multivitamins (11.3%), Gynecological purposes (4.7%), Analgesics (5.7%), Herbal medicines (1.2%)	Health Science	Antibiotics were more commonly used to treat sore throat, prolonged fever, lung infections, and other upper respiratory infections. High antibiotic consumption was found in the majority of students enrolled in the healthcare field, as they had affiliations with healthcare professionals. They had good knowledge about antibiotics and other medications	Exemption from medical fees, a convenient and inexpensive source of medications, and the lack of pharmacy availability
Yousaf <i>et al.</i> , 2021	Pakistan	Cross-sectional study	826	28%	Antibiotics	Biological Sciences	This study indicates a moderate level of knowledge regarding the use and resistance to antibiotics. Regarding the effectiveness of antibiotics against antiviral infections, the majority of participants in the current study knew that antibiotics are effective only against bacterial infections	NI
Palikhey <i>et al.</i> , 2021	Nepal	Cross-sectional study	519	69%	Paracetamol (45.7%) Ibuprofen (26.6%) Chlorpheniramine (25%) Pantoprazole (14.3%) Vitamin C (3.5%)	Medical and non-medical	This study revealed that one of the main benefits of self-medication in students is the quick relief of symptoms. Headache was the most common symptom that led to self-medication, followed by cough and cold	Quick relief, ease and convenience, previous experience, and the mildness of the illness
Shrestha, Kushwaha, Tiwari, 2021	Nepal	Cross-sectional study	199	50%	Analgesics (62%) Antipyretics (52%) Antihistamines (28%) Cough suppressants (28%) Antacids (24%) Vitamins (16%)	Medicine and Dentistry	The study revealed that the most common indication for self-medication was headache (47%). However, 16.6% of students encouraged and 23.6% considered self-medication to be safe	Pharmacology knowledge, mild illness, previous exposure to the disease, immediate relief, and familiarity with pharmacology education

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Subedi, 2021	Nepal	Cross-sectional study	206	100%	Analgesics (33.4%) Cold remedies (27%) Antilulcer agents (14.1%) Antipyretics (38.6%) Antibiotics (17.7%) Antihistamines/ sedatives (5.5%)	Fields of Science and Technology, Management, Humanities, Law, and Education	All students reported self-medication practices. The diseases included in this study that led to self-medication were headache (62.9%), fever (32.7%), gastric acidity (23.9%), cough (27.3%), and common cold	Previous experience, mild illnesses, timesaving, seeking quick relief, ease, and personal convenience
Alduraibi, Altowayan, 2022	Saudi Arabia	Cross-sectional study	316	63%	Analgesics (88.29%) Antipyretics (49.68%) Antihistamines (36.71%) Cough syrups (13.9%) Antacids (9.49%) Antiemetics (3.8%)	Pharmacy and Medicine	With regard to knowledge, 94.6% of students showed a good level of knowledge about self-medication. The proportion of pharmacy students with good knowledge on the subject was significantly higher than that of medical students. Regarding the practice of self-medication, the results showed that 63.9% of pharmacy and medical students had at least one occurrence of self-medication in the last 6 months	Due to the non- severity of the illness and quick relief
Qahtani <i>et al.</i> , 2022	Saudi Arabia	Cross-sectional study	205	60%	Antibiotics (25%) Analgesics (25%) NSAIDs (52.7%) Antipyretics (13.7%) Antacids (12.7%) Paracetamol (20%) Diclofenac (1%) Ibuprofen (1%) Pantoprazole (5.4%) Amoxicillin (3.9%) Hyoscine (2.9%) Vitamin C (2%) Domperidone (1.5%)	Medicine	About a quarter of the students (25.36%) used antibiotics for self- care. Students mentioned headaches, colds and flu, fever, gastric acidity, and ulcers as common illnesses for which self-medication is practiced	Less severe nature of the illness, quick relief, good pharmacological knowledge, prior information about medications, privacy, greater distance to a healthcare unit, and learning opportunities
Mannasheh <i>et al.</i> , 2021	Saudi Arabia	Cross-sectional study	371	55%	Antipyretics (37.7%) Multivitamins (36.4%) Sedatives (20.2%) Antihistamines (18.6%) Anti- inflammatories (17.3%)	Pharmacy, Medicine, and Applied Sciences	The overall adequacy of students' knowledge and attitude towards self- medication was satisfactory. The study shows that 78.7% of students are aware of responsible self-medication	Mild illnesses, previous experience, and lack of time to go to the health service
González <i>et al.</i> , 2022	Mexico	Pesquisa anônima	284	23%	Vitamins C and D (53.9%) Paracetamol/NSAIDs (17.1%) Herbal remedies (10.5%) Chlorine dioxide (3.9%)	NI	A significant percentage of students self-medicated with the intention of preventing COVID-19. Considering that the studied population has a high level of education, the use of chlorine dioxide (3.9%) as a preventive product for COVID-19 was concerning	Intention to prevent COVID-19
Roblero <i>et al.</i> , 2022	Mexico	Cross-sectional study	310	74%	Analgesics (Paracetamol and Ibuprofen)	Medicine	Students who conducted all academic activities virtually in the last semester experienced muscle pain and use medications to alleviate the pain. In general, they spend more than 10 hours a day on class, work, or study schedules. During the vacation period, the symptoms of muscle pain and the consumption of analgesics significantly decreased	Muscle pain
Alahendra <i>et al.</i> , 2021	Sri Lanka	Cross-sectional study	138	87%	Analgesics (83.2%) Vitamins and minerals (47.8%) Antiallergics (39.8%)	Biotechnology, Law, Psychology, Physical Sciences, Biological Sciences, English, and Nursing	Analgesics, vitamins, and minerals were the most commonly used types of medications for self-medication. Headache and cold were the main health conditions that led participants to engage in self-medication	The restrictions of Covid-19, the belief that it is unnecessary to consult a doctor for minor illnesses, and prior relief

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Bello <i>et al.</i> , 2022	Nigeria	Cross-sectional study	356	65%	Paracetamol (43%) Tramadol (2%) Cough syrup (8.1%) Vitamin C (52%) Herbal remedies (28.7%) Antimalarial (24.7%) Antidiarrheal (2.2%) Antiallergic (3.4%) Hydroxychloroquine (2%)	NI	Self-medication was significantly associated with the occurrence of COVID-19 symptoms. The study further reveals that the experience of COVID-19 symptoms significantly influences self-medication among Nigerian university students	Perceived symptoms of COVID-19
Johora <i>et al.</i> , 2021	Bangladesh	Cross-sectional study	916	51%	Paracetamol (88.9%) Antihistamine (48.5%) Vitamin C (40.2%) Zinc (31.3%) Azithromycin (22.6%) Doxycycline (7.2%) Ivermectin (6.8%)	Medicine	The most common illnesses that led to the practice of self-medication among students from 14 medical colleges were fever, headache, and dry cough. The rate of self-medication with anti-infective agents such as azithromycin (22.6%) was high among future doctors during the pandemic	8.5% engaged in self-medication as a prophylactic measure against COVID-19, driven by perceived symptoms
Sarango <i>et al.</i> , 2020	Chile	Cross-sectional study	62	85%	Paracetamol (40.31%) Ibuprofen (9.67%) Amoxicillin (6.45%) Azithromycin (6.45%) Loratadine (6.45%) Cetirizine (3.22%) Acetylsalicylic acid (Aspirin) (3.22%) Omeprazole (3.22%) Cold remedies (3.22%)	Nursing	85% of fourth-cycle nursing students engaged in self-medication, which is a significantly high percentage. A large proportion of the surveyed students self-medicate primarily for headaches, with 31% choosing this option as their most common reason, followed by the flu at 16%	They don't have time to go to the doctor and don't believe it's always necessary to consult a doctor
Alhaj <i>et al.</i> , 2021	Sudan	Cross-sectional study	725	79%	Antibiotics	Medical and non-medical	The study revealed that many participants did not exhibit appropriate behavior regarding the use of antibiotics, possibly due to decreased awareness of the adverse effects of unnecessary antibiotic use. Moreover, 37% of participants stop taking the medication when they feel better, while 79% use antibiotics as prophylaxis, and this is common among non-medical students. Additionally, 21% take antibiotics when they experience symptoms of the common cold	Prophylaxis of diseases and the common cold
Misli <i>et al.</i> , 2021	Malaysia	Cross-sectional study	214	70 %	Antipyretics (35%), Vitamins (14.5%), Antibiotics (13.1%), Antiallergics (2.8%)	Nursing	The overall prevalence of self-medication reported in this study was (70.1%). The majority of respondents (92.5%) had good knowledge of self-medication. Most (40.7%) of the undergraduates in this study choose to practice self-medication as soon as they fall ill, followed by seeking medical consultation (39.3%)	Previous experience, emergency use, quick relief, lack of time for a doctor consultation, and costs

AUTHOR(S), YEAR	COUNTRY	STUDY DESIGN	N°	SF* (%)	MEDICATIONS	COURSE OF UNIVERSITY STUDENTS	MAIN CONCLUSIONS OF THE STUDIES	REASONS FOR SELF-MEDICATION
Armillo <i>et al.</i> , 2022	Philippines	Descriptive and quantitative research	327	NI	Analgesic/Antipyretic (78.9%) NSAIDs (11.62%) Antibiotics (36.70%) Antacid (12.2%) Eye drops (12.8%) Cough suppressant/ expectorant (20.18%) Antihistamine (21.10%) Nasal decongestant (23.85%)	Medical and non-medical	The students reported that they only self-medicate two to four times a year to manage a mild illness because they believe it helps them improve. Researchers demonstrated that the internet could influence the self-medication habits of the interviewees. There is no significant relationship between the extent of internet use and the level of self-medication	Managing mild illnesses
Silva <i>et al.</i> , 2021b	Portugal	NI	2029	4%	Valerian (62.1%) and (Stilnoite®) (12.1%)	Social Sciences and Humanities, Sciences and Engineering, and Arts	Approximately 31% of students report suffering from insomnia. Regarding the frequency of consumption, 35.5% of individuals in the sample indicated consuming "every day or almost every day," 32.9% reported consuming "when they are stressed," and 10.5% reported consuming "two or three times a week"	Difficulty sleeping
Witteveen, 2021	United States	NI	45	11 %	(Adderall), (Ritalin), (Vyvanse), and Dexedrine	Nursing	20% of students have an official diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) or Attention Deficit Disorder (ADD) and are prescribed medication to help with their symptoms. When asked if they have ever taken (Adderall), (Ritalin), (Vyvanse), or Dexedrine without a prescription, 11.1% of students admitted to doing so.	Students resort to medication to stay awake longer and enhance their focus capacity. They believe that using these medications will improve academic performance
Cvitkovic, 2021	Croatia	Cross-sectional study ¹	213	3%	Diazepam (2.34%) Alprazolam (0.46%).	Pharmacy and Biochemistry	During the COVID-19 pandemic, almost half of the students experienced a deterioration in mental health. The majority of students in this study sought professional help for mental health issues. The frequency of antidepressant use was 11.7%. Five of these individuals use diazepam, and one person uses alprazolam without a professional prescription.	NI
Sljivo <i>et al.</i> , 2022	Bosnia and Herzegovina	Cross-sectional study	827	19%	Lorazepam, diazepam, bromazepam, phenobarbital, and zolpidem	NI	Students reported anxiety symptoms due to COVID-19. Individuals who reported depressive symptoms associated with COVID-19 were more likely to be female, exhibit anxiety symptoms, be unemployed, and use sedatives or alcohol	NI

Legend: NI - Not informed; SF - Self-medication; NSAIDS – Non-steroidal anti-inflammatory drugs.

The 35 selected studies revealed the profile of self-medication in the university population for preventing COVID-19 and other reasons across four different continents. A total of 16 studies were conducted in the Americas (Alves, 2022; Andrade, Moreno, Ortiz, 2021; Faria *et al.*, 2020; Maurício, 2022; Santos *et al.*, 2022; Silva *et al.*, 2021a; Souza, 2022; Cienfuegos *et al.*, 2022; Miñan-Tapia *et al.*, 2020; Rojas-Miliano *et al.*, 2022;

Escobar *et al.*, 2022; Sapana *et al.*, 2021; González *et al.*, 2022; Roblero *et al.*, 2022; Sarango *et al.*, 2020; Witteveen, 2021). In addition, two studies were conducted in Africa (Bello *et al.*, 2022; Alhaj *et al.*, 2021), three in Europe (Cvitković, 2021; Silva *et al.*, 2021b; Sljivo *et al.*, 2022), and 14 studies were conducted in Asia (Saleem, Butt, Ahmad, 2021; Yasmin *et al.*, 2022; Zeb *et al.*, 2022; Yousaf *et al.*, 2021; Palikhey *et al.*, 2021; Shrestha *et al.*,

2021; Subedi, 2021; Alduraibi, Altowayan, 2022; Qahtani *et al.*, 2022; Mannasaheb *et al.*, 2021; Alahendra *et al.*, 2021; Johora *et al.*, 2021; Misli *et al.*, 2021; Armillo *et al.*, 2022).

The studies included between 33 to 2,401 participants, and were conducted between March 2020 and April 2022. All studies involved health science students, but four of them mentioned students from physics, mathematics, engineering, arts, and law (Maurício, 2022; Rojas-Miliano *et al.*, 2022; Silva *et al.*, 2021b; Subedi, 2021). All studies were observational, but three studies did not inform the study design (Zeb *et al.*, 2022; Silva *et al.*, 2021b; Witteveen, 2021).

Self-medication for COVID-19 prevention/treatment

The reasons for self-medication among university students were identified in 31 included studies. Among these, eight studies revealed that the motive for self-medication was the pursuit of prevention/treatment against COVID-19, with the prevalence of self-medication in the population ranging from 14% to 83% (Alves, 2022; Andrade, Moreno, Ortiz, 2021; Souza, 2022; Rojas-Miliano *et al.*, 2022; Yasmin *et al.*, 2022; González *et al.*, 2022; Bello *et al.*, 2022; Johora *et al.*, 2021); the studies reported the consumption of: vitamin C, D or multivitamins; azithromycin; ivermectin; paracetamol; hydroxychloroquine; and chlorine dioxide (Table I).

Self-medication for other reasons

Among the included studies, four addressed the practice of self-medication for the control of specific symptoms, such as relief of muscle pain, improvement of difficulty concentrating and focusing, regulation of insomnia and sleep difficulties, and resolution of the common cold. Regarding the study that addressed self-medication for muscle pain, 74% of this population used paracetamol or ibuprofen for symptom relief (Roblero *et al.*, 2022). In the study that reported self-medication due to difficulty sleeping, it was observed that 4% of the studied population used herbal medicines (Silva

et al., 2021b). Regarding the use of medications to improve focus or academic performance, 11% self-medicated with Adderall®, Ritalin® (Methylphenidate Hydrochloride), Vyvanse® (Lisdexamfetamine), or Dexedrine® (Dextroamphetamine) (Witteveen, 2021). Alhaj *et al.* (2021) found that 79% of participants self-medicated with antibiotics to treat the common cold and as prophylaxis for it.

Furthermore, a total of 20 studies addressed different justifications for the practice of self-medication, including rapid relief of symptoms, non-aggravating symptoms, previous experience with the medication, knowledge about the drug, lack of time to see a doctor, recommendation from a friend or family member, difficulty accessing health services and exemption from medical fees. The prevalence varied from 50% to 100% among the research participants, and the main medications used by students were analgesics, antipyretics, anti-inflammatories, antibiotics, antiallergics, and antihistamines (Palikhey *et al.*, 2021; Shrestha *et al.*, 2021; Subedi, 2021; Alduraibi, Altowayan, 2022; Qahtani *et al.*, 2022; Sarango *et al.*, 2020; Santos *et al.*, 2022; Miñan-Tapia *et al.*, 2020; Saleem, Butt, Ahmad, 2021; Mannasaheb *et al.*, 2021; Armillo *et al.*, 2022; Silva *et al.*, 2021a; Misli *et al.*, 2021; Mauricio, 2022; Cienfuegos *et al.*, 2022; Sapaná *et al.*, 2021; Escobar *et al.*, 2022; Alahendra *et al.*, 2021; Alves, 2022; Zeb *et al.*, 2022).

Lastly, four studies did not inform the reason for the practice of self-medication, being that the self-medication prevalence varied between 3% to 93%, and these studies reported the use of lorazepam, diazepam, bromazepam, phenobarbital, zolpidem, alprazolam, antibiotics, analgesics/antipyretics, non-steroidal anti-inflammatory drugs, antiallergics, antihistamines and corticosteroids (Sljivo *et al.*, 2022; Cvitković, 2021; Faria *et al.* 2020; Yousaf *et al.* 2021)

DISCUSSION

The present study provides scientific evidence regarding the medication profile used during the pandemic for COVID-19 prevention and other reasons. Major databases, research sources, and grey literature

were analyzed without language or publication period restrictions, given the current relevance of the topic.

A systematic review with meta-analysis that estimated the overall prevalence of self-medication in the COVID-19 pandemic found that the prevalence of self-medication among the general population was 48%, while among COVID-19 patients it was 41.7%, for students it was 54.5%, and in health professionals it was 32.5% (Kazemioula *et al.*, 2022). It can be seen that the highest prevalence of self-medication in this study was related to students. The authors of the study compared their findings to those of a previous systematic review with meta-analysis in the Ethiopian population, in which the prevalence of self-medication among students prior to the pandemic was 49.5% (Fetensa *et al.*, 2021), indicating that the prevalence of self-medication among university students seems to have increased during the pandemic, with this finding being attributed to the higher education level of students compared to the general population (Kazemioula *et al.*, 2022).

According to medications used for COVID-19 prevention, it is concerning that even among university students who presumably have access to reliable information sources, there was a notable consumption of medications such as antibiotics, hydroxychloroquine, ivermectin, paracetamol, vitamin C, and chlorine dioxide. These medications are not recommended for this purpose and lack scientific evidence of their effectiveness against the virus. Thus, the use of these medications is considered irrational (WHO, 2022; IDSA, 2022; Souza *et al.*, 2021; OPAS, 2020; Tritany, Tritany, 2020).

Sales of these medications in Brazil increased significantly during the COVID-19 pandemic. For example, ivermectin sales rose from R\$ 44 million in 2019 to R\$ 409 million in 2020, hydroxychloroquine and chloroquine prescriptions increased from R\$ 55 million in 2019 to R\$ 91.6 million in 2020, and azithromycin saw a 30.8% increase, with 12 million boxes sold in 2019 and over 16 million in 2020 (Melo *et al.*, 2021).

It is essential to highlight that irrational or inappropriate medication use is a global problem (Brasil, 2013). Using medications without guidance from a

healthcare professional and lacking evidence of indication poses various health risks (Brasil, 2020b). The population has been using medications inappropriately during the COVID-19 pandemic. The fear generated by the pandemic may have led to a regression to empiricism and off-label medication use. In the context of COVID-19 prevention, the latter does not align with rational medication use which is based on Evidence-Based Medicine, emphasizing the most current and robust scientific evidence in choosing pharmacotherapy with the best cost-benefit profile, tailored to the individual's health condition and proven safety and efficacy in adequate studies (Tritany, Tritany, 2020; WHO, 2002; Brasil, 2013).

The prevalence of self-medication for COVID-19 prevention in the studies included in this review ranged from 14% to 83%. A study in Jordan demonstrated an 80% prevalence of self-medication in the general population, primarily using medications such as vitamin C and paracetamol (Elayeh, Akour, Haddadin, 2021). Self-medication prevalence during the pandemic in the general population in Nigeria was found to be 36.3% and 41%, according to studies by Okoye *et al.* (2022) and Wegbom *et al.* (2021), respectively. The most commonly used medications for COVID-19 prevention were vitamin C, antimalarials, and amoxicillin (Wegbom *et al.*, 2021). In addition to these medications, a study observed that 5.7% of healthcare professionals from three hospitals in southern Nigeria used hydroxychloroquine for COVID-19 prevention (Okoye *et al.*, 2022).

Aiming to mitigate misinformation, it is worth noting that the Ministry of Health in Brazil clarified that there is no vitamin, alternative therapy, or licensed medication capable of preventing contagion or treating COVID-19 (Brasil, 2020a). In turn, paracetamol is the recommended first-line drug for hyperthermia or fever particularly associated with SARS-CoV-2 infection, if there are no contraindications (Brasil, 2020a; Remião, 2020).

Regarding the use of chlorine dioxide, the Food and Drug Administration (FDA) clarified that this product and its derivatives are not safe or effective for treating COVID-19 (FDA, 2020). These products and their derivatives are usually used as disinfectants in various

industrial processes (Mostajo-Radji, 2021). However, two studies demonstrated that chlorine dioxide was used for COVID-19 prevention through self-medication (Rojas-Miliano *et al.*, 2022; González *et al.*, 2022). It is known that this compound is not safe for human consumption, and exposure to high doses can cause thyroid suppression, DNA damage, and neurotoxicity (Mostajo-Radji, 2021). Rojas-Miliano *et al.* (2022) revealed that students who used chlorine dioxide attributed adverse effects, especially throat irritation. The prevalence of self-medication with this compound was 8.3%, aligning with another study in the general population where 8% practiced self-medication with chlorine dioxide, although this study did not address adverse effects (Soriano-Moreno *et al.*, 2021).

Concerning ivermectin, it is known that this medication is an antiparasitic indicated for the treatment of various conditions caused by worms or parasites. Some studies in this review showed that ivermectin has been commonly used for COVID-19 prevention. However, there is no available evidence regarding the action of ivermectin for preventing SARS-CoV-2 infection (Popp *et al.*, 2022; Marra *et al.*, 2020). The indiscriminate use of this medication can lead to moderate to severe adverse effects, and in toxic doses it can cause gastrointestinal symptoms, hypersalivation, drowsiness, muscle weakness, tachycardia, hypotension, ataxia, agitation, rhabdomyolysis, and coma (Wong, 2020).

Next, the studies included in this review addressed antibiotic use for the treatment of sore throat, prolonged fever, lung infections, common cold, common cold prophylaxis, and COVID-19 prevention without the prescription of a qualified professional. Alhaj *et al.* (2021) assessed the misuse of antibiotics and revealed that many participants did not have proper behavior regarding antibiotic use, possibly due to decreased awareness of the adverse effects of antibiotic therapy. Qahtani *et al.* (2022) demonstrated that students had adequate knowledge of antimicrobial resistance and the consequences of irrational antibiotic use, yet 25% of these students' practiced self-medication with antibiotics. Two studies in Table I related knowledge levels to self-medication, concluding that higher medication knowledge was associated with a

higher prevalence of self-medication, typically starting after the pharmacology discipline (Silva *et al.*, 2021a; Sapana *et al.*, 2021).

As a common practice throughout the population, self-medication with antimicrobials is a cause for concern as it contributes to resistance to these medications spreading (Grigoryan *et al.*, 2006). Antimicrobial resistance represents a growing threat to global public health, jeopardizing human health, increasing treatment costs, raising hospitalization rates, and mortality levels (Fiocruz, 2019). Furthermore, certain antibiotic classes can cause comorbidities and other adverse effects, such as pseudomembranous colitis, dryness of the mouth and eyes, nervous system alterations, and severe allergic reactions (de Moraes *et al.*, 2018).

It is crucial to emphasize that actions taken by healthcare professionals are essential in the context of the rational use of antimicrobials. Actions such as counseling on the proper use of these medications and identification of major health issues make healthcare professionals partners in health promotion. The pharmacist plays a fundamental role in the prevention and guidance on the rational use of antimicrobials, given their extensive knowledge in the field, allowing them to mediate usage by providing information on consumption, major side effects, and guidance on treatment duration, emphasizing the importance of strictly following medical advice (Guedes, Álvares, 2017; Albuquerque *et al.*, 2022; Silva Júnior *et al.*, 2018).

A study conducted by the Federal Pharmacy Council in Brazil showed that there was an almost 14% increase in the sales of antidepressants and mood stabilizers from January to July 2020 compared to the same period in 2019. These medications are used in the treatment of affective disorders such as depression, dysthymia (neurotic depression), and bipolar affective disorder (CFF, 2020). Studies revealed the use of benzodiazepines and other sedatives through self-medication among university students, with the prevalence of self-medication ranging from 3% to 19%. The COVID-19 outbreak was associated with anxiety symptoms, leading to a deterioration in mental health and the practice of self-medication. This

practice can expose students to undesirable side effects, the development of dependence, and health risks (Dantas, 2023).

Most studies included in the review assessed self-medication for various reasons, with the prevalence of self-administration reaching 100% in some cases. The main medications used by these students were analgesics, antipyretics, anti-inflammatories, antibiotics, antiallergics, and antihistamines. Self-medication with analgesics and anti-inflammatories can result in drug poisoning, drug-induced hepatitis, perpetuation of pain, nephropathies, ulcers, and gastritis, depending on the quantity and usage frequency (de Moraes *et al.*, 2018).

One study addressed the use of medication through self-medication to improve focus or academic performance. About 11% of participating students self-medicated with Adderall, Ritalin (Methylphenidate Hydrochloride), Vyvanse (Lisdexamfetamine), or Dexedrine (Dextroamphetamine). Two studies conducted before the pandemic showed that approximately 30% of investigated students used methylphenidate through self-medication to improve focus (Cândido *et al.*, 2019; Fallah *et al.*, 2018). Thus, it cannot be asserted that the COVID-19 pandemic influenced self-medication with these medications, as there is evidence that such practice existed even before the pandemic period.

The integration of the pharmacist is necessary when analyzing the occurrence of inappropriate self-medication reported in studies included in this review, which resulted in adverse reactions, drug interactions, intoxications, and health-damaging effects. It is evident that a joint effort of the healthcare team is necessary for control of these substances, which are a fundamental therapeutic resource in the recovery and maintenance of population health, with the pharmacist playing a crucial role in providing correct guidance, systematic monitoring of individual drug treatments, assessment, and ensuring the safety and efficacy of properly indicated medications, promoting rational use (Nobre Junior, Andrade, 2022; Mendes, 2008; Lima, Guedes 2021).

Some limitations were identified in the construction of this review, such as studies with small sample sizes

and all studies including health science students. Unlike systematic reviews, scoping reviews generally do not include an assessment of the quality of the evidence in the studies. For this reason, the studies included in this review were not assessed for their methodological rigor. However, we recognize that by describing and summarizing the evidence without analyzing the quality of the evidence, we may have overlooked some aspects of self-medication by university students during the COVID-19 pandemic presented in this review.

Despite these challenges, it is emphasized that the construction of this integrative review was conducted with careful observation of the research methodology predominant in scientific literature, based on systematic search creation through the formulation of the research question, development of the search strategy, database search, study selection by two independent reviewers, and descriptive analysis of included studies. This systematic approach enabled clarifying and synthesizing the available evidence, bringing to light the profile of medications used through self-medication by university students during the COVID-19 pandemic.

Detailing the reasons for self-medication by university students during the COVID-19 pandemic is a notable aspect of the results presented in this review, as it can stimulate creation and implementation of educational strategies that promote rational and safe self-medication and health literacy.

CONCLUSIONS

This scoping review was able to identify that the irrational use of medications is a common practice in university students among the included studies, despite being a population with access to reliable information. It is noteworthy that a high prevalence of self-medication by students during the COVID-19 pandemic was observed in various countries around the world.

The reasons that led students to self-medicate during the pandemic are diverse, often related to the relief of symptoms they consider mild, recommendations from friends and/or family members, improvement in academic

performance, prevention of COVID-19, among others. The classes of medications used are associated with the symptom and/or the associated reason. Another relevant point observed in some studies is that knowledge about medication is interconnected with self-medication, making students in health-related courses more prone to self-medication.

Considering that the main medications used for COVID-19 prevention were vitamin C, paracetamol, azithromycin, ivermectin, and hydroxychloroquine, and that there is currently no scientific evidence supporting their use in this context, it is important to consider strategies and policies that can mitigate this misinformation and truly assist in promoting rational medication use.

The analysis of the studies included in this review highlights the need for information and education for university students regarding the rational use of medications and the harms of self-medication practices, especially concerning the risks of serious adverse effects and the lack of indication or proven efficacy for a particular health condition.

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