To Risk or Not to Risk? Evaluating Self-medication Practices among Ecuadorian Adults During COVID-19 Lockdown

Andrea Orellana-Manzano[1,#*] , Silvia Orellana-Manzano[2,#] , María José Vizcaíno[1] , Luis Dorado-Sánchez[3], Yaritza Segura[1], Kerly Alcivar[1], Fausto Gómez-Franco[4], Lenin Chuquimarca-Tandazo[5], Davide Di Grumo[2], Derly Andrade-Molina[6] and Daniel Ochoa[7]

[1]*Escuela Superior Politécnica del Litoral, ESPOL, Laboratorio para investigaciones biomédicas, Facultad de Ciencias de la vida (FCV), ESPOL Polytechnic University, Guayaquil, Ecuador*

[2]*Facultad de Ciencias de la Salud, Universidad de Especialidades Espíritu Santo, Samborondon, Ecuador*

[3]*Hospital General Monte Sinai – Guayaquil, Ecuador*

[4]*Hospital General Del Norte De Guayaquil Los Ceibos Coordinador De Farmacia Guayaquil, Ecuador*

[5]*Hospital Básico Catacocha Gestión De Medicamentos Y Dispositivos Médicos – Guayaquil-Ecuador*

[6]*Laboratorio de Ciencias Omicas, Facultad de Ciencias de la Salud, Universidad Espíritu Santo, Samborondon, Ecuador*

[7]*Escuela Superior Politécnica del Litoral, ESPOL, Facultad de Ingeniería en Electricidad y Computación (FIEC), ESPOL Polytechnic University, Guayaquil, Ecuador*

Abstract:

Background: Self-medication involves using drugs to treat self-diagnosed disorders or symptoms. According to WHO, it is associated with a high risk among the general population, exacerbated by the COVID-19 pandemic.

Objective: This study aimed to assess self-medication practices, risks, and severity index among Ecuadorian adults during the first COVID-19 lockdown period in April 2020, using a descriptive non-experimental research design and a hazard risk assessment score analysis.

Material and Methods: A descriptive non-experimental research design was used to assess self-medication practices, risk, and severity index among 364 Ecuadorian adults during the first COVID-19 lockdown period in April 2020. The study utilized an online survey and Hazard-Risk-Assessment-Score (HRAS) analysis of clinically relevant questions. Descriptive statistics were mainly used, integrating Chi-square and ANOVA analysis using R.

Results: Despite a high level of education among the surveyed population, there was a significant risk of medication-related problems, with 63.1% and 26.72% of respondents at the third and fourth risk levels, respectively. Furthermore, 55% were at severe risk of self-medication, while 35% opted for medication therapies recommended on television, social media, or by influencers instead of consulting health professionals. Another 39% took medication before receiving recommendations from a doctor or pharmacist.

Conclusion: The study highlights the need to improve the image of pharmaceutical chemists as part of multidisciplinary health teams, monitor prescriptions of the doctors, and reduce drug side effects to mitigate the risks associated with self-medication.

Keywords: Self-medication, Hazard-risk-assessment-score, COVID-19, Lockdown, Self diagnosed disorder, High risk.

*Address correspondence to this author at the ESPOL Polytechnic University, Biomedical Research Laboratory, Facultad de Ciencias de la Vida (FCV), Campus Gustavo Galindo Km 30.5 vía Perimetral, P.O. Box 09-01-5863, Guayaquil, Ecuador; E-mail: akorella@espol.edu.ec

#These authors contributed equally to this work

1. INTRODUCTION

Self-medication is a global phenomenon with reported prevalence rates from 11.2% to 93.7%, as documented by Chautrakarn *et al*. in 2021 [1]. Notably, the extent of self-medication varies among nations, prominently manifesting in developing countries. The utilization of self-administered treatments is dominated by analgesics and antipyretics, accounting for 44.3% of cases, followed by non-steroidal anti-inflammatory drugs at 36.4%, and antihistamines at 8.5%, according to research by Machado-Alba *et al*. in 2014 [2].

Of paramount significance is the rapid evolution of technology and the pervasive influence of the Internet, enabling the general populace to access a wealth of medical and pharmacological information, thus mitigating the need for expert intervention and inadvertently fostering an environment conducive to heightened self-medication practices [3]. Concurrently, a series of comprehensive studies have underscored a range of concerns arising from self-medication, including administering subtherapeutic doses, indiscriminate use of antibiotics, and the potentially injudicious reliance on natural remedies. A notable finding from a cross-sectional and observational study spanning 14 countries, including Ecuador, reveals that approximately 44.9% of instances pertain to self-medication [4].

During the COVID-19 pandemic, health awareness was a great factor that contributed to increased hesitancy to health regulations and recommendations, including self-medication. Social studies conducted in Russia showed significant similarities with Latin American health behavior changes during the lockdown. A survey with 2771 participants showed that 57,5% were unwilling to get vaccinated, and 28.6% were in denial of meeting the basic sanitary recommendations, being more likely to contract COVID-19 and other diseases [5]. In another study, the global population was more likely to develop some grade of depression, anxiety, and loneliness due to the lockdown, leading to an increase of at least 30% in the consumption of alcohol and other substances as a coping mechanism without awareness of health damage [6].

Along with many other regions, Ecuador is immersed in a crisis of multiple dimensions encompassing health, economy, social fabric, and politics. The country has already dealt with a precarious financial situation and is on the verge of facing the COVID-19 pandemic [7]. This landscape of formidable crisis, exacerbated by the overwhelming surge of COVID-19 patients, high mortality rates, and complex cases resulting from adverse drug reactions, has left the healthcare system and public institutions in a delicate state, making them more susceptible to the needs of citizens. Consequently, in the country, people have sought different alternatives to conventional medical care and have begun to intensively engage in self-medication [8, 9].

Given that in Ecuador, 70% of drug acquisitions are subject to prescription regulations within the Integral Public Health Network (RPIS), evidence has shown that many of these medications can be acquired without a medical prescription. This trend is not unique to Ecuador; it is also observed in various Latin American countries [10-12]. Consequently, the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have devised risk classification tools and checklists that emphasize the importance of mitigating the repercussions of self-medication. To quantify these risk factors and assess their severity, both organizations have employed the Hazard Risk Assessment Score (HRAS) tool [13, 14].

Based on this background, our study aimed to identify the self-medication and possible risks associated with drugs of Ecuadorians during the COVID-19 lockdown in Ecuador in 2020.

2. MATERIALS AND METHODS

This survey was developed during the first home lockdown in Ecuador, starting the outbreak peak from April 1 to April 20, 2020. The "Comité Nacional Expedito para Investigación sobre COVID-19" has approved the study as part of the "autosalud" proposal project MSP-MSP-2020-1113-O.

2.1. Study Design

A non-probability sampling for convenience pilot online survey was conducted with 363 participants from different regions and cities of Ecuador during the lockdown. This survey adopted a descriptive non-experimental research design to investigate the awareness and practice of self-medication conducted in April 2020 during the nationwide lockdown and increasing the number of positive COVID-19 cases. Because it was not feasible to do a community-

based sampling survey during this outbreak period, we decided to collect data online by convenience sampling and adopted the snowball sampling method. Instead, we used an open web-based survey using Google Forms (Appendix), distributed *via* social media platforms, such as WhatsApp and social networking (Instagram and Facebook). The survey was established based on the Hazard Risk Assessment Score (HRAS) tool. Before engaging in the web-based questionnaire, participants were allowed to provide informed consent voluntarily. The questionnaire briefly introduced the background, objective, procedure, voluntary nature of participation, declaration of anonymity and confidentiality, and notes for filling in the online questionnaire.

The inclusion criteria were participants with internet access and >18 years. We excluded all participants not in Ecuador during the first lockdown, those without internet, participants who did not carry out the lockdown, health professionals, and participants under 18 years old. To minimize bias during participant selection, the questionnaire with the questions of age, confinement, and population, which was not the objective of the study, was discarded.

2.2. Survey Design and Hazzard Risk Assessment Score

The survey questionnaire was grouped into nine sections, the first of which included participant confirmation and data protection disclosure before being carried out. The survey scheme involved the following stages. One is introducing the self-medication survey during COVID-19, in which we informed the primary objective of the study. Two, acceptance of the study, in which the participants could accept or decline participation. Third, Patient identification, in which we determine the age, gender, residency city, quarantine city, and educational level. Fourth, the etiology of self-medication, the focalization of the questionnaire was determined by three questions if, during the quarantine period, they have ever suffered any pain or discomfort associated with COVID-19; if they ever took or will take some drugs to treat the pain or discomfort, and if they knew the OTC medications. Fifth, the symptoms (related to the current Pandemic), which determined the main symptoms and the intensity, include fever, cough, back pain, sore throat, headache, shortness of breath, nasal congestion, loss of smell, loss of taste, or other symptoms. The sixth section, drug information, allows us to determine the severity of self-medication. We asked the participants about who recommended the drug and the frequency of the recommendation, the reason they took the medication without any medical consultation, where the participant obtained the medications, and which medication they consumed during the period if they read the instructions of the drug and if they understood the instruction of the medications. The seventh section is about the consumption of Medicines, in which we ask how the participants knew the doses of the medication, if they have been taking the same drugs but with different commercial brands or different pharmaceutical laboratories, how they consumed the medication, with coffee, water or another beverage. At this moment, did the participant decide to finalize the medication used, the treatment period, and if they had any other symptoms or discomfort related to the drug consumption? The eighth section is about possible adverse events related to medications. This question was addressed to those participants who answered that they suffered some discomfort after consuming the drug in the last section, and it was asked about the most common symptoms and their severity. It asked about what the participant did after presenting some of the symptoms. The last section was about the Image of the pharmacist professional, in which we asked the participants if they knew about the healthcare role and image of the pharmacist and if they trusted the pharmacist (Fig. **1**).

The overall score of the survey was derived from its minimum and maximum scores, encompassing both survey responses and clinically relevant indicators of predisposing self-medication factors [15-17]. The questionnaire scores ranged from a minimum of 15 to a maximum of 245 points. The scores were categorized, with 18 points indicating minimal risk of self-medication and 115 points signifying entire self-medication risk. The Self-medication Survey score, also known as the Hazard risk score in the context of COVID-19, was further delineated: a minimum hazard risk score of under 40 points indicated the minimal risk of self-medication behavior and a low likelihood of adverse drug reactions. A hazard risk score between 40 and 80 points indicated a moderate risk of mild behavior and potential adverse reactions to medications, categorizing this group as yellow in the Hazard identification and risk score system [18]. A severe hazard score exceeding 115 points corresponded to participants with high self-medication risks, potentially leading to adverse medication reactions, higher healthcare center visits, and an elevated risk of self-inflicted COVID-19. To assess the Hazard Risk Assessment Score, we meticulously analyzed the questionnaire's responses, focusing on indicators of self-medication behavior. The survey questions were stratified to establish the self-medication risk (Appendix). The arrangement of the queszthe Hazard Risk Assessment and Score (HRAS) matrix was guided by the Cardiff Vale University Health Board's Risk and Frequency Matrix, which categorized queries based on their presented risk and frequency in the study.

2.3. Statistical Analysis

The study carried out a data pre-treatment, which involved removing aberrant data, such as repeated surveys and missing data, that could distort the outcomes. Given that most variables in the database are qualitative and categorical, the analysis primarily revolved around frequencies and percentages as descriptive statistics. Inferential statistics were performed through the application of Fisher's exact test for independence. The "R Project" in the Rx64 4.0.2 version was employed for statistical analysis.
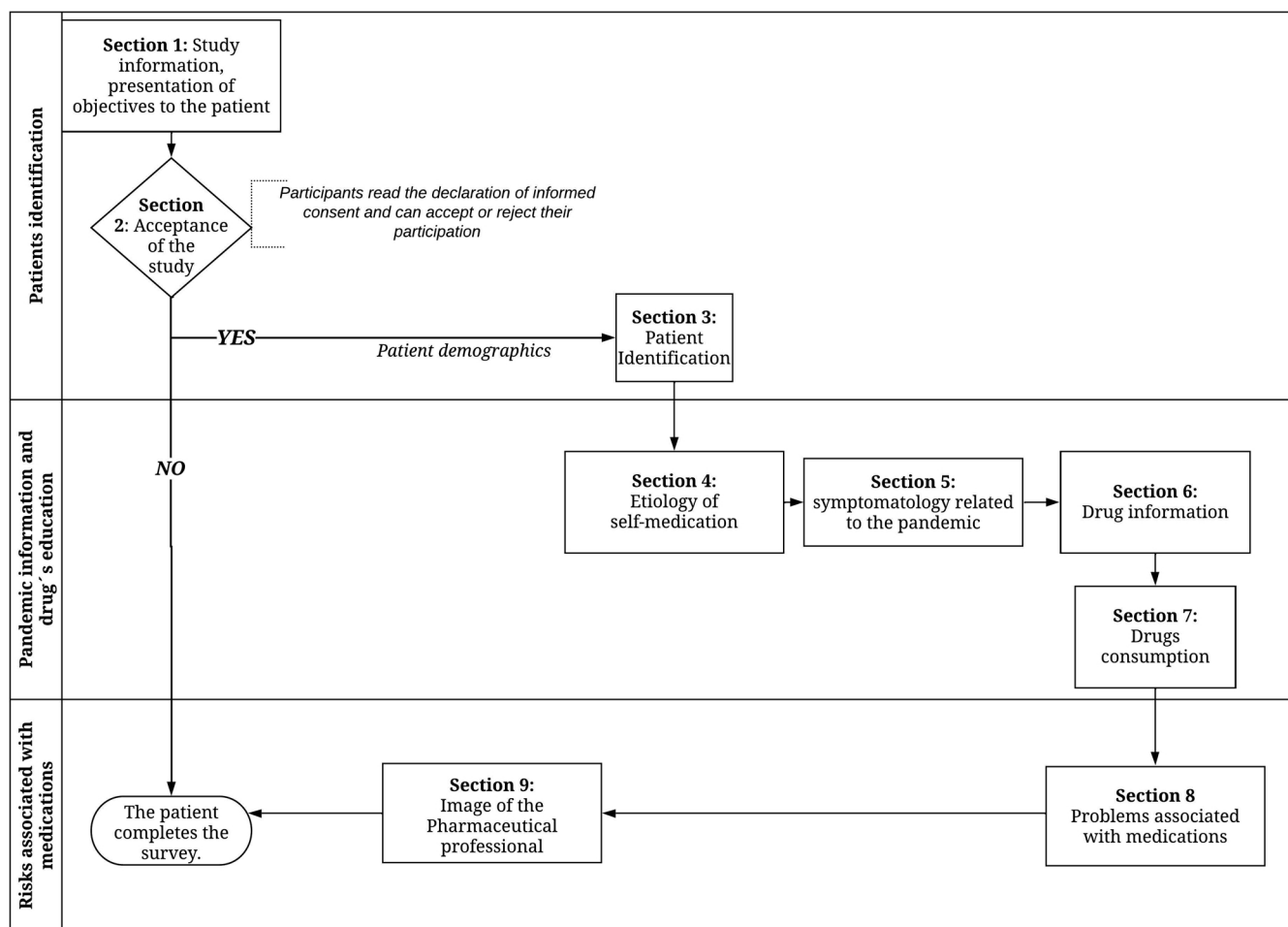
Fig. (1). Study design of the self-medication survey COVID-19.

2.4. Ethical Considerations

All participants were informed about the objectives and purpose of the study, and all participants provided electronic informed consent. This study was conducted by the Declaration of Helsinki and was approved by the Expedited Ethics Committee of the Ecuadorian Health Ministry (Approval No. 024–2020).

3. RESULTS

3.1. Prevalence of Self-medication during Lockdown

During the onset of the global COVID-19 lockdown in 2020, a period in which Ecuador faced its most significant surge in contagion and a notable increase in excess deaths, a comprehensive collection of responses was gathered from 363 participants who engaged in the questionnaire aimed at assessing the risk for self-medication. The demographic results established that 64% of the population held a higher level of education, while 27% attained postgraduate degrees, as presented in Table 1. Most surveyed individuals spent the lockdown period in different locations: 69% in Guayaquil, one of the largest cities of Ecuador; 6.3% in Manabí; 5% in Santa Elena; and the remaining 19.7% chose to stay confined in rural areas. Furthermore, specific queries regarding the knowledge of the public about medications were subjected to analysis. The results revealed that 74% reported using medication to alleviate their symptoms. Remarkably, 60% of those surveyed demonstrated a broad understanding of medicine, particularly Over-The-Counter (O.T.C.) medications.

About 67% of the population suffered pain or discomfort related to COVID-19 symptoms, and 74% indicated they took any medication to treat the condition. Additionally, 60% of Ecuadorians indicated a common knowledge about medicine, the O.T.C. medication.

The percentage of self-medication was determined by questions 7 and 8 (Table 2). The 25% of the population knew the drug dose by asking relatives or friends or reviewing the medicine leaflet, presuming indications of self-medication. An alarming number of 26% indicated that they were acquiring medicines elsewhere.

Table 1. General information of survey population during lockdown.

-	Frequency (Percentage)
Gender	
Male	99 (27%)
Female	265 (73%)
Age range	
16-21	14 (3,9%)
22-30	134 (36,8%)
31-45	128 (35,2%)
46-65	88 (24,1%)
Educational level	
Primary	1 (0,30%)
Secundary	33 (9,1%)
Third Level (University)	232 (62,9%)
Forth level (postgrade)	97 (26,7%)
Pandemic Location	
Guayas	252 (69,2%)
Carchi	2 (0,6%)
Cuenca	2 (0,6%)
El Oro	7 (1,9%)
Esmeraldas	1 (0,3%)
Foreign	7 (1,9%)
Loja	15 (4,1%)
Los Ríos	7 (1,9%)
Manabi	23 (6,3%)
Napo	6 (1,7%)
Pichincha	18 (4,9%)
Santa elena	19 (5,2%)
Santo Domingo	4 (1,1%)
Zamora	1 (0,3%)

Table 2. Critical questions of self-medication at the survey population during pandemic lockdown.

	Question	Total, Population N	Higher Education N (%)	Basic Education N(%)	p-value
7	*Who recommends you the treatment*				
	MD, pharmacist	327 (89)	266 (72)	61 (17)	-
	Social media	42 (11)	25 (7)	17 (4)	0.005 *
81	*Reasons why the survey population could lead to taking medication*				
	Never will take medication without a prescription	177 (49)	161 (48)	16 (45)	-
	Prevention	82 (23)	40 (12)	7 (20)	-
	Afraid of COVID-19	47 (12)	11 (3)	3 (8)	-
	Family adviced	14 (4)	30 (9)	5 (22)	-
	Read online, social media	35 (10)	9 (2)	0	-
	I did not have time for medical advice	9 (2)	78 (24)	4 (11)	0.4811
9	*Where did you buy the drugs*				
	Pharmacy	306 (84)	277 (84)	29 (82)	-
	Supermarkets	36 (10)	32 (10)	4 (11)	
	Family and Friends	15 (4)	13 (4)	2 (6)	0.7813
	Social media	7 (2)	7 (2)	0	
13	*How did you know the treatment doses?*				
	Asking an MD	222 (61)	198 (60)	24 (68)	
	Asking a pharmacist	48 (13)	43 (13)	5 (14)	0.4026
	Reading the drug instructions	52 (14)	47 (14)	5 (14)	
	Asking friends/ family/ social media	42(11)	41 (12)	1 (3)	

(Table 2) contd.....

	Question	Total, Population	Higher Education	Basic Education	p-value
		N	N (%)	N(%)	
	Which moment did you stop taking the treatment?				
16	According to health professional recommendations	202 (55)	183 (55)	19 (54)	-
	Not according to health professional recommendations	162 (45)	146 (45)	16 (46)	0.8797
	Treatment duration				
17	1-3 days	159 (44)	146 (44)	13 (37)	-
	3-5 days	74 (20)	59 (17)	15 (42)	-
	5-10 days	78 (21)	75 (23)	3 (9)	-
	>10 days	53 (15)	49 (15)	4 (11)	0.004043*

Note: The sum of all the reasons is the global percentage of self-medication (51%). (Prevention, afraid of COVID-19, Family adviced, read online, social media, I did not have time for medical advice) Statistical test: Xi Square with mantel-Haenszel correction; p-value * significant.
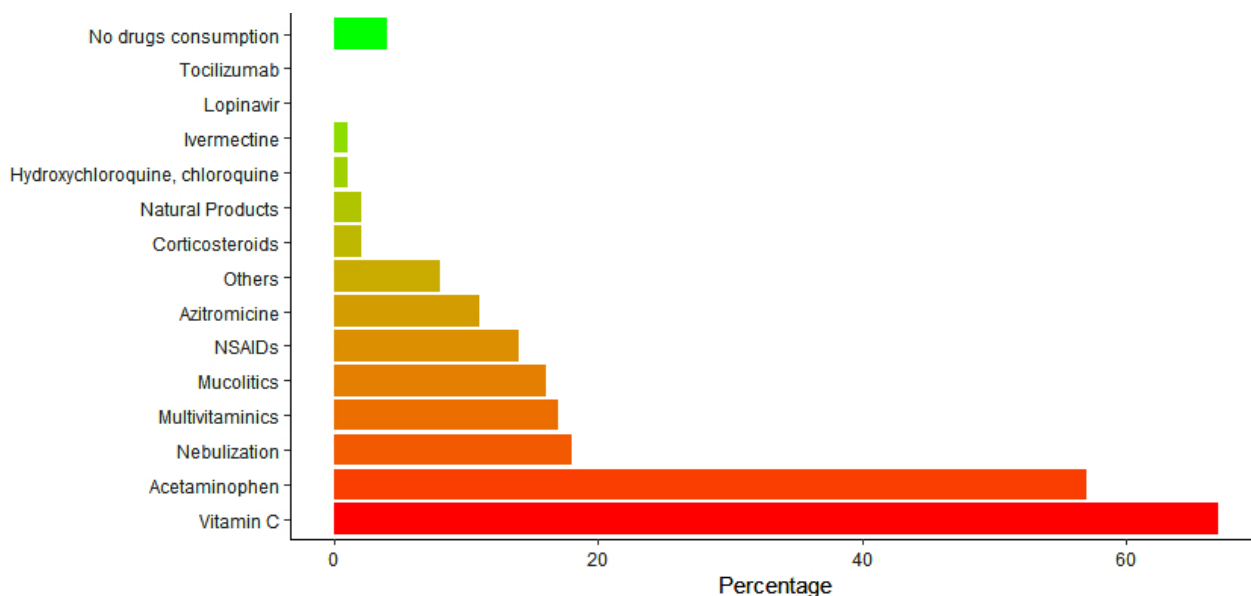
Fig. (2). Percentage of drug consumption of the survey population during SARS-CoV-2 confinement.

Regarding drug utilization patterns, our results revealed that Vitamin C and Paracetamol were the most frequently consumed, with 57% and 67% rates, respectively (Fig. **2**). Furthermore, 44% of the population used pharmacological treatments for only 1-3 days or a single dose, underlining impaired self-medication behavior (p=0.004).

3.2. Drug Risk and Severity used Analysis by Hazard Risk Assessment Score

The result of possible risks associated with drugs used by Ecuadorians during the COVID-19 lockdown in Ecuador recorded the highest Hazard Rate (H.R.) score of 25 points (question 8), underscoring the urgency of taking immediate steps to mitigate the risk of impending self-medication (55% of the population). Moreover, 35% of the surveyed population preferred therapeutic recommendations from the media over those provided by healthcare professionals. These findings underscore the gravity and frequency of self-medication consumption events. About 39% of the participants discontinued their treatment before seeking medical guidance, registering a Hazzard risk score of 12. Furthermore, three questions within the questionnaire attained an H.R. score of 14 points—questions 7b, 13, and 18—which applied to 74% of the population. It was determined that there is a high risk of self-medication with a score of 12 in the orange zone, which indicates that it is necessary to act within six months in these participants. In the same way, some participants presented a low risk in HRAS in the yellow zone, which means that the actions to be taken can be postponed for up to a year (Fig. **3**).

3.3. Drug-related Risk of the Study Population

Despite over 80% of the surveyed population not reporting any additional symptoms or occurrences related to medications, 12% encountered discomfort after medication intake, which included symptoms, such as

tachycardia at 2%, dizziness at 4%, nausea at 4%, vomiting at 2%, stomach pain at 3%, diarrhea at 3%, skin rash at 1%, pruritus at 2%, and exacerbation of dyspnea at 3%. Additionally, they were asked about the actions that they would take after presenting symptoms. These last participants were also asked about their actions after experiencing symptoms. The responses ranged from consulting a healthcare professional at 9% to self-administering another medication without supervision at 1% and seeking care at the emergency room at 2% (Table **3**).
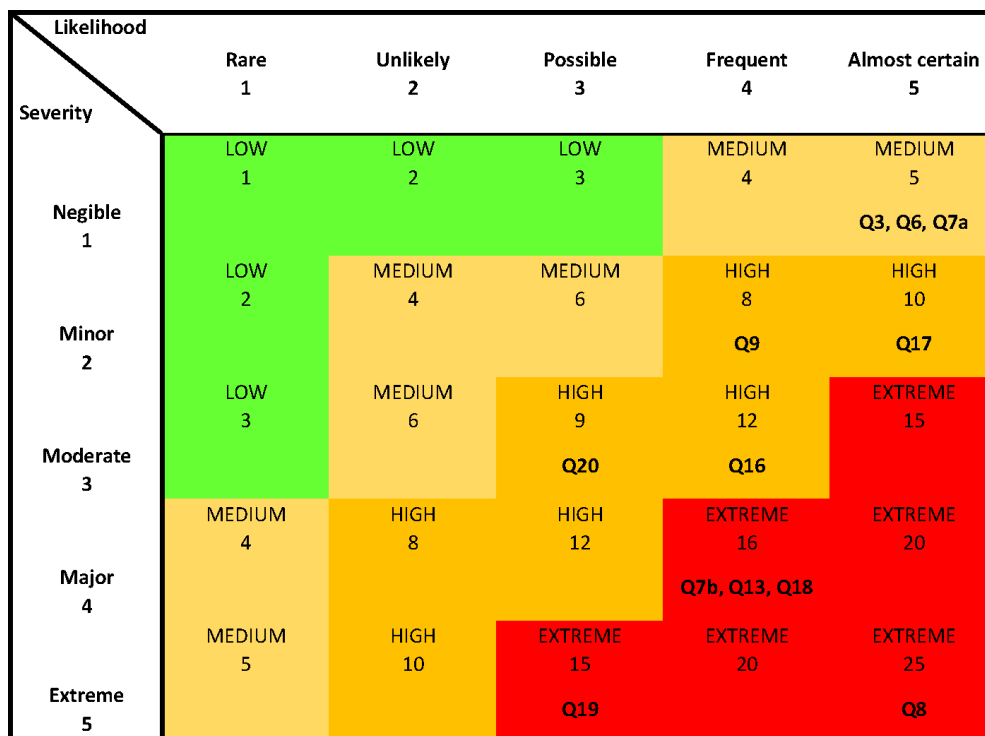

Fig. (3). Self-medication frequency score staging by severity (according to HRAS criteria).

Table 3. Drug-related risk during the COVID-19 lockdown.

Questions	N (%)
Question 18: After taking the drug or medication, did you feel any discomfort related to the drug? (Adverse drug reaction)	
No	322 (88%)
Yes	42 (12%)
Question 19: What type of adverse reaction did you present related to taking medications?	
Tachycardia	
Not answer	343 (94%)
Non-existent	12 (3%)
Mild	4 (1%)
Moderate	5 (1%)
Severe/intense	0 (0%)
Dizziness	-
Not answer	344 (95%)
Non-existent	9 (2%)
Mild	6 (2%)
Moderate	3 (1%)
Severe/intense	2 (1%)
Vomito	
Not answer	341 (94%)
Non-existent	12 (3%)

(Table 3) contd.....

Questions	N (%)
Mild	6 (2%)
Moderate	4 (1%)
Severe/intense	1 (0%)
Nauseous	
Not answer	339 (93%)
Non-existent	9 (2%)
Mild	7 (2%)
Moderate	8 (2%)
Severe/intense	1 (0%)
Skin rash	
Not answer	347 (95%)
Non-existent	14 (4%)
Mild	1 (0%)
Moderate	2 (1%)
Severe/intense	0 (0%)
Skin itch	
Not answer	344 (95%)
Non-existent	12 (3%)
Mild	4 (1%)
Moderate	4 (1%)
Severe/intense	0 (0%)
Yellowing of the skin (Jaundice)	
Not answer	349 (96%)
Non-existent	15 (4%)
Mild	0 (0%)
Moderate	0 (0%)
Severe / intense	0 (0%)
Worsening breathlessness or choking	
Not answer	344 (2%)
Non-existent	10 (2%)
Mild	6 (2%)
Moderate	4 (2%)
Severe/intense	0 (2%)
Question 20: What did you do or what would you do after developing any of these symptoms?	
Not answer	325 (89%)
Ask a doctor	29 (8%)
Ask a pharmacist	2 (1%)
Go to the emergency room	2 (1%)
Ask a family member or friend	1 (0%)
Search for the response on social media	1 (0%)
Take another medicine	3 (1%)
Various other	1 (0%)

Table 4. Pharmacist image as a health professional during the lock-down.

Questions	N (%)
Question 21: Did you know that the pharmaceutical professional can assist you with your questions regarding drugs in this PANDEMIC?	
Yes	195 (54%)
Not sure	121 (33%)
No, I do not trust them	48 (13%)
Question 22: Do you trust the role of the pharmacist as a health professional?	
Yes	-
No, I will never trust them	239 (66%)
I do not know any pharmacist	60 (16%)
-	65 (18%)

Questions	N (%)
Question 23: Do you prefer to find the same pharmacist for the delivery of your medications?	
Yes	185 (51%)
No	179 (49%)

We also evaluated the influence of pharmacists as healthcare professionals in Ecuador. In 46% of the population, pharmacists were required to comprehend their role within the medical team better, particularly their ability to guide prescription medications. Additionally, 34% of the interviewees indicated a lack of trust and familiarity with pharmacists' role as healthcare professionals, and 49% of the population remained unaware that they could seek a consulting pharmacist for medicine delivery and dispensing (Table **4**).

4. DISCUSSION

Our study has found that 67% of the population suffered any symptom of COVID-19 related or discomfort, and 74% took any medication to treat the condition. Overall, 51% of Ecuadorians practiced self-medication independently of their education level. Even though some participants previously responded that health professionals recommended the treatment, 25% of the study population determined the drug dose by asking relatives or friends or reviewing the medicine leaflet, our leading indicator of self-medication. Similarly, a recent study by Miñan-Tapia and colleagues showed that around 51.5% of the Peruvian population also practiced self-medication [19]. Another study on self-medication patterns in Ecuador found a rate of 53.5% during the first wave. Ecuadorians practice this pattern, which is more evident in women [20].

When considering the methods of medicine acquisition, 26% of the population preferred to obtain information on social media or phone group chats rather than in the pharmacy. A concerning data rely on the frequent consumption (44% of our study population) of a single dose of medications usually prescribed for a period, such as vitamins, azithromycin, and mucolytics. Single-dose consumption without professional supervision or indications is also considered self-medication [21]. Unfortunately, this single-dose consumption of antibiotics, such as azithromycin, promotes drug–resistance, a significant public health problem worldwide [22, 23]. Even though Vitamin C endovenous administration as a single dose is used for COVID-19 treatment at the hospital level [24, 25], consumption of Vitamin C at an ambulatory level with oral administration still needs reliable information about its safety and effectiveness before suggesting recommendations. Our study corroborates the literature that indicates that 56% of the population from other regions of Ecuador acquired medicines and obtained information about their use on social media, mainly during the first COVID-19 wave [9].

The lockdown experienced in many countries due to the COVID-19 pandemic has magnified facing outbreaks, which are responsible for O.T.C. medication. These lead to adverse reactions, such as hydroxychloroquine, azithro-

mycin, and acetaminophen. The most used drugs for COVID-19 treatment were hydroxychloroquine [26]and azithromycin [27].

Our data show that Vitamin C was the most consumed drug in a single dose by 67% of the survey population. The following was acetaminophen, which was consumed by 54% of the population. Even though acetaminophen is an O.T.C. medication, it has risks, such as hepatotoxic damage [8]. A study in The United States showed that 48.29% of people suffered acetaminophen poisoning [28, 29]. Of this population, 72.72% suffered from kidney failure and heart issues, indicating possible toxicity unawareness due to prolonged consumption or an increased daily dose [13, 30].

Nebulization, vitamin supplementation, and combined azithromycin with hydroxychloroquine were reported to be less than 15% [31]. These differences could be due to the analysis period, considering our study has focused on the COVID-19 lockdown. Even though there is a high risk of self-medication in Ecuador, medication consumption is more related to preventing COVID-19. Nevertheless, in our study, the consumption was mainly of a single dose, compared with other studies that reported a paired self-medication prevalence. Ivermectin, acetaminophen, and azithromycin are consumed by over 50% of the population [17]. Quizpe Cañaris and colleagues determined that the primary medication consumption among the population during the lockdown was acetaminophen, with a rate of 27% [15].

The risk of self-medication is a worldwide concern that demands the development of tools to evaluate and mitigate its effects [32]. The Hazard Risk Assessment Score (HRAS) tool assesses risk factors for a given 'problem' and stratifies them according to severity and frequency [33]. This study research is necessary to have a national range of studies and limited investigation that use the HRAS tool to identify risk factors, severity, and frequency of self-medication. About 55% of the population had a risk of imminent self-medication with HRS 25 points, and 35% preferred therapy recommendations from social media rather than health professionals. We determined 55% higher risk and 74% mild risk in actions that have been considered for decreasing the HRS of self-medication in our population. The documentary framework on the unsafe practice of consumption of these medicines describes advantages, such as promoting responsible self-medication, reducing the bill of public spending by transferring it to private spending, and saving time for health professionals and citizens by reducing the number of primary care for minor symptoms [17, 34-36]. However, the current public policy does not cover a security framework for consumerism [35]. This policy affects the main use drawbacks, such as correct information being received only through advertising offers, increased costs

as greater medication consumption is derived inappropriately, and adverse side effects due to misuse. It generates the opposite outcome: irresponsible self-medication with greater distrust of the vendor and the consumer [36-38].

Even though we reported a 12% lower rate of drug-related problems in the study population, which were acetaminophen and Vitamin C. Additionally, our study identified that 49% of the survey population did not know that pharmacists could assist them during drug-related issues. These results correlated with a study conducted in the U.S. about acetaminophen consumption in which 56% of the population did not know that the pharmacist could help with O.T.C. medication to avoid self-medication, and 72% presented effects of adverse [39]. These results show an urgency in Ecuador to regulate O.T.C. medication and pharmacovigilance, which is necessary to avoid serious consequences. In the quality management of pharmaceutical care, relevant information with a safety profile on any drug must reach the consumer [35]. This action can reduce drug-related problems, besides educating the population about the proper use of medication and the importance of contacting a health professional.

According to the outcomes of this study, self-medication is the highest risk in Ecuador. Further studies must be conducted to determine the extent of the consequences and causes of self-medication, such as how self-medication practice could increase health spending. The development of automatic information systems might be safe to contribute to the search for this over-the-counter (O.T.C.) medication, as Han-Yu Sung and colleagues developed an improved drug consultation system, especially for self-medication users [40]. As we show in our results, the image of pharmacists as health professionals must be better received. Nevertheless, pharmaceutical professionals at this level need to be more present [41]. The question arises: Who oversees identifying the effects of self-medication and preventing or resolving such problems? This approach far exceeds the activities traditionally carried out by the person who currently collaborates in most hospitals nationwide, so the new processes must be adapted to this new paradigm" [42].

CONCLUSION

In conclusion, our results indicate that at least 55% of the population had a high or maximum risk of self-medication and the appearance of drug-related problems despite the high level of education of the surveyed population. Therefore, the indiscriminate use of drugs and self-medication in the Ecuadorian population can be controlled by the development of public health educational programs that communicate with the general population. We determined that working on the health education of the Ecuadorian population and the image of pharmacists as health professionals could mitigate this growing problem. There have been overselling drugs, azithromycin and paracetamol. It could lead to an increase in intoxication and even mortality. Further, hydroxy-

chloroquine and tocilizumab are still being evaluated for their effectiveness in hospitalized patients.

Health education regarding the administration, monitoring, and completion of medical treatment makes it imperative to improve the image of pharmacists as part of the multidisciplinary health team, monitor the prescription of the doctors, and reduce the side effects of the medications. Further cross-sectional studies with a larger population and extended timeline are being performed to confirm the self-medication risk and prevalence. Besides, longitudinal studies with PCR SARS-CoV-2 detection, drug consumption, and symptoms are being carried out to confirm the study.

7. STRENGTHS AND LIMITATIONS

The limitation of our study is the national sample size, which needs to be increased to improve the significance of the results. It is also important to note that self-reported data may be affected by recall bias or inaccuracies, potentially impacting result accuracy. Additionally, focusing solely on single-dose consumption of vitamins and antibiotics may limit the scope of the study by not considering chronic self-medication patterns. Further research is necessary to understand self-medication behavior using a longitudinal approach and the Hazard Risk Assessment Score, which evaluates the high risk of self-medication and drug-related problems in the population.

The study on self-medication practices among Ecuadorian adults during the COVID-19 pandemic has several strengths that enhance its academic rigor and relevance. We address a critical public health issue - self-medication - in the context of the COVID-19 pandemic. During this period, we encountered challenges in healthcare access and widespread misinformation, potentially exacerbating self-medication behaviors. The findings offer valuable insights into the response of the population to healthcare limitations during a global crisis. This detailed examination of specific self-medication behaviors, such as the single-dose consumption of vitamins and antibiotics, adds depth to the literature on risky medication practices. This focus highlights behaviors that may contribute to public health risks, such as antibiotic resistance. There is high relevance in public health, emphasizing the need for targeted public health interventions to educate the population on the risks associated with unsupervised medication use. This practical application of the findings makes the study highly valuable for public health policymakers and healthcare professionals. By focusing on the consumption of single doses of medications, particularly antibiotics like azithromycin and vitamins, the study sheds light on specific practices that may pose long-term health risks. This aspect of the research is particularly relevant for addressing issues, such as drug resistance and inappropriate medication use during the pandemic.

AUTHORS' CONTRIBUTIONS

D. D. G., S. O.-M., A. O.-M.: Study concept or design;

M. J. V.: Data analysis or interpretation; D. O., D. A.-M., L. C.-T., F. G.-F., K. A., L. D.-S.: Writing the paper; Y. S.: Data collection.

LIST OF ABBREVIATIONS

HRAS = Hazard-Risk-Assessment-Score

WHO = World Health Organization

CDC = Centers for Disease Control and Prevention

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All experimental protocols were approved by the "Comité Nacional Expedito para Investigación sobre COVID-19" as part of the "autosalud" proposal project MSP-MSP-2020-1113-O and Expedited Ethics Committee of the Ecuadorian Health Ministry, Ecuador (Approval No. 024–2020).

HUMAN AND ANIMAL RIGHTS

All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

All participants were informed about the objectives and purpose of the study, and all participants provided electronic informed consent.

STANDARDS OF REPORTING

COREQ guidelines were followed.

AVAILABILITY OF DATA AND MATERIALS

The data and supportive information are available within the article.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

REFERENCES

[1] Chautrakarn S, Khumros W, Phutrakool P. Self-medication with over-the-counter medicines among the working age population in metropolitan areas of Thailand. Front Pharmacol 2021; 12: 726643.
http://dx.doi.org/10.3389/fphar.2021.726643 PMID: 34456738

[2] Machado-Alba JE, Echeverri-Cataño LF, Londoño-Builes MJ, Moreno-Gutiérrez PA, Ochoa-Orozco SA, Ruiz-Villa JO. Economic, social and cultural factors associated with self-medication. Biomédica 2014; 34(4): 580-8.
http://dx.doi.org/10.7705/biomedica.v34i4.2229 PMID: 25504247

[3] Baracaldo-Santamaría D, Trujillo-Moreno MJ, Pérez-Acosta AM, Feliciano-Alfonso JE, Calderon-Ospina CA, Soler F. Definition of self-medication: A scoping review. Ther Adv Drug Saf 2022; 13
http://dx.doi.org/10.1177/20420986221127501 PMID: 36211626

[4] The work of WHO 1986-1987: Biennial report of the director-general. 1988. Available from: https://iris.paho.org/handle/10665.2/45438?show=full&locale-attribute=es

[5] Peshkovskaya A, Galkin S. Health behavior in Russia during the COVID-19 pandemic. Front Public Health 2023; 11: 1276291.
http://dx.doi.org/10.3389/fpubh.2023.1276291 PMID: 37849726

[6] Peshkovskaya A. Letter to the editor: Other consequences. COVID-19 and underestimated public health crisis. J Psychiatr Res 2021; 144: 320-2.
http://dx.doi.org/10.1016/j.jpsychires.2021.10.038

[7] Herrera-Lasso Regás V, Dordal Culla MT, Lleonart Bellfill R. Adverse reactions to drugs used in the specific treatment of SARS-CoV-2 infection. Med Clin (Barc) 2020; 155(10): 448-53.
http://dx.doi.org/10.1016/j.medcli.2020.06.019 PMID: 32718715

[8] Paladines-Santacruz GL, Orellana-Manzano A, Manzano P, *et al*. Hepatoprotective effect of a novel functional drink based on Ecuadorian plant species. FASEB J 2022; 36(S1): fasebj.2022.36.S1.0R543.
http://dx.doi.org/10.1096/fasebj.2022.36.S1.0R543

[9] Arias F, Izquierdo-Condoy J S, Naranjo-Lara P, *et al*. A cross-sectional analysis of self-medication patterns during the COVID-19 pandemic in Ecuador. Medicina (Kaunas) 2022; 58(11): 1678.
http://dx.doi.org/10.3390/medicina58111678

[10] Izquierdo-Condoy JS, Morales-Lapo E, Hidalgo M, *et al*. Job satisfaction and self-perceptions among Ecuadorian medical doctors during their compulsory rural community social service: A countrywide cross-sectional analysis. J Prim Care Community Health 2023; 14
http://dx.doi.org/10.1177/21501319231179936 PMID: 37291965

[11] Droguett N, Vidal C, Medina B, Hoffmeister L. Factors associated with the use of nonprescription psychotropic drugs in Chile: A descriptive study using a nationwide drug consumption survey. Medwave 2019; 19(6): e7670.
http://dx.doi.org/10.5867/medwave.2019.06.7670 PMID: 31442218

[12] Castaño N, Cordts SC, Kurosu Jalil M, *et al*. Fomite transmission, physicochemical origin of virus–surface interactions, and disinfection strategies for enveloped viruses with applications to SARS-CoV-2. ACS Omega 2021; 6(10): 6509-27.
http://dx.doi.org/10.1021/acsomega.0c06335 PMID: 33748563

[13] Prudhvi V, Sravani R, Beulah D, Anantha CH. A prospective randomised study on prevalence and awareness of self medication of analgesics among teritiary care hospital. World J Curr Med Pharm Res 2020; 2(1): 63-6.
http://dx.doi.org/10.37022/WJCMPR.2020.02016

[14] Algren A. Acetaminophen toxicity. Toxicology Cases for the Clinical and Forensic Laboratory. 2020; pp. 75-7.
http://dx.doi.org/10.1016/B978-0-12-815846-3.00035-1

[15] Quispe-Cañari JF, Fidel-Rosales E, Manrique D, *et al*. Self-medication practices during the COVID-19 pandemic among the adult population in Peru: A cross-sectional survey. Saudi Pharm J 2021; 29(1): 1-11.

http://dx.doi.org/10.1016/j.jsps.2020.12.001 PMID: 33519270

[16]   Knight M, Bunch K, Vousden N, *et al.* Characteristics and outcomes of pregnant women admitted to hospital with confirmed SARS-CoV-2 infection in UK: National population based cohort study. BMJ 2020; 369: m2107.
http://dx.doi.org/10.1136/bmj.m2107 PMID: 32513659

[17]   Dahir C, Hernandorena C, Chagas L, Mackern K, Varela V, Alonso I. Self-medication: A determinant in the rational use of medicines. Evid Update Outpatient Pract 2015; 18(2)
http://dx.doi.org/10.51987/evidencia.v18i2.6328

[18]   Sahoo B, Sahoo MC, Pillai JS. Making our hospitals a safe workplace: Hazard Identification and risk assessment at a tertiary-level public hospital in Eastern India. Cureus 2024; 16(4): e59110.
http://dx.doi.org/10.7759/cureus.59110 PMID: 38803767

[19]   Miñan-Tapia A, Conde-Escobar A, Calderon-Arce D, Cáceres-Olazo D, Peña-Rios AJ, Carlos Donoso-Romero R. Associated factors to self-medication with drugs related to COVID-19 in health science students from a Peruvian city. SciELOPreprints 2020.
http://dx.doi.org/10.1590/SciELOPreprints.1225

[20]   López Arias M, López Arias YL, Zuluaga Valencia JB. Autism spectrum disorder and social cognition: A review study. Psicoespacios 2022; 16(29): 1-20.
http://dx.doi.org/10.25057/21452776.1483

[21]   WHO. The role of the pharmacist in self-care and self-medication: Report of the 4th WHO consultative group on the role of the pharmacist, The Hague, The Netherlands. 1998. Available from: https://iris.who.int/handle/10665/65860(Accessed on: Jul 26, 2024)

[22]   Medina E, Pieper DH. Tackling threats and future problems of multidrug-resistant bacteria. Curr Top Microbiol Immunol 2016; 398: 3-33.
http://dx.doi.org/10.1007/82_2016_492 PMID: 27406189

[23]   Heinemann JA. How antibiotics cause antibiotic resistance. Drug Discov Today 1999; 4(2): 72-9.
http://dx.doi.org/10.1016/S1359-6446(98)01294-X   PMID: 10234159

[24]   Milani C, Lugli GA, Fontana F, *et al.* METAnnotatorX2: A comprehensive tool for deep and shallow metagenomic data set analyses. mSystems 2021; 6(3): e00583-21.
http://dx.doi.org/10.1128/mSystems.00583-21 PMID: 34184911

[25]   Tabatabaeizadeh SA. Safety and effectiveness of high-dose vitamin c in patients with COVID-19: A randomized open-label clinical trial. Eur J Med Res 2021; 26(1): 1-9.
http://dx.doi.org/10.1186/S40001-021-00490-1/TABLES/2 PMID: 33388089

[26]   Kapoor A, Guha S, Kanti Das M, Goswami KC, Yadav R. Digital healthcare: The only solution for better healthcare during COVID-19 pandemic? Indian Heart J 2020; 72(2): 61-4.
http://dx.doi.org/10.1016/j.ihj.2020.04.001 PMID: 32534691

[27]   Herrera-Lasso Regás V, Dordal Culla MT, Lleonart Bellfill R. Adverse reactions of drugs specifically used for treatment of SARS-CoV-2 infection. Medicina Clínica (English Edition) 2020; 155(10): 448-53.
http://dx.doi.org/10.1016/j.medcle.2020.06.026 PMID: 33521297

[28]   Ishitsuka Y, Kondo Y, Kadowaki D. Toxicological property of acetaminophen: the dark side of a safe antipyretic/analgesic drug? Biol Pharm Bull 2020; 43(2): 195-206.
http://dx.doi.org/10.1248/bpb.b19-00722 PMID: 32009106

[29]   Pawa K, Ray SD. Acetaminophen. Encyclopedia of Toxicology. 2023.
http://dx.doi.org/10.1016/B978-0-12-824315-2.00159-7

[30]   Adam Algren D, Khazaeni B. Acetaminophen toxicity. StatPearls. PMID: 28722946

[31]   Cadegiani FA, Goren A, Wambier CG, McCoy J. Early COVID-19 therapy with azithromycin plus nitazoxanide, ivermectin or hydroxychloroquine in outpatient settings significantly improved COVID-19 outcomes compared to known outcomes in untreated patients. New Microbes New Infect 2021; 43: 100915.
http://dx.doi.org/10.1016/j.nmni.2021.100915 PMID: 34249367

[32]   BMA briefing: Living with COVID-19 response. Available from: https://www.bma.org.uk/advice-and-support/covid-19/what-the-bma-is-doing/bma-briefing-living-with-covid-19-response(Accessed on: Jul 26, 2024)

[33]   CCOHS: Annual   report.   Available   from: https://www.ccohs.ca/ccohs/reports/annual/2017/annual1718.html (Accessed on: Jul 26, 2024)

[34]   Quality medicines – National public procurement service. Available   from: https://portal.compraspublicas.gob.ec/sercop/medicamentos-de-calidad/(Accessed on: Jul 26, 2024)

[35]   Garzón Ricaurte W. Legislation on access to medicines in Ecuador. Biological medicines, present and future of therapeutics. 2017; pp. 189-202.

[36]   Astudillo Gavilanes R A. Pharmacoeconomics and the impact of drug prices on the cost of therapeutic treatment of common diseases in Ecuadorians. Master's Thesis in Business Management (FCA) 2011.

[37]   Cavaco E, Pacheco I, Camara J. Detailing of concrete-to-concrete interfaces for improved ductility. Eng Struct 2018; 156: 210-23.
http://dx.doi.org/10.1016/j.engstruct.2017.10.058

[38]   Tobón Marulanda FÁ, Montoya Pavas S, Orrego Rodriguez MÁ. Family self-medication, a public health problem. Educación Médica 2018; 19: 122-7.
http://dx.doi.org/10.1016/j.edumed.2017.03.004

[39]   Prudhvi PVVP, Deepika S, Sutar PP. Modeling moisture and solids transfer kinetics during a novel microwave assisted water absorption-desorption process of dry red gram (*Cajanus cajan* L.) splits. J Food Eng 2022; 318: 110891.
http://dx.doi.org/10.1016/j.jfoodeng.2021.110891

[40]   Sung HY, Chi YL. A knowledge-based system to find over-the-counter medicines for self-medication. J Biomed Inform 2020; 108: 103504.
http://dx.doi.org/10.1016/j.jbi.2020.103504 PMID: 32673790

[41]   Rincón Alarcón AC, Villalón Muñoz PA, Escudero Vilema Ed, Toaquiza Aguagallo CN, Miranda AA, Aguiar Torres C. Evaluation of the pharmaceutical care service in four private pharmacies in Riobamba, Ecuador. Rev Cubana Farm 2019; 52(2)

[42]   Legal base-national directorate of medicines. Available from: https://www.salud.gob.ec/base-legal-direction-nacional-de-medicamentos/