

# A Comparative Piloting of Determinants of Self-Medication Among University Students in the MENA Region; UAE and Jordan as an Example

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**Purpose:** Unsupervised self-medication (SM) is a global public health concern. University students are particularly vulnerable due to misperceptions of improved academic performance and thus are at risk of dependence, addiction, and drug overdose. Past studies have shown an alarming prevalence of SM among university students in the Middle East and North Africa (MENA) region. However, there is a scarcity of reports from the region dissecting determinants of SM. Therefore, this study aimed to determine the prevalence and epidemiological correlates of SM among university students and its perceived impact on their academic performance.

**Methods:** Two countries in the MENA region were surveyed in a cross-sectional design; UAE and Jordan. Through a stratified sampling technique, undergraduate students in both healthcare and non-healthcare majors of study were recruited to participate. A structured, self-administered questionnaire developed for the purpose of this study was distributed to consented participants via the university's official email. Statistical analyses were performed using SPSS. Descriptive and inferential statistics were used to analyze data. A  $p$ -value  $<0.05$  was considered statistically significant.

**Results:** A total of 362 students participated in the study (74% were females, 60% were from the UAE, and 59% were in healthcare majors). Significantly higher prevalence rates and adjusted odds of SM were found among females, students from Jordan, and those in healthcare majors, particularly for paracetamol (90.2% of females [ $p=0.001$ ], 88.3% from Jordan [ $p=0.03$ ], 92.5% in healthcare majors [ $p=0.001$ ]) and antibacterial drugs (48.9% of females [ $p=0.01$ ], 60.7% from Jordan [ $p=0.001$ ], 53.3% in healthcare majors [ $p=0.001$ ]). Majoring in healthcare fields was the most consistent determinant of such practice, while social influences of family and friends represented the chief source of recommendation. Only 21% of respondents assumed SM boosts their academic performance.

**Conclusion:** Our pilot study underlines the predominant determinants of SM among university students in the MENA region, namely female gender, students from Jordan, and those in healthcare majors. Informed data-driven awareness campaigns to mitigate such practice should be designed to focus on these susceptible populations.

**Keywords:** self-medication, university, pilot, UAE, Jordan, MENA

## Introduction

Self-medication (SM) is the practice of using drugs according to self-diagnosis without referring to physicians, or continuing the use of a physician-prescribed drug beyond its specified time.<sup>1,2</sup> A recent surge in SM rates has been reported worldwide, reaching endemic proportions among populations in developing countries.<sup>3</sup> University students in general,<sup>4</sup> and those in the Middle East and North Africa (MENA) region in particular,<sup>5</sup> have embarked heavily on such practice warranting public health attention. Past studies have shown a prevalence of SM among university students reaching up to 98.7% in Saudi Arabia,<sup>6</sup> 98.4% in Jordan,<sup>7</sup> 98% in Palestine,<sup>8</sup> 97.8% in Kuwait,<sup>9</sup> 92.4% in Iraq,<sup>10</sup> 86.7% in Iran,<sup>11</sup> 86% in the UAE,<sup>12</sup> 79.5% in Sudan,<sup>13</sup> and 62.9% in Egypt.<sup>14</sup> These alarmingly high prevalence rates

encompassed mainly students who were influenced by TV commercials, online advertisements, and purchasing through mass media. Unfortunately, university students, as educated individuals, tend to share their experiences and recommend SM to their family and friends.<sup>15</sup>

The informed and responsible self-use of medicines has the potential to save time and cost on the patient, as well as reducing the load on the different constituents of the national healthcare system, including the emergency departments, outpatient and private clinics, primary healthcare facilities, governmental agencies, and insurance companies.<sup>16</sup> This has been particularly elucidated during times of crises such as that during the most recent coronavirus pandemic (COVID-19).<sup>17</sup> However, the unsupervised reliance on the practice of SM carries detrimental consequences, including missed/delayed diagnosis, development of drug resistance, addiction and dependence, and drug overdose and death, warranting immediate interventions to tone down these long-term effects.

A considerable number of papers has been produced in recent years to tackle the epidemiology of SM among university students in the MENA region (Table 1). Based on the sociodemographic factors of investigated student populations, the university major has been frequently underscored for playing a pivotal role in SM habits, with medical and pharmacy students being the most prone.<sup>3,18–22</sup> Furthermore, over-the-counter analgesics and non-steroidal anti-

**Table 1** Summary of a Selected Number of Published Research Articles Assessing the Prevalence of Self-Medication Among University Students in the MENA Region (as Defined by the UNICEF Website in 2021)

Country	Year	First Author	Sample Size	Prevalence Rate (%)	Ref. Number
Bahrain	2006	James	134	44.8	20
Egypt	2011	El Ezz	300	55.0	21
	2017	Helal	800	62.9	14
Iran	2012	Tabiei	1048	86.7	11
	2014	Pirzadeh	197	85.0	27
	2016	Ahamdi	364	33.7	26
Iraq	2017	Al-Ameri	1435	92.4	10
Jordan	2016	Alkhatatbeh	1317	78.5	32
	2018	Alshogran	504	96.0	18
	2019	Malak	1565	98.4	7
Kuwait	2014	Al Hussaini	837	97.8	9
Libya	2015	Ghaieth	363	N/A	31
Palestine	2008	Sawalha	1581	98.0	8
Saudi Arabia	2016	Albasheer	300	87.0	37
	2019	Alshahrani	528	98.7	6
	2021	Mannasaheb	371	55.5	28
	2022	Al-Qahtani	205	60.0	35
Sudan	2007	Awad	1121	79.5	13
Syria	2017	Haroun	436	40.9–60.5	22
UAE	2012	Sharif	169	86.0	12
	2019	AlQahtani	566	70.7	24
	2022	Al-Kubaisi	2355	57.5	38

inflammatory drugs (NSAIDs), as well as antibiotics, have been found to be the most widely used SM drugs worldwide.<sup>23,24</sup> Substantively cited motives for such practices by university students included perceiving symptoms as minor and too insignificant to visit a physician, thus saving their time and money.<sup>15,25–28</sup> SM was also sought by many students to better their academic performance.<sup>29</sup>

There is, however, a considerable variability in the reported prevalence rates of SM practices by university students in the aforementioned studies from the MENA region. This can be principally attributed to the lack of standardization of study population, design, and endpoints, limiting their comparability and the exact assessment of the scale of misuse.<sup>5</sup> As a result, building on the generated conclusions of those studies to audit, guide, and inform drug prescription policy making efforts becomes seriously problematic. For instance, the recent adoption of the Antimicrobial Stewardship Programs (ASP) in several countries of the MENA region necessitates gauging its uptake and application, particularly amid the more educated stratum of the community; ie, university students.<sup>30,31</sup>

Based on this background, this study aimed to comparatively pilot the prevalence and epidemiological determinants of SM practice among university students, as well as correlating the habits of SM with the perceived effect on academic performance. Two countries in the MENA region were surveyed; UAE and Jordan.

## Subjects and Methods

### Ethical Statement

This study was approved by the Research Ethics Committee at Ajman University (#C-H-F-April 13), and in accordance with the Declaration of Helsinki.

### Study Design, Population, and Settings

An analytical cross-sectional study was conducted between September 2021 to June 2022. A stratified sampling technique was used to recruit undergraduate students (ages of 18–25 years) at both Ajman University, UAE, and Jordan University of Science and Technology, Jordan. Students from healthcare-related (medicine, dentistry, pharmacy, nursing, allied health) and non-healthcare related (engineering, sciences and arts, and humanities) university majors were eligible to participate in the study. Study participants were recruited using a standardized online “recruitment message” explaining the purpose of the study and asking participants for consent. Messages were disseminated via official university websites and social media platforms (WhatsApp, Facebook, etc.). Consented respondents received an electronic version of a questionnaire specifically developed and piloted for the purpose of this study.

### Study Questionnaire

A structured questionnaire was used to collect the study data. The questionnaire was adapted from several instruments used elsewhere considering the aim of the current study.<sup>7,14,18,32</sup> Validity of the questionnaire was reviewed by an expert panel of physicians, pharmacists, students, academicians, and public health experts. The questionnaire was then piloted on a sample of 20 students from each institution to check for the time needed to finish, overall understanding of its components, particularly with students in non-healthcare-related fields of study, as well as the interpersonal and intrapersonal consistency. All needed adjustments were then made as scientifically justified. Those were not included in the final results. The overall reliability of the study tool was assessed using Cronbach alpha (0.7).

The questionnaire consisted of four major sections; sociodemographic characteristics, past medical and surgical history, SM habits and correlates, and academic performance. The sociodemographic characteristics section included questions relating to gender, age, nationality, marital status, university major, academic level, and social behavior indicators such as smoking habits. The past medical and surgical history section explored chronic diseases and surgeries in study participants. The SM habits and correlates section included directed questions about the self-use of certain drugs over the past two years, specifying the dose, frequency, and rationale behind using the drug, in addition to the source of information/recommendation about that drug. The choice of drugs surveyed in this study was based on a host of previous reports in the literature, taking into account the cultural and public contexts of the two countries, as well as the overall study objective exploring the perceived enhancers of academic performance.<sup>33,34</sup> The medications evaluated were:

peripheral analgesics (paracetamol and nonsteroidal anti-inflammatory drugs [NSAIDs]), central analgesics (eg, morphine, tramadol, pethidine), antibacterial drugs, sleeping pills, anabolic agents, propranolol, and amphetamine. The last section in the questionnaire gauged the rationale and the perceived academic benefits of SM through statements presented on a 3-point Likert scale (agree, neutral, disagree).

## Statistical Analysis

The minimum sample size was calculated using the Cochran's formula and found to be approximately 350 across the two universities, with a conservative estimate of 50% prevalence rate of SM, 95% confidence interval, and 5% margin of error, considering the combined total number of registered students at both universities (35,000). Data analysis was performed using the Statistical Package for Social Sciences (SPSS) program version 26 (IBM Inc., New York, USA). Descriptive statistics were employed for analysis. Categorical variables were presented as proportions and frequencies, while continuous variables were presented as means ( $\pm$ SD). Chi square test or Fisher's exact test was used to compare proportions while independent sample *T*-test was used to compare means. Logistic regression analyses were used to assess the adjusted effects of gender, country, and university major on SM use. Adjusted odds ratio and 95% confidence interval were reported. A *P*-value of less than 0.05 was considered statistically significant.

## Results

### Background Characteristics of Study Respondents

The total number of consented respondents was 362. The overall mean age ( $\pm$ SD) was 20.36 ( $\pm$ 1.66) years, with no statistically significant differences between students from Jordan (20.68 $\pm$ 1.84 years) and their peers from the UAE (20.14  $\pm$ 1.49 years; *p*=0.1). As shown in Table 2, 267 (73.8%) study participants were females, 217 (59.9%) were from the UAE, and 214 (59.1%) were in the healthcare-related majors. The majority of students were single (352 [97.2%]) and had no chronic illnesses (328 [90.6%]). Smoking was reported by 20% of our sample, with vapes and e-cigarettes being the most prevalent (80%).

### Prevalence and Determinants of SM Usage

Table 3 summarizes the prevalence of SM usage of drugs/drug classes under investigation stratified by gender, country, and university major. Overall, gender differences in SM use were statistically significant only for paracetamol (*p*=0.001),

**Table 2** Participants' Background Characteristics (N = 362)

Category	Subcategory	n (%)
<b>Gender</b>	Male	95 (26.2%)
	Female	267 (73.8%)
<b>Country</b>	UAE	217 (59.9%)
	Jordan	145 (40.1%)
<b>University Major</b>	Healthcare-related	214 (59.1%)
	Non-healthcare-related	148 (40.9%)
<b>Marital Status</b>	Single	352 (97.2%)
	Ever married	10 (2.8%)
<b>Smoking Status</b>	Non-smoker (including ex-smokers)	289 (79.8%)
	Smoker	73 (20.2%)
<b>Chronic Illnesses</b>	Yes	34 (9.4%)
	No	328 (90.6%)

**Table 3** Prevalence of Self-Medication Usage Stratified by Gender, Country, and University Major

Self-Medication	Overall Use	By Gender	P	By Country	P	By University Major	P
Paracetamol	299 (82.8%)	M: 59 (62.1%)	0.001	UAE: 171 (79.2%)	0.03	HC: 198 (92.5%)	0.001
		F: 240 (90.2%)		JOR: 128 (88.3%)		Non-HC: 101 (68.7%)	
Ibuprofen	148 (41.0%)	M: 24 (25.3%)	0.001	UAE: 92 (42.6%)	0.53	HC: 113 (52.8%)	0.001
		F: 124 (46.6%)		JOR: 56 (38.6%)		Non-HC: 35 (23.8%)	
Other NSAIDs	86 (23.8%)	M: 18 (18.9%)	0.21	UAE: 44 (20.4%)	0.08	HC: 62 (29.0%)	0.006
		F: 68 (25.6%)		JOR: 42 (29.0%)		Non-HC: 24 (16.3%)	
Central Analgesics	33 (9.1%)	M: 4 (4.2%)	0.06	UAE: 16 (7.4%)	0.19	HC: 21 (9.8%)	0.71
		F: 29 (10.9%)		JOR: 17 (11.7%)		Non-HC: 12 (8.2%)	
Antibacterial Drugs	162 (44.9%)	M: 32 (33.7%)	0.01	UAE: 74 (34.3%)	0.001	HC: 114 (53.3%)	0.001
		F: 130 (48.9%)		JOR: 88 (60.7%)		Non-HC: 48 (32.7%)	
Sleeping Pills	38 (10.5%)	M: 8 (8.4%)	0.56	UAE: 20 (9.3%)	0.38	HC: 22 (10.3%)	0.86
		F: 30 (11.3%)		JOR: 18 (12.4%)		Non-HC: 16 (10.9%)	
Anabolic Drugs	10 (2.8%)	M: 3 (3.2%)	0.73	UAE: 7 (3.2%)	0.75	HC: 4 (1.9%)	0.33
		F: 7 (2.6%)		JOR: 3 (2.1%)		Non-HC: 6 (4.1%)	
Propranolol	8 (2.2%)	M: 0 (0.0%)	0.12	UAE: 2 (0.9%)	0.07	HC: 5 (2.3%)	1.00
		F: 8 (3.0%)		JOR: 6 (4.1%)		Non-HC: 3 (2.0%)	
Amphetamine	6 (1.7%)	M: 2 (2.1%)	0.65	UAE: 3 (1.4%)	0.69	HC: 4 (1.9%)	1.00
		F: 4 (1.5%)		JOR: 3 (2.1%)		Non-HC: 2 (1.4%)	

**Note:** Shaded cells represent statistically significant results ( $p < 0.05$ ).

**Abbreviations:** NSAIDs, non-steroidal anti-inflammatory drugs; F, female; M, male; HC, healthcare; JOR, Jordan; UAE, United Arab Emirates.

ibuprofen ( $p=0.001$ ), and antibacterial drugs ( $p=0.01$ ). The use of these drugs was significantly higher among female compared to male students. Similarly, significant differences in SM by country were only detected for paracetamol and antibacterial drugs, with students from Jordan reporting a higher prevalence of use of these medications compared to students from the UAE ( $p=0.03$  and  $p=0.001$ , respectively). Of importance, as well, is the magnitude of gap in the prevalence of antibacterial drug use between participants from Jordan (88 [60.7%]) and the UAE (74 [34.3%]). Further, the prevalence of SM was significantly higher among healthcare-related compared to non-healthcare-related majors of study for paracetamol ( $p=0.001$ ), ibuprofen ( $p=0.001$ ), NSAIDs ( $p=0.006$ ), and antibacterial drugs ( $p=0.001$ ). Importantly, the rate of inappropriate use of central analgesics, sleeping pills, amphetamine, anabolic drugs, and propranolol was limited, with no significant differences found among strata.

To further identify how gender, country, and university major impact the SM habits of the frequently utilized drugs in our sample, a binary logistic regression model was performed. The adjusted odds ratio (95% confidence interval) was estimated for each of these factors after controlling for potential confounders in the regression model (Table 4). Of the three investigated factors, the university major was found to be consistently significant as a determinant of the self-use of paracetamol, ibuprofen, and other NSAIDs, as well as antibacterial drugs, with the adjusted odds of using these medications invariably higher among healthcare-related majors (5.9 [95% CI: 3.06–11.38], 3.54 [95% CI: 2.20–5.68], 2.05 [95% CI: 1.21–3.49], and 2.39 [95% CI: 1.51–3.77], respectively). Female gender was significantly associated with the self-use of paracetamol (5.55 [95% CI: 2.95–10.41]) and ibuprofen (2.62 [95% CI: 1.52–4.54]) only. Of interest, the country of origin for participants was found to be

**Table 4** Regression Analysis of Determinants of Self-Medication Usage

Self-Medication	Variable		Adjusted Odds Ratio	95% Confidence Interval	
				Lower Bound	Upper Bound
Paracetamol	Gender	F M (REF)	5.55	2.95	10.41
	Country	JOR UAE (REF)	1.60	0.82	3.12
	University Major	HC Non-HC (REF)	5.90	3.06	11.38
Ibuprofen	Gender	F M (REF)	2.62	1.52	4.54
	Country	JOR UAE (REF)	0.72	0.45	1.14
	University Major	HC Non-HC (REF)	3.54	2.20	5.68
Other NSAIDs	Gender	F M (REF)	1.30	0.72	2.37
	Country	JOR UAE (REF)	1.54	0.94	2.53
	University Major	HC Non-HC (REF)	2.05	1.21	3.49
Antibacterial Drugs	Gender	F M (REF)	1.56	0.93	2.61
	Country	JOR UAE (REF)	2.91	1.86	4.57
	University Major	HC Non-HC (REF)	2.39	1.51	3.77

**Note:** Shaded cells represent statistically significant results ( $p < 0.05$ ).

**Abbreviations:** NSAIDs, non-steroidal anti-inflammatory drugs; F, female; M, male; HC, healthcare; JOR, Jordan; UAE, United Arab Emirates.

a significant determinant of SM habits only for antibacterial drugs, with the odds of inappropriate use approximately three times higher among students from Jordan compared to those from the UAE (2.91 [95% CI: 1.86–4.57]).

Moreover, the study respondents reported that family and friends, regardless of their profession, as well as an inappropriate/extended use of a doctor prescription were by far the major sources of recommendation for SM use, as shown in Table 5. The role of pharmacists in such practices was justifiably less frequent, particularly for centrally acting drugs. On the other hand, participants' absolute reliance on their own judgement upon embarking on SM use was least frequently reported.

## The Perceived Rationale and Academic Performance Benefits of SM Practice

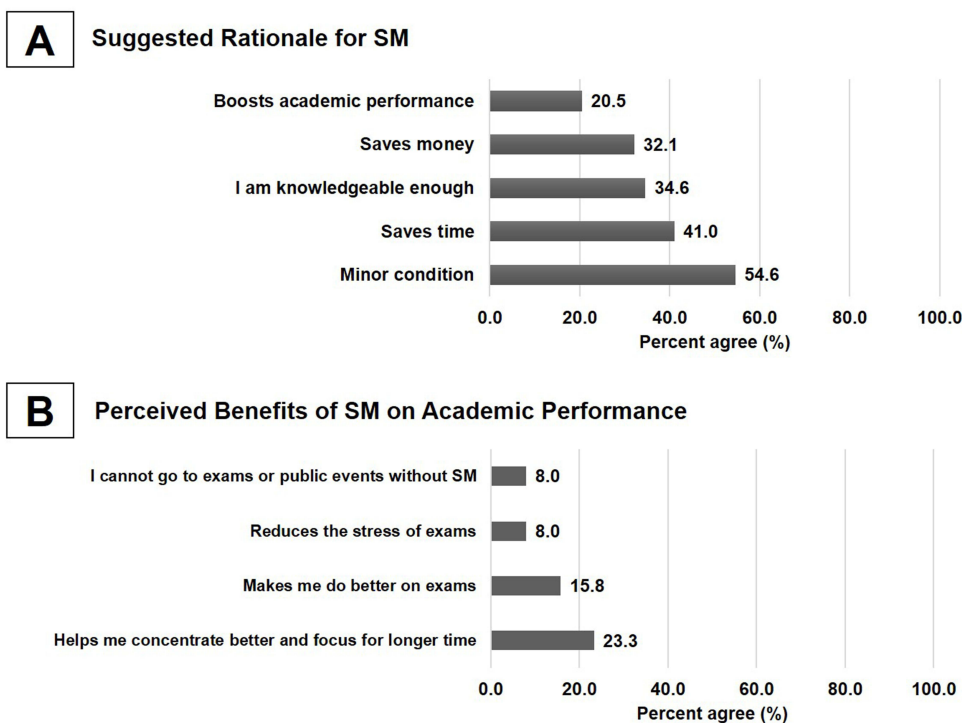
We evaluated how university students justify the practice of self-medicating and whether it improves their academic performance by considering their agreement with specified open statements (Figure 1). Of the suggested motives, the majority of students assumed they self-medicate when their health issue is perceived as minor (197 [54.6%]), albeit only 125 (34.6%) of them thought that they are knowledgeable enough to do so. Further, the practice of SM was believed to save time and/or money by 148 (41.0%) and 116 (32.1%) of students, respectively. Notably, only 74 (20.5%) of the

**Table 5** Distribution of Self-Medications by the Source Recommending Its Use

Self-Medication	Family and Friends	Pharmacist	Inappropriate/Extended Use of a Doctor Prescription	Self
Paracetamol	156 (52.2%)	51 (17.1%)	59 (19.7%)	33 (11.0%)
Ibuprofen	63 (42.5%)	17 (11.5%)	54 (36.5%)	14 (9.5%)
Other NSAIDs	32 (37.2%)	13 (15.1%)	38 (44.2%)	3 (3.5%)
Central Analgesics	11 (33.4%)	3 (9.1%)	18 (54.5%)	1 (3.0%)
Antibacterial Drugs	28 (17.3%)	15 (9.3%)	117 (72.2%)	2 (1.2%)
Sleeping Pills	14 (36.9%)	7 (18.4%)	14 (36.8%)	3 (7.9%)
Anabolic Drugs	5 (50.0%)	2 (20.0%)	2 (20.0%)	1 (10.0%)
Propranolol	5 (62.5%)	0 (0.0%)	3 (37.5%)	0 (0.0%)
Amphetamine	2 (33.3%)	0 (0.0%)	4 (66.7%)	0 (0.0%)

**Abbreviation:** NSAIDs, non-steroidal anti-inflammatory drugs.

respondents agreed that the practice of self-medicating boosts their academic performance. Such perception was justified by improved concentration and focus during study (84 [23.3%]), improved performance in exams (57 [15.8%]), and relief of the stresses of exams (66 [8.0%]) and public appearances (29 [8.0%]). Of significance, we found that almost 27% of students did not agree to any of the proposed/stated benefits of SM on the academic performance, while a minor 4% of respondents agreed to all statements, particularly among those who reported using central analgesics and/or propranolol (data not shown).



**Figure 1** (A) Frequency distribution of study participants' rationale for self-medication use. (B) Frequency distribution of study participants' perceived benefits of self-medication on their academic performance.



## Discussion

This comparative pilot study shed light on the most predominant determinants of SM among university students in the MENA region using UAE and Jordan as an example. The main findings of this study are; (1) over-the-counter analgesics as well as antibacterial drugs are the most widely misused medications by university students; (2) female gender, Jordan as the country of study, and majoring in healthcare fields were the significant determinants of SM in our sample, with the latter being the most consistent factor impacting this practice; and (3) only a minority of university students believe that SM boosts their academic performance.

In agreement with a substantial body of literature, we report here that peripheral pain killers, such as paracetamol, ibuprofen and other NSAIDs, and antibacterial drugs have been most frequently self-used by university students.<sup>3,35</sup> This finding is justifiable for peripheral analgesics as they are sold over-the-counter and represent a patient's "best friend" in the face of conventional pain, particularly among females suffering regularly from menstrual pains and associated symptoms.<sup>36,37</sup> For instance, Al-Kubaisi et al has reported in 2022 that approximately 60% of university students across the UAE have used over-the-counter medications in the past three months with or without a pharmacist advice.<sup>38</sup> Similarly, a recent study by AlShahrani et al in 2019 showed an overwhelming 92% self-use of painkillers among medical students in Saudi Arabia.<sup>6</sup> However, the prevalent unsupervised use of antibacterial drugs in our sample is quite perplexing, given that both the UAE and Jordan have recently adopted the ASP in their healthcare systems.<sup>30</sup> Among the general population, it was recently reported that the prevalence of SM with antibiotics was almost comparable between the two countries; 31.7% in the UAE<sup>39</sup> vs 40.4% in Jordan.<sup>40</sup> To the contrary, we report here that the odds of misusing antibacterials have been almost three times greater for students from Jordan compared to their peers from the UAE. This serves as a proper window into the uptake and application of ASP in both countries, particularly Jordan. While most published literature alludes to the significant success of ASP strategies in the UAE and Jordan,<sup>41,42</sup> our findings must be dissected by health policy makers to better understand the deep-rooted limitations and strategies to alleviate them. In the context of university education, for example, revolutionization of health education curricula and targeted awareness campaigns to students tackling ASP and antimicrobial resistance are urgently needed.

Consistent with our results, the university major of students has been frequently highlighted for its essential role in their SM habits. Medical students, as potential medical doctors, have a unique drive to bring their ill-perceived expertise into effect, creating serious issues regarding misdiagnosis and overdosage. Niroomand et al found in 2020 that almost 72% of medical students in Iranian universities practiced SM in their first year.<sup>25</sup> Interestingly, Kasulkar et al revealed in 2015 that the prevalence rate of SM among medical students in India starts rising from the first year to the graduation year.<sup>19</sup> In pharmacy majors, a study surveyed the SM habits among pharmacy and PharmD students at the University of Jordan. Within that group, approximately 87% of students reported self-medicating.<sup>43</sup> Nonetheless, these findings are in contrast to other studies conducted in Brazil,<sup>44</sup> Pakistan,<sup>45</sup> and Ghana,<sup>46</sup> which found insignificant differences in the prevalence of SM between students in health- and non-health-related majors. Whether this contrast is related to successful health education programs and policies in these countries or simply mirroring a cultural variation is not clear though.

Moreover, our results show that social influences from family, friends, and relatives played a significant role in spreading the practice of SM. This is in line with several previous studies delineating the high cultural and societal acceptance of SM in developing countries. For instance, Janatolmakan et al have recently identified cultural promotion of SM as a strong driving factor for the unsupervised use of medicines in the Iranian society.<sup>15</sup> In Nigeria, social factors such as peer pressure played a positive role in endorsing SM behavior.<sup>47</sup> Further, students in Saudi universities<sup>6</sup> as well as Egyptian universities<sup>14</sup> were found to list "relatives" knowledge of medications as the second main source of information regarding drugs. Critically, such societal attitude leads to a vicious cycle of misuse in the community as students who self-medicate tend to offer advice to family and friends. In a study among adults in Uganda, more than half (68.2%) of the participants expressed their willingness to recommend SM to sick people.<sup>48</sup>

Noteworthy, our results highlight an encouraging limited abuse of central analgesics, sleeping pills, amphetamine, and propranolol. This perhaps can be intuitively connected to the finding that only a minority of our respondents assumed that SM improves their academic performance. Studies from the US<sup>34,49</sup> and Switzerland<sup>50</sup> have previously shown that a significant percentage of self-medicating university students were found to engage in the nonmedical use of



prescription and illicit neuroenhancers to allegedly boost their concentration and ability to sustain focus for a longer duration. Such misconception, however, has been refuted by several cross-sectional studies emphasizing that college students on such stimulants skipped more classes, had a lower cumulative grade point average (cGPA), and were involved in other forms of illicit drugs use.<sup>33</sup> Furthermore, experimental studies have clearly shown no significant improvement of any molecular or biochemical markers of cognition in users compared with controls.<sup>51</sup>

Our study manifests several limitations. First, the sample size is not sufficient to yield more robust statistical analyses with more precise correlation statistics, which precludes generalizability of results. Second, the stratified sampling technique in our pilot study has its inherent limitations that could affect the interpretation of the results. Exact matching of respondents based on gender, university major, and country of study was indeed difficult to achieve despite efforts to extend timeframe and to employ targeted invitations to participate. Based on the reported results, however, one can focus future research to fine-tune research methods addressing more specified research questions. Third, online self-administered questionnaires surveying practices over a long duration carry the risks of recall bias, duplication, inaccuracy, and dishonesty. Nonetheless, the comparative and multicentric nature of our study targeting a critical public health gap should be viewed as major strengths that support its utilization by health policy makers.

## Conclusion

Our study identifies the major determinants of SM among university students in the MENA region, namely female gender, students from Jordan, and those in healthcare majors. Results of this study should be the cornerstone for informed, data-based awareness campaigns in the future, aiming to mitigate the prevalent practice of SM among university students, with a special focus on the aforementioned susceptible populations. Further research in this area is needed to better understand the impact and determinates of SM use among this vulnerable age group.

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## Disclosure

The authors report no conflicts of interest in this work.

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