Abstract

Background: Self-medication can lead to serious consequences but its overall prevalence in students is not known.

Aims: The aim of this study was to determine the prevalence of self-medication in students through a systematic review and meta-analysis of studies on the prevalence of self-medication in students across the world.
Methods: PubMed/MEDLINE, EMBASE, ISI/Web of Science and Google Scholar were searched up to October 2017. Studies reporting the prevalence of self-treatment in university students were selected. Data recorded included year of publication, country where the study was conducted, sample size, prevalence of self-medication, sex and mean age of students, and faculty of students (medical or non-medical). A random-effect model was used to determine effect size with a 95% confidence interval (CI). Heterogeneity across studies was assessed with the I² test. A sensitivity analysis assessed stability of the findings.

Results: A total of 89 studies were included in the analysis, which comprised 60,938 students. The overall prevalence of self-medication in university students was 70.1% (95% CI: 64.3–75.4%). Female students self-medicated more often than male students: odds ratio = 1.45 (95% CI%: 1.17–1.79). The prevalence of self-medication in medical students (97.2%) was higher than in non-medical students (44.7%). The I² test indicated high, statistically significant heterogeneity. The sensitivity analysis showed that the results were stable.

Conclusion: The prevalence of self-medication among students worldwide is high. Programmes on the risks of self-medication and increasing control and monitoring of the sale of drugs are recommended. Facilitating students’ access to doctors and health centres could reduce self-medication in students.

Keywords: self-medication, students, prevalence, meta-analysis

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**Introduction**

Self-medication is the self-administration of a treatment (either pharmacological or behavioural) without a prescription from a physician or a caregiver (1). Self-medication is an umbrella term, which includes a variety of behaviours, ranging from self-care to disease prevention and disease management. As such, self-medication is not limited to drug intake, but includes also interventions aimed at modifying lifestyle (2). Self-medication is occurring increasingly and is a serious public health concern, both in developing and developed countries (3). Self-medication can lead to serious consequences such as delay in diagnosis of illness, drug resistance, development of co-morbidities and, in some cases, death (4,5).

The number of people reported to self-medicate varies greatly depending on the country in which a study has been conducted and the study design. For instance, in the United States of America (USA) in a period of 6 months, about 71% of men and 82% of women had self-medicated at least once (6). In the United Kingdom of Great Britain and Northern Ireland, 41.5% of people had used drugs without a doctor’s prescription (7). In Spain, 27% of people suffering from pain self-medicated (8). The rise in the prevalence of self-medication is a serious issue for health decision-makers and policy-makers. This increase could be due to higher costs of consulting a doctor, greater availability of drugs and easier access to medications, lack of access to health care facilities and services, and patients’ experiences of previous treatments (9).

Determinants of self-medication include the type of physical/psychological illness, the social, cultural and economic status of the patients, and the national laws regulating drug use and sales (10–13). Self-medication may also have its root in the illegal sale of medicines (14).

Young people are among the most vulnerable to self-medication. In particular, students, because of their higher educational level and ability to find information about medications through the Internet, are more likely to self-medicate (15,16). A precise and reliable estimate of the self-medication rate is important for health decision-makers and policy-makers so they can design and implement programmes aimed at preventing self-medication. Therefore, we aimed to investigate the prevalence of self-medication in university students worldwide through a systematic review and meta-analysis of studies published on self-medication in students.

**Methods**
We did a two-stage literature search in order to identify the relevant studies. In the first stage, scholarly electronic databases, namely PubMed/MEDLINE via Ovid, EMBASE, ISI/Web of Science and Google Scholar, were searched up to November 2017 using Boolean operators and Medical Subject Headings (MeSH) where appropriate, and restricting the search to articles with full text and/or abstract published in English. The full texts of papers written in languages other than English, were translated by professional translators. The search strategy was as follows: ("prevalence" OR "epidemiology" OR "frequency") AND ("self-medication" OR "self-administration" OR "self-care" OR "illicit use" OR "self-prescription" OR "without doctor’s prescription") AND ("university students" OR "medical students" OR "college students" OR "undergraduates").

In the second stage, we also checked the reference lists of the studies retrieved for possible relevant related studies. We included studies that reported the prevalence of self-treatment in students, or those that had the necessary data for calculation of the prevalence. We excluded letters to editor, reviews, case reports or case series, interventional studies, conference proceeding or studies with no available full text. After identification of relevant studies, we examined their titles and abstracts for inclusion based on the above-mentioned inclusion and exclusion criteria. Then, two authors independently reviewed the full text of the articles and extracted the relevant information: surname of first author, year of publication, country where the study was conducted, and then information about the participants including sample size, reported prevalence of self-medication, average age and sex, and type of university where the students studied. If there was disagreement between the reviewers, a third reviewer was consulted as the final referee.

We used the Hoy checklist for evaluation of research quality (risk of bias) for critical appraisal of studies retained in the meta-analysis (17). The checklist includes 10 items, the first four investigate external validity of the studies and the remaining ones relate to internal validity.

To calculate the overall prevalence, we used a random-effect model, computing effect sizes with a 95% confidence interval of (CI). We examined heterogeneity across studies using the I2 test (18). To investigate the effect of the different variables on heterogeneity, we did a subgroup analysis stratifying participants by income (based on the country in which the study was carried out and retrieved from the World Bank website), region of the study, type of student (medical or non-medical), sample size, study quality and publication year. To assess the stability of the findings, we did a sensitivity analysis examining the effect of removing studies one at a time on the overall outcome (prevalence). To assess publication bias, we used the Egger linear regression test (19). Furthermore, we did a meta-regression analysis to assess the role of year of publication, sample size and mean age of the participants of the included studies: we used these parameters as co-variates, while the dependent variable was the effect size of the studies.
We used Comprehensive Meta-Analysis, version 2.0 (CMA v2.0, Biostat, New Jersey, USA) software for all statistical analyses.

**Results**

We report our results according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines (20).

We initially retrieved 519 studies: 438 were found through database searching and 81 through additional sources. After removing duplicates, the titles and abstracts of 341 articles were examined. After screening the remaining studies based on the inclusion and exclusion criteria, we excluded 135 articles. We then reviewed the full text of the remaining 206 articles for eligibility, after which we excluded 117 studies with reason (not being relevant to the aim of our systematic review and meta-analysis and/or not providing sufficiently detailed information). We thus retained 89 studies in the final analysis. *Figure 1* and *Table 1* show the process of study selection and the main characteristics of the studies included, respectively.

The total sample size analysed comprised 60,938 students (21–109). Studies were published between 1995 and 2017, the mean age of the students ranged from 17 to 26 years, and sample sizes from 120 to 9,161 participants. Thirty-seven (41.6%) studies recruited ≤ 400 participants, while 52 (58.4%) had > 400 participants. As regards region where the studies were done, 54 (60.7%) studies were done in Asia, 14 (15.7%) in Africa, 11 (12.4%) in South America, 7 (7.9%) in Europe, 2 (2.2%) in the USA, and 1 (1.1%) in Australia. Most studies (62, 69.7%) were done in middle-income countries, 19 (21.3%) in high-income countries and 8 (9.0%) in low-income countries. Forty-six (51.7%) studies explored self-medication in medical students, and 25 in non-medical students; information on students’ faculty was not provided in the 18 remaining studies. As regards study quality, 52 (58.4%) articles were judged of high (score 16–22) quality, 28 (31.5%) of medium (7–15) quality and 9 (10.1%) of low (1 to 6) quality.

The overall prevalence of self-medication in university students was 70.1% (95% CI: 64.3–75.4), ranging from 7.9% to 99%, as shown in the forest plot (Figure 2, available online). The I2 test revealed a high, statistically significant heterogeneity of 99.39%.

Results of the subgroup analysis based on income level, geographical region, sample size, study quality, year of publication, type of students (medical or non-medical) and sex are shown...
in Table 2. Heterogeneity as assessed by the I² statistic was high, statistically significant for all these subgroup analyses and ranging from 87.77% to 99.89%. Stratifying according to the income level of the country in which the study was conducted, the prevalence of self-medication was 65% (95% CI: 44.8–80.9%), 71.8% (95% CI: 66.8–76.3%) and 67.2% (95% CI: 46.5–82.9%) in high-, middle- and low-income countries, respectively. Based on region, the highest prevalence of self-medication was 91.7% (95% CI: 85.2–95.5%) in Oceania and the lowest was 55.8% (95% CI: 28–80.4) in Europe. The prevalence of self-medication was higher in female students (76.6% (95% CI: 65.0–85.2%)) than male students (66.9% (95% CI: 56.4–75.9%)), and in medical students (97.2% (95% CI: 95.4–98.3%)) than non-medical students (44.7% 95% CI: 29.7–60.7%). Between 2012 and 2017, the later studies included, the prevalence of self-medication was 71.8% (95% CI: 66.66–76.4%).

The effect of moderator variables (i.e. predictors of self-medication) – publication year, sample size of studies and the mean age of participants – was evaluated using meta-regression analyses (Table 3). All these moderator variables were statistically significantly associated with the prevalence of self-medication (P).

The odds ratio of self-medication in female versus male students was 1.45 (95 CI%: 1.17–1.79), that is to say self-medication was significantly more prevalent in females (Figure 3, available online).

The sensitivity analysis showed the stability of the results (Figure 4, see Supplement 1, available online). We sorted studies according to the year of publication and did a cumulative meta-analysis. The results showed that the prevalence of self-medication did not generally change, confirming once again the robustness of our findings (Figure 5, see Supplement 1, available online). In addition, we sorted studies by sample size and again the prevalence of self-medication did not generally change (Figure 6, see Supplement 1, available online). This confirms the reliability and robustness of our findings.

Finally, we found evidence of publication bias based on the Egger linear regression test. The intercept was 12.57 (95% CI: 7.24–17.90), t = 4.68, degrees of freedom = 87, P

Discussion

Our results show that the prevalence of self-medication in students worldwide was 70.1%. The range of prevalence of self-medication in students (7.9–99.0%) was higher than self-medication in adolescents aged 13–18 years (prevalence rate ranging from 2% to 92%) (110). In addition, the prevalence of self-medication in students was higher than non-student adults (for instance 35.0% (95% CI: 29.0–40.0%) in Brazil) (111). A possible factor for such a high prevalence of self-medication in students could be the high level of education. Indeed, awareness and knowledge of drugs among students has been reported as a key factor in students' behaviour in
seeking health care. Students are much more likely to read books and materials on different medications and their benefits for treating illnesses (15,16). This knowledge may lead to them self-prescribe treatment rather than seeing a physician. Furthermore, in some cases, living on campus may change students attitudes and make them more prone to self-medication (112). We found that the prevalence of self-medication in students in medical sciences (97.2%) was more than twice the prevalence of self-medication in non-medical students (47.7%), which, as hypothesized before, could be because medical students generally have a greater awareness and knowledge about drugs (113). Students of medical sciences sometimes try different drugs which they will use in their future profession. In addition, the frequent use of medicines during their training in health centres and their easy access to medications could make them more likely to use medications to treat themselves (77,96).

Our subgroup analyses showed that the prevalence of self-medication was lower in high-income countries than middle- and low-income countries. More up-to-date knowledge on the consequences of self-medication, as well as the health counselling against self-medication by health care professionals and the easier access to health care in high-income countries could explain such difference (114). At the same time, lower socioeconomic status could lead people to self-medicate, because they cannot afford to go to a doctor. Today, most people have easier access to drugs than before, which can be dangerous for health, especially if poor-quality and inadequate medications are used (115).

Moreover, we found that the prevalence of self-medication was higher in women than men (OR = 1.45). This could be because women may use medications before they get ill (116). Female use more drugs because of menstruation and gynaecological problems, and usually they look for information about their illnesses (117). However, some studies found different results (118,119).

Asian students were more likely to self-medicate compared with students in other regions. Cultural, ethnic, economic and social factors can explain such differences in prevalence. Poor supervisory structures for purchase of medications, easy access to medicine, lack of insurance coverage for some students and misconceptions about taking medications without referring to a doctor can increase the prevalence of self-medication (11,120).

We found a statistically significant time trend in self-medication worldwide. Despite efforts made by countries to reduce self-medication in students, this practice is still rising; therefore new and more effective measures are urgently needed (9). In addition, based on the result of our meta-regression analyses, the mean age of participants was associated with the prevalence of self-medication, with younger students being more likely to self-medicate. This may be due to
negative effects of self-medication experienced when students were younger. When someone suffers from complications of self-medication, fear of suffering from other physical or mental problems may prevent him/her from self-medicating again (77).

The strengths of our study include: its large sample size, the subgroup analysis, sensitivity analysis, cumulative meta-analysis and meta-regression analyses. All these analyses indicate the methodological rigor of our systematic review and meta-analysis. On the other hand, our review has some limitations. We observed high, statistically significant heterogeneity across the studies included, which could be due to methodological differences in the different studies. Publication bias was also statistically significant so the results should be interpreted/generalized with caution. In addition, the quality of the studies included differed and the inclusion of some poor-quality investigations might have affected the final estimation.

**Conclusion**

The results of this study showed that the prevalence of self-medication in students worldwide was high. We recommend that health decision-makers and policy-makers consider developing and implementing programmes about the risks of self-medication, and increasing control and monitoring of the sale of drugs. Facilitating students’ access to doctors and health care centres could be effective in reducing self-medication among students.

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**Competing interests:** None declared

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**Prévalence de l’automédication chez les étudiants universitaires : examen systématique et méta-analyse**

**Résumé**

**Contexte** : L’automédication peut avoir de graves conséquences, mais sa prévalence globale chez les étudiants n’est pas connue.

**Objectifs** : La présente étude avait pour objectif de mesurer la prévalence de l’automédication chez les étudiants au moyen d’un examen systématique et d’une méta-analyse des études portant sur la prévalence de l’automédication chez les étudiants à travers le monde.
Méthodes : Les bases de données PubMed/MEDLINE, EMBASE, ISI/Web of Science et Google Scholar ont été consultées jusqu’au mois d’octobre 2017. Les études portant sur la prévalence de l’automédication chez les étudiants universitaires ont été sélectionnées. Les données enregistrées comprenaient l’année de publication de l’étude, le pays où l’étude avait été menée, la taille de l’échantillon, la prévalence de l’automédication, le sexe et l’âge moyen des étudiants, ainsi que la faculté de ces derniers (discipline médicale ou non). Un modèle à effet aléatoire a été utilisé pour déterminer la taille de l’effet avec un intervalle de confiance (IC) de 95 %. L’hétérogénéité des résultats entre les différentes études a été évaluée à l’aide du test I2. Une analyse de sensibilité a permis d’évaluer la stabilité des résultats.

Résultats : Au total, 89 études ont été incluses dans l’analyse, qui comprenait 60 938 étudiants. La prévalence globale de l’automédication chez les étudiants universitaires était de 70,1 % (IC à 95 % : 64,3-75,4 %). Les étudiantes s’auto-médicament plus souvent que les étudiants : odds ratio = 1,45 (IC à 95 % : 1,17-1,79 %). La prévalence de l’automédication chez les étudiants en médecine (97,2 %) était plus élevée que chez les étudiants des filières non médicales (44,7 %). Le test I2 a révélé une hétérogénéité élevée et statistiquement significative. L’analyse de sensibilité a permis de conclure que les résultats étaient stables.

Conclusions : La prévalence de l’automédication chez les étudiants du monde entier est élevée. Il est recommandé de mettre en place des programmes sur les risques liés à l’automédication et renforcer le contrôle et la surveillance de la vente de médicaments. Le fait de faciliter l’accès des étudiants à des médecins et à des centres de santé pourrait permettre de réduire l’automédication chez les étudiants.
Prevalence of self-medication in university students: systematic review and meta-analysis

Google, Science of Web/ISI, EMBASE, MEDLINE/PubMed: search in Scholar (which includes Google Scholar) on the following databases (searched until 2017): Google, Science of Web/ISI, EMBASE, MEDLINE/PubMed. The search was performed on the following search terms: self-medication, university students, prevalence, study, country, gender, age, study design, type of study, year of publication, and quality of studies. The search was limited to studies published in English, and the studies were selected based on their relevance to the research question.

A total of 60,938 students were included in 89 studies, with a total of 5,277 students being included in the analysis. The prevalence of self-medication among university students was 70.1% (95% CI: 64.3-75.4%). The prevalence of self-medication among male students was 74.8% (95% CI: 70.1-79.5%), while the prevalence among female students was 66.4% (95% CI: 61.7-71.1%). The prevalence of self-medication among male students was significantly higher than that of female students (I² = 44.7%).

The analysis showed that self-medication is prevalent among university students, and that male students are more likely to self-medicate than female students. The results also suggest that self-medication is a significant public health issue, and that more research is needed to understand the factors that contribute to self-medication among university students.

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