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Review article

A Systematic Review of Self-Medication Practices Among Adolescents

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A B S T R A C T

The purpose was to systematically review the global trends and factors influencing self-medication (SM) among adolescents. Databases (Medline/Pubmed, Ingenta, Cochrane Library, EMBASE, CINAHL, Proquest, Scopus, and Google Scholar) were searched for peer-reviewed research published between January 2000 and December 2013 on SM among adolescents aged 13–18 years. Articles were scrutinized for country of origin, sample size, recall period, prevalence rates and associations, influencing factors, medicines used, self-medicated health complaints, sources of drug information, recommendation and procurement, knowledge about medicines, and adverse drug reactions. One hundred and sixty-three publications met the inclusion criteria. SM prevalence ranged from 2% to 92% in different countries. The most frequently self-medicated over-the-counter and prescription-only medicines were analgesics and antibiotics, respectively. Headache, allergies, and fever were the most common self-medicated health complaints reported. Misuse of both over-the-counter and prescription-only medicines reflected a risky trend. Female gender, older age, maternal education, and familial practices were associated with SM among adolescents. The primary sources of drug information, recommendation, and procurement included pharmacists, parents, and friends. High-risk practices such as diversion of prescription medicines and utilization of previous prescriptions were also reported. Most studies revealed gaps in drug knowledge, although adolescents self-rated it as satisfactory. However, few adverse drug reactions were reported, probably because of lack of awareness about the potential harmful effects of medicines. Recommendations for "responsible SM" have been made to minimize the adverse effects of SM. Understanding the links between various factors promoting SM can be helpful in deriving strategies aimed at reducing drug-related health risks among adolescents. Moreover, these will aid in creating awareness among adolescents about the potential risks of using drugs without proper information and consultation. Studies need to be designed to assess the changing trend and identify new correlates of self-medication practices among adolescents, which pose fresh challenges to monitor the menace.

IMPLICATIONS AND CONTRIBUTION

This review identifies factors that influence self-medication among adolescents. These factors need to be considered while planning strategies to create awareness regarding "Responsible self-medication," which will result in safer use of medicines. Association between SM practices during adolescence and adulthood needs to be explored.

"Responsible self-medication (SM)" involves treatment of self-recognized disorders or symptoms, through the use of medicines that are approved, available without prescriptions (over-the-counter [OTC] drugs), and are considered relatively safe and effective when used as directed [1,2]. SM is one of the common health risk behaviors encountered among adolescents [3]. Moreover, habits picked up during this stage are usually

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carried forward during adulthood [4] and may lead to misuse of the drugs [5]. This has often raised serious concerns by the medical fraternity and the society.

Several factors have been reported to influence the SM behavior among the adolescents [6,7]. A positive attitude toward self-care and overconfidence in medication knowledge often act as driving force for SM [2,8] and misuse of drugs [9]. Adolescents use medicines without a prescription, use old prescriptions, share medicines with friends/relatives, and use leftover medicines from previous prescriptions/stocks at home [5,10]. Both OTC and prescription-only medicines (POMs) could easily be accessed without having necessary information on indications and contraindications, subjecting them to undue risk [8,11,12]. Although adolescents do exhibit a sense of responsibility, the potential risks associated with SM can be misuse, overuse, or abuse of drugs [9].

Several studies and reviews on SM practices among adolescents have been published in different regions of the world in the past decade, each assessing different classes of drugs and associated factors. A minireview described the SM frequency in children and adolescents in five countries [13], and another systematic review focused on POM use among U.S. adolescents [14]. Two other reviews dealt with nutritional supplements among young athletes [15] and adolescents [16]. Others focused on the misuse of anabolic steroids among adolescents [17–23]. However, all these reviews did not provide a global perspective on the correlates of SM among adolescents.

The objective of this review was to provide an overview of the extant literature on SM among adolescents. It gives a comprehensive account of adolescent behavior toward SM with respect to prevalence rates and associations; factors promoting/facilitating SM; OTC drugs and POMs used; self-medicated health complaints; sources of drug information; recommendation and procurement; adult guidance; adverse events encountered; general knowledge about drug, their benefits, and risks; and recommendations for "responsible SM."

Methods

Search strategy

Databases, namely Medline/Pubmed, Ingenta, Cochrane Library, EMBASE, CINAHL, Proquest, Scopus, and Google Scholar, were searched for peer-reviewed research published between January 2000 and December 2013. Primary search terms, "Adolescent," "Self medication," "Prevalence," "Drug Utilization," "Non-prescription Drugs," and "Prescription Drugs," were used in various combinations. In Medline (MESH database), the search term "Self medication" was used in MAJR (main subject heading) combined (AND) with "Adolescent and Prevalence". All search terms were "exploded." In addition, manual searches were done for the relevant articles in the following journals: *Journal of Adolescent Health*, *International Journal of Adolescent Medicine and Health, Journal of Adolescence, JAMA Pediatrics,* and *Journal of Adolescent Research*. Reference lists and potentially relevant citations of articles identified through the primary search were also examined.

Article selection

All full-length articles, reviews, editorials, original articles, and short communications published in English language and English abstracts of articles published in other languages dealing with SM among adolescents aged 13–18 years were reviewed. SM was defined as "obtaining and consuming drugs without the advice of a physician to treat self-recognized illnesses or symptoms" [1,2]. Studies in population over a wider age range were considered, only if the analyses included the pertinent data of the desired age group, that is, 13–18 years. Studies dealing with specific drug groups and those which clearly specified the recommender as anyone other than a physician were also included. All articles dealing exclusively with drug usage among adults or children (<13 years) were excluded. Studies with combined data on adolescents, children and/or young adults, or those not focused on SM were also excluded. Moreover, opinion pieces and critiques of prior studies were not considered in the review.

Data abstraction

The lead reviewer (S.I.S.) along with another reviewer (A.K.A.) screened the articles based on the inclusion–exclusion criteria. The following details were extracted from each study using an abstraction form: year of publication, country of origin, population sampled, recall period, and data pertaining to the study objectives. Data were extracted by all three authors, and differences, if any, were resolved by consensus between them.

Assessment of methodological quality

A critical appraisal checklist, based on guidelines for reporting observational studies [24–26] and previous studies [27–29], was used to assess the methodological quality of reviewed articles independently by two reviewers (S.I.S. and A.K.A.). The individual appraisal results were discussed, and the final appraisal confirmed. Disagreements were resolved through discussion. The evaluation included the following four features: the sample (recruitment, representativeness, descriptive data, response rates, and sample size); definition of SM; validity of data collection (methods, reproducibility); and analysis (statistics, confounding factors). The quality criteria were clearly defined a priori. Studies with a score of 7–10 points were considered to be of high quality, 4–6 of medium quality, and 1–3 of poor quality.

Results

Literature search results

A two-stage process was used in the selection of eligible studies. The database search yielded 2,637 publications for review. Title examination of 2,313 articles revealed that they did not deal with adolescents/SM/drug utilization (including 400 duplicates) and were excluded. The remaining 324 articles underwent abstract review. Independent review of abstracts led to further elimination of 98 articles (77 out-of-target age range and 21 non-English abstracts) and provided 226 articles for detailed review.

A secondary search was performed to elaborate the primary concept. Hand search of reference lists, citations of important articles, and Web sites of the previously specified journals resulted in an additional 130 articles, of which 77 were exclusively related to SM among adolescents.

Full texts of 303 articles were retrieved and reviewed. This resulted in 163 articles which fulfilled the inclusion criteria. The

remaining 140 articles (47 out-of-target age range, 11 opinion pieces, 46 without adolescent data, and 36 not focused on SM) were excluded.

Methodological quality of included studies

Most studies were of high quality (n = 126; 77%), whereas 31 (19%) were of medium quality and six (4%) were of poor quality. There was no pattern observed between the quality scores and prevalence rates. It is also noteworthy that 109 studies (67%) had adjusted the results of SM correlates for various confounders, which could have influenced the interpretation.

Study characteristics

The studies in the 163 publications differed substantially in sample size, recall period, and location. These studies covered 3,663,647 adolescents aged 13–18 years and sample size ranged from 32 to 2,494,535. The articles reviewing overall prevalence rates originated from different countries (Table 1). Four studies investigated cross-national patterns of SM among the adolescents from Canada, United States, Greenland, Israel, and 24 European countries [72]; 19 countries in Europe and the United States [73] and European countries [74,75]. All the studies were cross-sectional in nature barring six longitudinal studies [4,37,76–79]. Most of the studies used self-administered questionnaires for data collection. Web-based surveys [54–57,59,80,81], interviews [10,45,82], or mixed data collection techniques [77] were also adopted. Around 40 studies elaborated SM with multiple drugs, whereas the rest dealt with specific drug groups or other correlates.

Results based on specific self-medication aspects

Definition of self-medication. The phrasing of questions to assess SM was inconsistent across studies. Some studies clearly defined SM, whereas others used the term "medicine use" for data collection and later specified the details about SM. However, most studies dealing with POMs obtained data relevant to SM through the following questions:

(1) "Have you ever, even once, used [drug] that was not prescribed for you or that you took only for the experience or feeling it caused?" [39,61–64,70,83–86] or,
(2) "Have you ever taken 'on your own' or non-medically (drug category) like (examples in that category) [65]?" or
(3) "On how many occasions (if any) have you used prescription opioids on your own, without a doctor's orders." [87] or
(4) "During the last 12 months, on how many occasions (if any) have you taken (drug) (without a doctor's orders)?" [88,89] or
(5) "Have you used prescription drugs not prescribed to you?" [53,54,56,57,59,77,80,81,90]

Prevalence rates and associated factors. The overall prevalence of SM ranged from 2% to 92% (Table 1). As the recall period highly influences the prevalence of medicine use, the results have been presented based on this criteria. A high prevalence was reported from Germany [8], the United States [31], India [41], Malta [11,42,43], Kuwait [48], United Arab Emirates [12,49,50], Sweden [67], and Spain [30]. Different approaches adopted to gather SM information along with actual differences across populations could be responsible for the wide variation in prevalence. There was no difference in the prevalence estimates of studies with small and large sample sizes (Table 1).

The prevalence of SM was higher in female adolescents [6,8,34,55,72] in most countries. However, in Brazil [33] and Kenya [45], self-treatment practices were higher in employed male adolescents. Most studies showed that the prevalence of SM increased with age [6,7,36,51,55,72] in both genders. A cross-national study in 29 countries concluded that the use of analgesics for headache increased with age, but medication for insomnia or nervousness declined [72]. Another cross-national survey revealed that medicine use was much more consistent for insomnia and nervousness between countries than for headache and stomachache [73]. An upward trend in use of medicine for headache and stomachache was earlier reported over a 10-year period [32].

SM with OTC drugs has frequently been associated social and psychosocial factors such as maternal education [6,7], socioeconomic status [7,35,91,92], smoking, unhealthy eating habits [3], bullying at school [93], and poor self-rated health [94]. In Brazil, family practice of SM, maternal influence [6], access to medical facility, and utilization of public health care [36] were other factors that influenced SM. Similarly in United Arab Emirates, associated factors were familial practice of SM (especially among expatriate female students) and nonutilization of private health care services [49]. A strong maternal influence on attitudes and pain management strategies in adolescents had also been reported from Canada [95]. Adolescents in Belgium were more influenced by television, which led to increased use of OTC analgesics [96]. A longitudinal study tracking SM from infancy to adolescence over 15 years reported a higher prevalence among those who were frequently self-medicated during their childhood [37].

Apart from these specific observations, there had been number of general factors, such as previous experience with medicines, presence of minor/frequent ailments, lack of time to visit the physician, convenience of procurement [49], cost of medicines, and inaccessibility to health facilities [44], which favored SM among the adolescents.

Medications self-prescribed. The most widely consumed OTC drugs were analgesics followed by vitamins and nutritional supplements, antiallergic, and cold and cough medicines (Table 2). In a study among U.S. adolescents, 22% overmedicated with analgesics and 14% did not inform their parents about their use [158]. Analgesic use was associated with female gender [34,48,97,99], increasing age [72], and liberal attitudes [100]. Most girls used one analgesic, whereas one-third of them reported having used two to three analgesics for dysmenorrhea [98]. A number of other drugs such as vitamins [7,43], drugs for sports injuries [43], antidandruff, athlete's foot preparations [48], antiallergic, and herbal/homeopathic drugs [12] were used more by boys. Vitamins and nutritional supplements were often used by sportspersons [106,115,118], primarily for health benefits and enhancement of their athletic performance [15].

Among the POM subgroups, systemic antibiotics topped the list with the highest usage in India [41] and the least in Kenya [45]. This was followed by the opioids subgroup and mainly reported from the United States [38,54,68,77] and Canada [125]. A study among U.S. students revealed that the nonmedical use of POMs was highest for opioids (18%), followed by

Table 1
Global prevalence of self-medication (SM) and correlates

Country	Prevalence (%)	Sample size (n)	Recall period	Significant correlates to SM
Point of time				
Spain [30]	45.4	23,349		Age; Illicit
1-week to 1-month recall period				
Germany [8]	57	56	2 weeks	F; Mob
U.S.A. [31]	57	101	1 month	
Denmark [32]	55–36^{HA}	12,782	1 month	F; Age (F)
Brazil [6]	53.2	1,281	7 days	F; Age; Fam; MEd (L)
Brazil [33]	52.6	991	15 days	M; Wo; PF
Norway [34]	52.5; F: 64; M: 41	11,708	4 weeks	F
The Netherlands [35]	F: 44.8; M: 23.6 (OTC)	1,477	14 days	F; SES (H); Mob
Germany [7]	F: 29.6; M: 24.4	3,764	1 week	F; Age; MEd (H); SES (H)
Brazil [36]	29.5	177	15 days	Age (H); PHS
Brazil [37]	20.2; F: 22.9; M: 17.3	4,341	15 days	F
U.S.A. [38]	20 (POMs)	849	30 days	Age; M; Illicit
U.S.A. [39]	3.3 (POMs)	36,992	1 month	—
U.S.A. [40]	2.1 (OTC)	39,345	1 month	F (SenS); Age; Illicit; W (SenS)
2-month to 11-month recall period				
India [41]	92.2	640	4 months	—
Malta [11,42,43]	90.3	474	3 months	F; Mob
Brazil [44]	72	722	60 days	F; PvtS
Kenya [45]	42	57	30 weeks	M; Age (M)
Saudi Arabia [46]	20.4	1,022	4 months	—
Hong Kong [47]	16.9	3,355	3 months	—
1-year recall period				
Kuwait [48]	92; F: 94; M: 91	1,110	1 year	F; Age
United Arab Emirates [12,49,50]	89.2	324	1 year	Mob; Fam
Saudi Arabia [51]	37.7	1,330	1 year	Age (OTC, Ab); ADR
U.S.A. [52]	36	86	1 year	—
U.S.A. [53]	F: 31.3–5.2; M: 18.9–4.6 (POMs)	12,644	1 year	SexP
U.S.A. [54]	F: 15.5 (POMs)	490	1 year	SV
U.S.A. [55–57]	14; F: 15; M: 9 (POMs)	1,086	1 year	F (An); Age (An; Ax); W (Ax); Illicit
U.S.A. [58]	11.3	12,431	1 year	W; SP
U.S.A. [59]	10.9 (POMs)	912	1 year	F (Self T); Age (SenS); D (SenS); W (SenS); Illicit use (SenS);
U.S.A. [60]	10.4 (POMs)	2,135	1 year	Illicit
U.S.A. [61]	9.2 (POMs)	24,945,358	1 year	F; Age; Illicit; W; PF (Ax)
U.S.A. [62,63]	8.8 (POMs)	17,047	1 year	F; Age; SES (L); Peer; PF; D; R; Illicit
U.S.A. [39]	8.3 (POMs)	36,992	1 year	—
U.S.A. [64]	8.2 (POMs)	18,678	1 year	F; Age; Illicit; SP; PF; D
U.S.A. [65]	6.7 (POMs)	3,614	1 year	Age; Illicit; D
Canada [66]	5.9 (POMs)	44,344	1 year	Age; F (An; Ax); M
U.S.A. [40]	4.7^{Y} (OTC)	39,345	1 year	F (SenS); Age; Illicit; W (SenS)
Lifetime use				
Sweden [67]	M: 62.6; F: 37.7	245	No limited time span	—
U.S.A. [68]	43	574	Lifetime use	PF; Peer
U.S.A. [38]	34 (POMs)	849	Lifetime use	Age; M; Illicit
U.S.A. [55–57]	20.9 (POMs)	1,086	Lifetime use	F (An); Age (An; Ax); W (Ax); Illicit
U.S.A. [69]	13.6	54,631	Lifetime use	PF; Peer
U.S.A. [70]	13 R; 10 U (POMs)	17,872	Lifetime use	M; Age; Illicit; R; SP; PF
U.S.A. [59]	16.2 (POMs)	912	Lifetime use	F (Self T); Age (SenS); D (SenS) W (SenS); Illicit use (SenS);
U.S.A. [39]	12.1 (POMs)	36,992	Lifetime use	—
U.S.A. [71]	6.5 (POMs)	6,790	Lifetime use	—

Superscripts refer to specific health conditions or recall period. Correlates indicate increasing prevalence of self-medication. Words within the parenthesis indicate specific subgroups. Example: MEd (L) refers to low maternal education.
Ab = antibiotics; ADR = adverse drug reactions (knowledge of medication side effects); Age = prevalence increases with increasing age; An = analgesics; Ax = anti-anxiety drugs/tranquilizers; Bully = victimization from bullying; D = delinquency; F = females; Fam = familial practice of SM; H = high; HA = for headache; Illicit = abuse of alcohol, cigarettes, and other drugs of abuse; L = low; M = males; MEd = maternal education; Mob = morbidity (health complaints); OTC = over-the-counter drugs; Peer = peer influence; PF = parental factors (parental bonding, monitoring, disapproval of drug use); PHS = public health care system; POMs = prescription-only medicines; PvtS = private schools; R = rurality; Self T = self-treating motives; SenS = for sensation seeking motives; SES = socioeconomic status; SexP = sexual preferences; SP = poor school performance; SV = sexual victimization; U = urbanity; W = whites; Wo = employed adolescents; Y = use in past year.

hypnotics (6%), antianxiety (3.5%), and stimulants (2%) [55]. The nonmedical use of POMs was higher among white American than African-American students, indicating racial differences [55,83,86].

The use of anabolic–androgenic steroids (AAS) was associated with participation in team sports [105,159] or recreational physical exercise [75,156]. Male gender [75,105,142,148,150,154–156] and illicit drug use [75,143,145,149,150,155,156] were also associated with AAS misuse. Moreover, an association between high school sports participation and adult AAS use (among males) was also observed in longitudinal studies [78,79], and this misuse decreased with increasing age [79].

Table 2
Self-medicated drugs and their correlates

Prevalence of self-medicated drugs (%)	Sample size (n)	Significant correlates to self-medicated drugs	Country
OTC			
Analgesics			
93.6[HA, Y]	5,847	F	Norway [97]
F: 90[DYS]	76	—	U.S.A. [98]
F: 78.5[3M]; M: 68.4[3M]; 60.3; F: 70.5[Mn]; M: 49.7[Mn]	367	F	Norway [99,100]
78.4[HA]	640	—	India [41]
70.2 (An); 68.5 (Ap)	324	—	United Arab Emirates [12]
65.9–28.3:F[HA]; M: 50–21.1[HA]; F: 43–10.3[SA]; M: 26.9–5.1[SA]	123,227	F; Age[HA]	Cross-national [72]
65.4 (An); 11.7 (Ap)	722	—	Brazil [44]
65; F: 69; M: 63	1,110	F	Kuwait [48]
60[HA]; F: 64.7; M: 54	474	F	Malta [42,43]
F: 55; M: 36[HA]; F: 33[SA]	12,782	F	Denmark [32]
55	57	—	Kenya [45]
F: 54; M: 25	11,708	F	Norway [34]
F: 49.2[HA]; M: 35.9[HA]; F: 26.1[SA]; M: 7.4[SA]; F: 4[IN]; M: 3.3[IN]; F: 3.5[N]; M: 2.7[N]	4,824	F; Ethnic	Denmark [91]
F: 46.8[HA]; M: 34.9[HA]; F: 30.7[SA]; M: 16.6[SA]	31,180	F	Cross-national [73]
46.6	245	F	Sweden [67]
F: 46.4[HA]; M: 35.7[HA]; F: 27.4[SA]; M: 14.9[SA]	123,227	F; Age[HA, SA]; Age (F)	Cross-national [72]
F: 45.7[HA]; M: 34.3[HA]; F: 20.4[SA]; M: 6.2[SA]	5,205	F; Bully[HA]; Bully (M)[SA]	Denmark [93]
F: 43.3[DYS]	1,330	Age; ADR	Saudi Arabia [51]
42.5[Mn]	595	—	Denmark [101]
41.7–11.2	177	—	Brazil [36]
35	56	—	German [8]
F: 34.9; M: 18	996	—	Denmark [4]
32.5	1,281	—	Brazil [6]
F: 9.8; M: 5.4	3,764	F	Germany [7]
Vitamins/nutritional supplements			
F: 83[3D]; M: 61[3D]	105	F	U.S.A. [102]
74	362	Sports (H)	U.S.A. [103]
62; F: 75; M: 55	32	—	UK [104]
59.3[L]	3,248	—	U.S.A. [105]
48.7[2W]	78	—	U.S.A. [82]
45[Y]; F: 49[Y]; M: 40[Y]	22,519	F; Age; Sports (H)	Finland [106]
42.9; M: 36.6; F: 50	324	F	United Arab Emirates [12]
42.5	333	—	Canada [107]
38.5	640	—	India [41]
33[2D]	423	—	U.S.A. [108]
F: 32.4–23.2[Mn]; M: 27.4–20.5[Mn]	—	—	U.S.A. [109]
29.2–23.8[Y]	2,409	SES (H)	Korea [110]
28.7	100	—	New Zealand [111]
27[Mn]	5,306	W	U.S.A. [112]
26.6[Mn]	—	W; SES (H)	U.S.A. [113]
25.7[Mn]	3,043	SES (H)	U.S.A. [114]
25	2,761	F; Sports (H)	U.S.A. [115]
22.3	139	M	U.S.A. [116]
22	1,110	M	Kuwait [48]
21.5	474	—	Malta [42]
20	1,272	—	Germany [117]
19.3	818	Sports (H)	Slovenia [118]
17.8–11.2[Y]; 15–14.4[Mn]	305	Age; PF	Japan [119]
17.6	1,532	W	U.S.A. [120]
11.2[3D]	—	MEd (H)	Germany [121]
M: 5.7; F: 4.2	3,764	M	Germany [7]
4.4	722	—	Brazil [44]
3.1	177	—	Brazil [36]
Antiallergic drugs			
81.6	640	—	India [41]
39	1,110	—	Kuwait [48]
32.5	324	—	United Arab Emirates [12]
F: 16; M: 15	11,708	—	Norway [34]
2.1	722	—	Brazil [44]
For cold and cough			
70.6	640	—	India [41]
65.8	474	—	Malta [42]
54; F: 59; M: 50	1,110	F	Kuwait [48]
37.4	324	—	United Arab Emirates [12]
23	56	—	German [8]
15.4	177	—	Brazil [36]

(*continued on next page*)

Table 2
Continued

Prevalence of self-medicated drugs (%)	Sample size (n)	Significant correlates to self-medicated drugs	Country
12.3	722	—	Brazil [44]
6	57	—	Kenya [45]
4	1,281	—	Brazil [6]
3.7–2.4^{Y}; 4.9–3.4^{L} (SenS)	4,176	M; Illicit use	U.S.A. [122]
F: 2.9; M: 2.6	3,764		Germany [7]
2.03^{Y}; 3.71^{L}; .50^{Mn} (SenS)	17,875	Age (SenS); Illicit	U.S.A. [123]
1.9^{Y}; M: 1.5^{Y}; F: 2.3^{Y}; 3.7^{L}; M: 3^{L}; F: 4.3^{L}	22,912	F; W; Illicit	U.S.A. [124]
Dermatologic drugs			
37; F: 41; M: 33	1,110	F	Kuwait [48]
31; F: 35; M: 26	474	F	Malta [42,43]
25.2	640	—	India [41]
18	57	—	Kenya [45]
F: 3.7; M: 3	3,764	—	Germany [7]
Gastrointestinal drugs			
33.4	640	—	India [41]
25.3–24.2	324	—	United Arab Emirates [12]
21	1,110	—	Kuwait [48]
16	474	—	Malta [42]
9.6	177	—	Brazil [36]
M: 9.2; F: 6.1	3,764	M	Germany [7]
Prescription drugs			
Systemic antibiotics			
57.5	640	—	India [41]
53.2	324	—	United Arab Emirates [12]
F: 43.5	1,330	Age; PuS; ADR	Saudi Arabia [51]
19.2	474	—	Malta [42]
9.8	722	—	Brazil [44]
8.6	177	—	Brazil [36]
4	57	—	Kenya [45]
Opioids			
35^{L}	574	—	U.S.A. [68]
28.2	754	Age; Illicit use; D	U.S.A. [77]
26–13	849	—	U.S.A. [38]
20.6^{Y}	2,914	F, Age (F); Illicit	Canada [125]
F: 14.1^{Y}	490	SV	U.S.A. [54]
12.9^{L}	7,374	W; Illicit use	U.S.A. [126]
12^{Y}; 17.7^{L}	1,086	F; Age	U.S.A. [55,56]
12^{L}	126,764	F; Age; Illicit	U.S.A. [127]
R: 11.5^{L}; U: 8.6^{L}	17,872	R	U.S.A. [70]
11^{Y}; 15.9^{L}	1,017	F; Age; Illicit use	U.S.A. [80]
10^{Y}; 14.6^{L}	912	—	U.S.A. [59]
9.8^{L}; F: 10.3^{L}; M: 9.3^{L}	18,678	F (W); Age; W; SES (L); Illicit; SP; D (M)	U.S.A. [84]
9.6–4^{Y}	4,522	M; Illicit; SP; W; R	U.S.A. [88]
8.7^{Y}	2,135	Age; Illicit; SP	U.S.A. [60]
8^{Y}; 12.3^{L}	12,441	Illicit (R)	U.S.A. [87,128]
8^{Y}	12,431	—	U.S.A. [58]
7.8^{Y}	24,945,358	Age; Illicit; SP	U.S.A. [61]
F: 7.8^{Y}; M: 6.9^{Y}	17,709	F; Age; W; PF; SES (L); D; Illicit; Peer	U.S.A. [86]
7.4^{Y}	17,047	Age; SES (L); Illicit; PF; D; Peer	U.S.A. [62,63]
7^{Y}	36,992	F; Age; SP; W	U.S.A. [83]
7^{Y}; 10.1^{L}	36,992	—	U.S.A. [39]
6.8^{Y}	18,678	F; Age; Illicit; SP; PF; D	U.S.A. [64]
5.6^{Y}; 8.8^{L}	2,744	F	U.S.A. [129]
5.6^{Y}	68,736	—	U.S.A. [130]
5.5^{Y}	13,636	Sports	U.S.A. [131]
5; Self T: 2.7; SenS: 2.5	2,597	—	U.S.A. [132]
3.7^{L}	6,790	—	U.S.A. [71]
3.6^{L}	3,614	—	U.S.A. [65]
2.1^{Mn}; 2.3^{Y}	1,672	Age; Illicit; Peer	U.S.A. [90]
Sedatives/hypnotics			
27; F: 33.8; M: 20.1	324	F	United Arab Emirates [12]
20^{L}	574	—	U.S.A. [68]
M: 18.7–1.5^{IN}; F: 11.9–1.4^{IN}	123,227	M	Cross-national [72]
18–8.6	912	—	U.S.A. [77]
M: 6.5; F: 6.2	123,227	M	Cross-national [72]
M: 6.5; F: 6.4	31,180	—	Cross-national [73]
5.4	2,135	Illicit; SP; W	U.S.A. [60]
F: 4^{IN}; M: 3.3^{IN}	4,824	F; Ethnic	Denmark [91]
F: 3.9^{IN}; M: 3.5^{IN}	5,205	Bully	Denmark [93]
3.3^{Y}; 5^{L}	18,131	Age; F; PrS; SES (H)	Brazil [133]
3^{Y}; 5.9^{L}	1,086	Age; W	U.S.A. [55,56]

Table 2
Continued

Prevalence of self-medicated drugs (%)	Sample size (n)	Significant correlates to self-medicated drugs	Country
F: 3; M: 2	12,782	—	Denmark [32]
F: 2.7[Y]	490	SV	U.S.A. [54]
2.5[Y]; 4.5[L]	912	—	U.S.A. [59]
1.9[L]	3,614	—	U.S.A. [65]
F: 1.8; M: 1.4	11,708	—	Norway [34]
1 (R)[L]; .8 (U)[L]	17,872	—	U.S.A. [70]
.5[Y]	17,047	F; Illicit; PF; D	U.S.A. [62,63]
.5[Y]	24,945,358	Illicit	U.S.A. [61]
.4[Y]; 0.9[L]	36,992	—	U.S.A. [39]
.4[Y]	18,678	Age; Illicit; SP; D	U.S.A. [64]
Stimulant medications			
25.5–23.8	912	—	U.S.A. [77]
10	849	—	U.S.A. [38]
9.5[Y]	12,441	M; Co-ingest	U.S.A. [128]
9.5[L]	4,572	Illicit	U.S.A. [134]
8.7–6.6[L]	12,990	—	Canada [135]
8.5[Y]	13,549	Illicit	Canada [136]
8.5[L]	21,465	—	U.S.A. [137]
8[L]	574	—	U.S.A. [68]
7.2[Y]	12,431	—	U.S.A. [58]
5.3–3[Mn]; 24.8–10.9[L]	9,642	—	U.S.A. [138]
4.5[L]	1,536	M; W; Illicit	U.S.A. [81]
4[Y]	12,237	Age; SP; Illicit; W	U.S.A. [89]
3[L]	126,764.	F; Age; Illicit	U.S.A. [127]
2.7[L]	3,614	—	U.S.A. [65]
2.6[L]	54,079	—	U.S.A. [139]
2.6 (R)[L]; 2.3 (U)[L]	17,872	—	U.S.A. [70]
2.4	6,790	—	U.S.A. [71]
2.3[Y]	24,945,358	Illicit; W	U.S.A. [61]
2.1[Y]	17,047	F; Age; Illicit; PF; D	U.S.A. [62,63]
2[Y]; 3.4[L]; 0.7[Mn]	36,992	—	U.S.A. [39]
2[Y]; 2.4[L]	1,086	W	U.S.A. [55,56]
1.9[Y]	18,678	F; Age; Illicit; SP; D	U.S.A. [64]
1.7[Y]	17,338	Illicit; PF	U.S.A. [85]
1.2[Mn]; 2.4[Y]	5,205	Age; Illicit; Peer	U.S.A. [92]
1.2[Y]; 1.5[L]	912	—	U.S.A. [59]
1.1[Y]	68,736	—	U.S.A. [130]
F: 1[Y]	490	—	U.S.A. [54]
.9[M]	6,417	—	Brazil [140]
Antianxiety/tranquilizers			
M: 20.4–1.1[N]; F: 14.8–.7[N]	123,227	F	Cross-national [72]
15[L]	574	—	U.S.A. [68]
14	849	—	U.S.A. [38]
10.3[Y]	12,441	M; Coingest	U.S.A. [128]
F: 6.9[N]; M: 6.7[N]	123,227	F	Cross-national [72]
F: 6.5[N]; M: 6.5[N]	31,180	—	Cross-national [73]
5.3[Y]	12,431	—	U.S.A. [58]
4.9[Y]; 2.4[Mn]	1,672	Age; Illicit; Peer	U.S.A. [90]
F: 3.7[N]; M: 2.8[N]	5,205	Bully	Denmark [93]
3.5 (R)[L]; 2.5 (U)[L]	17,872	R	U.S.A. [70]
F: 3.5[N]; M: 2.7[N]	4,824	F; Ethnic	Denmark [91]
F: 3; M: 1	12,782	—	Denmark [32]
2.9	6,790	—	U.S.A. [71]
2.5[Y]; 5.6[L]	85,000	F; Illicit; D	Europe [74]
2.3	24,945,358	F; Age; Illicit; W; PF	U.S.A. [61]
2.2[Y]	68,736	—	U.S.A. [130]
2.2[L]	3,614	—	U.S.A. [65]
2[Y]; 3.5[L]	1,086	Age; W	U.S.A. [55,56]
2[Y]; 3[L]	36,992	—	U.S.A. [39]
2[Y]	17,047	F; Age; W; Illicit; PF; D; SES (L); Peer	U.S.A. [62,63]
1.9	11,708	—	Norway [34]
1.9[Y]	18,678	F; Age; Illicit; SP; D	U.S.A. [64]
1.3[Y]; 2[L]	912	—	U.S.A. [59]
F: 1	490	Age	U.S.A. [54]
.5[Mn]	6,417	—	Brazil [140]
Anabolic–androgenic steroids			
M: 14.3[L]; F: 11.1[L]	—	M; Sports (M)	Poland [141]
M: 5.4[Y]; F: 2.9[Y]	4,746	M	U.S.A. [142]
F: 5.3[L]	7,544	Age (L); Illicit; Sports (L)	U.S.A. [143]
M: 5.1[Y]; F: 0.2[Y]; .8[L]	8,877	M; Illicit; Sports (H)	Norway [144]

(*continued on next page*)

Table 2
Continued

Prevalence of self-medicated drugs (%)	Sample size (n)	Significant correlates to self-medicated drugs	Country
M: 4.1[L]; F: 2[L]	16,000	Illicit; D	U.S.A. [145–147]
3.6[L]; M: 4.2[L]; F: 2.9[L]	15,425	M; Age (L)	U.S.A. [148]
M: 3.6[L]; F: 0.6[L]	1,351	Illicit	Norway [149]
3.5–1.2[L]	18,430	M; Illicit; Fitness	Europe [75]
M: 2.9[L]; F: 0[L]	5,827	M; Illicit	Sweden [150]
2.6[L]	269	—	U.S.A. [151]
M: 2.4; F: 0.8	3,248	M; Age; Sports (H)	U.S.A. [105]
M: 2.3[Y]; F: .4[Y]; M: 2.6[L]; F: 0.9[L]	6,823	D (M)	U.S.A. [152]
M: 2.1[L]; F: 0.2[L]	2,742	SP (Ax)	Sweden [153]
M: 1.8–1.0[Y]; F: .5–.4[Y]	46,700	M	U.S.A. [154]
1.8[Y]; 2.4[L]	21,905	M; Illicit; SP	Australia [155]
M: 1.7[Y]; F: 1.4[Y]	2,516	Age (L)	U.S.A. [79]
.9; M: 1.6; F: 0.2	11,031	M; Age; Illicit; Fitness	Iceland [156]
.7[Y]	2,319	Sports (L)	Germany [157]
.2[L]	3,614	—	U.S.A. [65]
.1[Mn]	6,417	Age	Brazil [140]
Antimalarial drugs			
14	57	—	Kenya [45]
Hormones			
13	56	—	German [8]
9.2	1,281	—	Brazil [6]
Ophthalmic drugs			
11.3	640	—	India [41]
9.1	474	—	Malta [42]

Superscripts refer to specific health conditions or recall period. Correlates indicate increasing prevalence of self-medication. Words within the parenthesis indicate specific subgroups. Example: MEd (L) refers to low maternal education.
ADR = adverse drug reactions (knowledge of medication side effects); Age = prevalence increases with increasing age; An = for analgesics; Ap = antipyretics; Ax = for antianxiety drugs/tranquilizers; Bully = victimization from bullying; Co-ingest = co-ingestion with opioids; D = delinquency; DYS = dysmenorrhea; Ethnic = ethnic minority group; F = females; Fam = familial practice of SM; Fitness = participation in leisure/fitness; H = high; HA = headache; Illicit = abuse of alcohol, cigarettes, and other drugs of abuse; IN = insomnia/sleep disorders; L = lifetime use; (L) = low; M = males; MEd = maternal education; Mn = use in past month or 4 weeks; Mob = morbidity (health complaints); N = nervousness; OTC = over-the-counter drugs; Peer = peer influence; PF = parental factors (Parental bonding, monitoring, disapproval of drug use); PuS = public schools; PvtS = private schools; R = rurality; SA = stomachache; Self T = self-treating motives; SenS = sensation seeking motives; SES = socioeconomic status; SexP = sexual preferences; SP = poor school performance; Sports = participation in sports; SV = sexual victimization; U = urbanity; W = whites; Wo = employed adolescents; Y = use in past year; 3M = use in past 3 months.

SM with antimalarials was reported only from Kenya [45]. Hormonal preparations, including contraceptives, also figured in the list of self-medicated drugs in Brazil [6] and Germany [8]. Although the associated correlates for use of POMs were elaborated in most studies [14], those for OTC drugs were not clarified.

Health complaints for which self-medication is practiced. Studies had identified a strong association between SM and health complaints among adolescents with significant age and sex differences [12,42,73,93,94]. Headache was the most frequent health complaint that led to SM (Table 3). Other common complaints included fever, allergies, cold and cough–related symptoms, insomnia, skin problems, and menstruation disorders. Most studies reported health complaints in relation to SM and not vice versa.

Adolescent girls generally reported more self-medicated health complaints [12] and frequent episodes of pain and depression [99,100]. However, headache, nervousness [73], and sports injuries [43] were self-medicated more in boys. A study conducted in Hong Kong reported self-perceived poor health, smoking, and alcohol as contributing factors for the reported illnesses, which favored SM among adolescents [47].

Sources of drug recommendation, procurement, and information. The common sources of drug recommendation included parents (especially mother), relatives, pharmacists, and teachers (Table 4). Local pharmacists often suggested treatment for certain chronic ailments in adolescents [33]. Adolescent athletes often consulted their coaches for nutritional supplements [104]. Nearly 34% were influenced by television, Internet, and newspaper for drug selection [44]. Interestingly, a positive relationship between television viewing and analgesic use was observed in Belgium, especially among boys [96].

Adolescents asserted their medical autonomy by self-medicating without adult consultation with significant ethnic [100] and gender differences [45] (Table 4). Students with a Western origin and boys (especially older ones) practiced medical autonomy more often than those from non-Western countries and girls [45,100].

The commonest source for drug procurement was community pharmacy followed by home medicine chest, parents, friends, and relatives (Table 4). However, in Norway, 31% adolescent girls obtained analgesics from their friends. Significant ethnic differences were also observed, wherein Western girls (22.8%) procured medicines more often from their friends as compared with non-Western girls (7%) [100]. Moreover, families practicing SM had large stocks of analgesics/antipyretics (29%) and systemic antibiotics (18%) in their home medicine chests [163]. Adolescents reported having easy access to most medicines in their homes [52]. In Kenya, the drugs for SM were mostly procured from small shops in the villages [45]. POMs were frequently procured through leftover prescriptions [36,39,126,129,160] and rarely from the Internet [160].

Around 14%–28% of students (especially girls) diverted their legal prescriptions by giving away, loaning, or selling their

Table 3
Self-medicated health complaints

Health complaints	Prevalence (%)	Sample Size (n)	Country
Headache and muscle ache	88.9[HA]; 67.8[SA]	324	United Arab Emirates [12]
	82.5	604	India [41]
	68.5	474	Malta [42]
	F: 60[HA]; M: 48.9[HA]; F: 20.4[SA]; M: 6.2[SA]	5,205	Denmark [93]
	51	57	Kenya [45]
	49[BA]; 36[HA]	56	German [8]
	45 (N = 595)	595	Denmark [101]
	F: 34.3[W, HA]; M: 21.1[W, HA]; F: 23.5[Mn, HA]; M: 23.5[Mn, HA]; F: 24.7[W, SA]; M: 13.7[W, SA]; F: 34[Mn, SA]; M: 23.7[Mn, SA]	31,180	Cross-national [73]
	F: 33.9–31.6[HA]; M: 16.8–10.4[HA]; F: 15.4–9.6[SA]; M: 6.8–3.7[SA]	12,782	Denmark [32]
	M: 27.5; F: 30.6[HA]	367	Norway [99]
	23.6	3,355	Hong Kong [47]
	14	177	Brazil [36]
	7.2	3,764	Germany [7]
Allergy/hay fever	84.7	640	India [41]
	57.1	324	United Arab Emirates [12]
Fever	84.1	324	United Arab Emirates [12]
	15	177	Brazil [36]
	2.9	3,764	Germany [7,44]
Flu/cough/cold	81.3	324	United Arab Emirates [12]
	79.3	474	Malta [42]
	77	56	German [8]
	74.2	640	India [41]
	55.2	3,355	Hong Kong [47]
	45	722	Brazil [44]
	30	57	Kenya [45]
	17.2	177	Brazil [36]
	16.7–3.3	3,764	Germany [7]
Menstrual complaints	74	1,110	Kuwait [48]
	41.4	367	Norway [99]
	33.6	324	United Arab Emirates [12]
	27.5	474	Malta [42]
	13.8	3,355	Hong Kong [47]
Gastrointestinal complaints	59	57	Kenya [45]
	42.9–39.4	324	United Arab Emirates [12]
	34.6	3,355	Hong Kong [47]
	30	56	German [8]
	30	640	India [41]
	27.1	474	Malta [42]
	F: 9.7; M: 3.4[SA]	367	Norway [99]
	9	177	Brazil [36]
Skin complaints	53[INJ]	57	Kenya [45]
	45	324	United Arab Emirates [12]
	34	474	Malta [42]
	27.5	640	India [41]
	23	56	German [8]
	9.5	3,355	Hong Kong [47]
Inability to sleep	50.9	324	United Arab Emirates [12]
	F: 37.2–28.5; M: 27.8–26.2	12,782	Denmark [32]
	F: 34.3[W]; M: 27.7[W]; F: 16.2[Mn]; M: 16[Mn]	31,180	Cross-national [73]
	20.1	3,355	Hong Kong [47]
	15	56	German [8]
Eye complaints	43.6	324	United Arab Emirates [12]
	13.4	640	India [41]
	11.6	474	Malta [42]
Nervousness/aggressiveness	F: 38.5[W]; M: 30.6[W]; F: 23.7[Mn]; M: 25[Mn]	31,180	Cross-national [73]
	38	56	German [8]
	F: 31.8–16.5; M: 21.3–16.3	12,782	Denmark [32]

Superscripts refer to specific health conditions or recall period.
BA = backache; F = females; HA = headache; INJ = injuries; M = males; Mn = about every month; SA = stomachache; W = about every day/week.

medications (particularly analgesics, central nervous system stimulants, and sleeping medications) to their friends [5,10,57,80,136,161,162]. Similarity in health complaints (29%), possession of a previous prescription (40%), ease of procurement from a family member (33%), desire to treat pimples or oily skin (10.5%), and avoidance of physician consultation (20%) were the prime reasons given for diversion of medication [5,10].

Adolescents commonly approached parents and pharmacists seeking drug information (Table 4). Besides these sources, physicians (74%) and package inserts (62%) were also consulted [11]. Girls retrieved drug information significantly more than boys [43]. Females were more inclined to seek advice from parents [48], school nurses [50], and through package insert [11,50,100], whereas males resorted to physicians [48]. Cultural differences

Table 4
Drug recommendation, procurement, and information from various sources

Sources	Drug recommendation, %; country	Drug procurement, %; country	Drug information
Parents	68.9; United Arab Emirates [12] 58.2; Slovenia [118] 56; Sweden [67] Mo: 51, Fa: 7.8; Brazil [36] F: 44, M: 36; UK; [104] 43; USA [31] Mo: 42.5, Fa: 8.3; Brazil [6] 16.2; U.S.A. [105]	73.1[HA]; Denmark [101] 50.2; Europe [74] M: 47.8, F: 44.1; Norway [100] 41–14; Malta [42][a] 33–32; Germany [8]	F: 88.2, M (An): 82.6; Norway [100] 66.2, F: 71.8, M: 59.6; Malta [11,43][a] Mo: 65, Fa: 49.8; Kuwait [48] 58.8; United Arab Emirates [50] 7.2 (N = 1,022); Saudi Arabia [46]
Pharmacists	46; United Arab Emirates [12] 20.1; Brazil [36] O: 18.7, C: 12.8; Brazil [33] 7.7; Sweden [67] 3.8; Brazil [44]	80.1 (Ab)–20.1[HA]; India [41] 77 (Ab)–26.8[HA]; Malta [42] 71.3; United Arab Emirates [12] 66.2; Brazil [44] 46[HA]; Germany [8][b] F: 20.5, M: 16.7; Germany [7] M: 6.7, F: 10.2; Norway [100]	67.9; Malta [11] 46.7; United Arab Emirates [50] 15.7; Saudi Arabia [46] 15.2; Brazil [44] M: 10.1, F: 10.8; Norway [100]
Relatives	51.2; Brazil [44] O: 30.9, C: 7.4; Brazil [33] 15.4; Brazil [6]	52.7; Brazil [133] 40.8[HA]–18.5 (Ab); India [41][a] 34.4; U.S.A. [80][a] 28.8 (Free), 1.4 (Buy); U.S.A. [129]	39; Brazil [44] 16.8; Kuwait [48] M: 6.2, F: 3.8; Norway [100][c]
Friends	9.5; Saudi Arabia [46][d] 6.3; Brazil [44] 5.5; Sweden [67] 5.2; Brazil [6] M: 2.2, F: 1.4; United Arab Emirates [12]	62.9–56.5 (Free), 51.6–50.9 (Buy); U.S.A. [126][d] 55 (Free), 37.9 (Buy) (N = 8,888); U.S.A. [160][d] 49.7–33.4 (Free), 17.5–6 (Buy); U.S.A. [39][d] F: 31, M: 9; Norway [100] 24.5; Europe [74] 19; Brazil [44] 17.2; U.S.A. [80] 17.1–6.8 (Free), 6.8–6.2 (Buy); U.S.A. [129] 14.2–6.2; U.S.A. [138][d] 11; Brazil [133] 7; Germany [8][d] 6.0; Canada [125][d] 4.2–1.3; India [41][d] 3.2–1[HA]; Malta [42][d]	19.8; Kuwait [48] M: 12.7, F: 6.3; United Arab Emirates [50] 6.3, F: 8.6, M: 3.7; Malta [11,43] M: 4.5, F: 9.7; Norway [100]
School/Teacher/Coach	F: 67, M: 64; UK [104] 38.1; USA [116] 36; USA [105]	—	32.5; Saudi Arabia [51] 21; Brazil [44] M: 7.9, F: 4.8; Norway [100] 4.4; Malta [11] 2; Saudi Arabia [46]
Media (Internet, TV, newspaper, and magazines)	34.1; Brazil [44] 9; Sweden, [67] M: 4.5, F: 2.8; United Arab Emirates [12] 1.8; Brazil [36]	1.4; U.S.A. [160][e]	60.9–22.2; Saudi Arabia [41,51] 35.5%–9%; Kuwait [51] F: 23.9, M: 20.1[e]; United Arab Emirates [50] 17.3–6.5; Malta [11] F: 13.4, M: 29.2; Norway [100] 5.6; Saudi Arabia [46][e]
Without adult guidance	We: 77, NWe: 62; Norway [100] 36; U.S.A. [52] 32.6; India [41] 26.6; Slovenia [118] 24.3; Malta [42] 22.2; Denmark [101] 22; U.S.A. [31] 20.8; Brazil [44] 14.2; U.S.A. [158] 14, M: 25, F: 9; Kenya [45] 12.3; Brazil [6] 10.9; Saudi Arabia [46]	NA	NA
Doctor/school nurse/dietician	30 (Di); UK [104] M: 6, F (Nu): 4.2; United Arab Emirates [12] 3.6 (Nu); Sweden [67]	—	73.6; Malta [11] 57; Kuwait [48] 50.6; Saudi Arabia [46] 43.3 (D), 15.7 (Nu); Brazil [44] M: 30.3, F (D): 28.5, M: 13.5, M (Nu): 14.5; Norway [100] H: 28.7, PHC: 15.7; Saudi Arabia [51] F: 16.2, M: 7.5; United Arab Emirates [50]

Table 4
Continued

Sources	Drug recommendation, %; country	Drug procurement, %; country	Drug information
Previous prescriptions	NA	79.5; U.S.A. [126] 36.9; U.S.A. [160] 22.2–7.7; U.S.A. [39] 19.9; U.S.A. [129] 15.3 (Ab); Brazil [36]	NA
Home medicine cabinets	NA	74; Norway [100] 72.4; Canada [125] 65.5^{HA}–10.9 (Ab); India [41] 60^{DYS}–9.9 (Ab); Malta [42] 38.9; Brazil [44] 29.3; Brazil [133] 20.4; United Arab Emirates [12]	NA
Supermarkets/grocery stores/health food shops	NA	Health food shops: 53, supermarkets: 29; UK [104] 17; Brazil [44] 7.1; Norway [100]	NA
Diversion of prescription (selling, trading, loaning, giving away of controlled medications)	NA	28.2–15.5; Canada [136] 26; Canada; [135] 24, F: 27.5, M: 17.4; U.S.A. [57] 23.6; U.S.A. [80] 23.3; U.S.A. [81] 21 (N = 138); U.S.A. [161] F: 20.1, M: 13.4; U.S.A. [5] 20 (N = 594); U.S.A. [10] 13.8 (N = 2,744); U.S.A. [162]	NA
Drug dealer	NA	19.4; U.S.A. [160] 13.9; U.S.A. [80] 12.0–4.6; U.S.A. [39] 2.1; U.S.A. [129]	NA
Package insert	NA	NA	62.2, F: 71.8, M: 50.6; Malta [11,43] 62; Germany [8] F: 58.6, M: 35.4; Norway [100] 44.2; Brazil [44] F: 23.2, M: 14.2; United Arab Emirates [50] 8.1; Saudi Arabia [46]

Superscripts refer to specific health conditions or recall period.
Ab = for antibiotics; An = for analgesics; Ap = antipyretics; Buy = obtained on payment; C = chronic use; D = doctor; Di = dietician; DYS = dysmenorrhea; F = females; Fa = fathers; Free = obtained without payment; HA = headache; H = hospitals; M = males; Mo = mothers; NA = not applicable; Nu = nurse; NWe = nonwestern origin; O = occasional use; PHC = primary health care center; We = western origin.
[a] Parents or adult relatives.
[b] Pharmacy or home medicine chest.
[c] Siblings.
[d] Friends or young relatives.
[e] Internet.

were also evident with non-Western students depending more on doctors (44%) and pharmacists (20%) than Western students [100]. In Saudi Arabia, adolescent girls relied highly on television (61%) for their drug knowledge [51]. However, in Kuwait, mothers and package inserts took the lead [48].

Knowledge about medicines. Adolescents often perceive that they have complete knowledge about proper use of medicines, which has been contradicted in many studies. A study from Malta reported that the drug knowledge mean score of students was 22.9 ± 4.3 of a maximum of 32 points [11]. In Germany, students obtained a score of 5.74 ± 1.9 on 13, reflecting poor understanding. Despite the overall low scores, 55% students rated their knowledge as satisfactory, and many reported to have read the package inserts and consulted their physicians for drug information [8]. However, girls [8,11] and frequent medicine users [8] revealed better drug knowledge. Sloand et al. [52] also reported that only 15% students could choose the right drug for menstrual pain.

In Brazil, 71% students in schools were not aware of the proper use of the medicines [44]. Overmedication with OTC analgesics was reported in 22% adolescents who consumed more than three doses per week for more than 6 weeks [158]. In contrast, many young females (70%) had been reported to use lower doses of analgesics to treat dysmenorrhea because of lack of drug knowledge [98]. Another study in Saudi Arabia revealed poor knowledge, misconception, and negative attitude of adolescents about medicines [46].

Specific studies on assessing knowledge about use of analgesics (especially acetaminophen) also reported overall poor score because of confusion about the drug name, associated side effects, contraindications, and usage instructions on the drug label [164,165]. Similar errors in understanding instructions from package inserts of other OTC drugs had also been reported [31]. However, a study from United Arab Emirates reported that reading package inserts before SM significantly improved the drug knowledge [50].

Adverse drug reactions. Adverse drug reactions (ADR) due to SM have been largely unexplored. One-third of 594 U.S. adolescents experienced side effects probably because of sharing of

prescription drugs or lack of proper instructions [10]. Another study on ADR among 245 adolescents in Germany observed 31.1% female and 19.6% males experiencing therapeutic failure and other OTC drug–related problems because of wrong drug selection, underdosing, or overdosing. However, the side effects were mild and mostly resolved by the teenagers themselves or by their parents [67]. Not many studies have been undertaken, probably because of lack of severity and seriousness of the ADR with SM practices.

Abuse of self-medicated drugs (nonmedical use of prescription-only medicines and over-the-counter drugs). Abuse of POMs (nonmedical use of POMs) refers to intentional use of a POM either without a prescription, in a nonprescribed manner, or for experiencing its effects [166]. This has become an alarming issue in the United States with one in four adolescents (approximately 5 million; 24%) reporting misuse or abuse of POMs at least once in their lifetime [167]. In fact, POMs and OTC medicines were the second most common drugs (after cannabis) abused by high school students followed by other illicit drugs (cocaine, heroin, ecstasy, and methamphetamine) combined [166,168].

Abuse of POMs and OTC drugs has emerged as a risky trend and is initiated during early adolescence [169]. The POMs frequently self-medicated include narcotic pain killers, tranquilizers, stimulants, and sedatives [14,169,170], which have higher addictive potential than other drug groups. Furthermore, the OTC drug dextromethorphan, present in many cough and cold preparations, was also widely abused [122–124]. Two longitudinal studies observed that the average age for abusing opioids was 17 years [77], and long-term misuse of opioids was associated with increased risk for substance abuse [76]. A study on the age–period–cohort analysis of nonmedical use of analgesics also revealed that the prevalence was higher among the current generation than the adolescent cohorts of the past [171].

The abuse of POMs may be due to self-treatment motives or for sensation-seeking urges [56,57]. Thus, POMs have been reported to be abused for pain, anxiety, insomnia, obesity, and enhancing academic performance or for getting high [14,56,58,70,80,87,132]. Females were observed to be more inclined toward self-treatment motives, whereas males for sensation seeking [58,59,80,172]. A lax parental attitude and behavior, easy accessibility, increased medical exposure [56,57,59,80,81,136,169], and misconception about drug safety [167,169,170] were other important raison d'être for the observed trend.

The abuse of POMs was found to be more prevalent among older students [60–65,70,83,84,86,89], whites and native American youth [40,59,88], high socioeconomic class [133], sportspersons [131], bisexuals, gays [53], and females who were sexually victimized [54]. Sex differences have been also reported with both female [61–64,83,84,86,125,133] and male [70,88] preponderance. Most adolescents had unsupervised access to their prescription medicines [173], and a common source was one's own prescription [39,126,129,160]. Many also obtained these drugs from their relatives/friends [10,38,39,64,80,133], which resulted in high potential for abuse [126,160,174]. Moreover, they were more likely to be engaged in other risky behaviors like alcoholism, illicit drug use, delinquency [56,60,88,125,136], and "pharm parties" [175]. Studies have shown that a stable family environment, high parental bonding, and monitoring were associated with *less* self-reported misuse of POMs [61,63,64,70,86].

Summary and Implications

A critical appraisal was done for the methodological quality of 163 articles published beyond 2000. The review of the articles revealed that SM is common among adolescents, and the trend is highly influenced by several factors. The studies varied in their country of origin, sample size, recall period, gender, and age group. The high variation in prevalence of SM could be significantly influenced by the recall period. The practice was higher among females and increased with age. Maternal education, parental factors, familial practice, and socioeconomic status were other important factors that influenced SM. Monitoring important factors that facilitate SM can help to reduce health risks among adolescents.

OTC drugs (analgesics, cold remedies, and antiallergics) and POMs (antibiotics, opioids, and hypnotics) were frequently used for various health complaints. Nonmedical use of POMs was found to be more prevalent among whites, delinquents, and illicit users. There was a higher reporting of nonmedical use of drugs from the United States compared with other countries, which need to be explored.

Pharmacists, parents, and friends served as main sources of drug information and procurement to deal with headache, cold, and menstrual problems. High-risk practices such as utilization of previous prescriptions were also reported. In addition, media motivated the adolescents for independent drug use. Most studies revealed gaps in drug knowledge, although adolescents self-rated it as satisfactory. Observing the existing trend of SM could help to monitor the overuse and abuse of the drugs among the adolescents. However, few ADR had been reported, probably because of lack of awareness about the potential harmful effects of medicines. The results have been summarized in Table 5.

The review not only gives an insight into the general practices of SM but also highlights poorly explored factors such as ease of access and diversion of prescriptions. These factors seem to have a close association with autonomous SM, particularly among females. Future research needs to explore other correlates of SM such as age of onset, health education programs in schools, health literacy, and so forth. Longitudinal studies will give an insight into the association between adolescent SM practices and drug behavior during adulthood.

The results of this review should be viewed with caution as the key information of each study has been scrutinized to project a broader picture of SM practices among the adolescents. Also of note, there have been variations in the quality of the included studies, the operational definitions of medicine use, study design, data collection tools, sample selection, sample size, and measurement time frame. Other limitations of this review pertain to cross-sectional research design, variable recall period, and inherent constraints of self-reporting methodology.

Recommendations

Adolescents are vulnerable to the prevailing self-care culture. This puts parents, teachers, relatives, and friends in a responsible position to guide the adolescents about the self-management of their common health problems. Parents should repeatedly reinforce the principles of proper/improper use of medicines and their potential side effects. They should be aware about the common side effects of OTC drugs and POMs in the home medicine chest and share the same with their children. Maintaining drug accountability at home, limiting access, and safe disposal of

Table 5
Summary of results

Variables (reference table)	Range (total studies)
Overall prevalence of self-medication (Table 1)	2%–92% (40)
Sample size (Tables 1–4)	32–24,945,358
Recall period (Table 1)	Point of time to lifetime use
Age (Tables 1–4)	13–18 years
Overall prevalence of nonmedical use of POMs (Table 1)	3%–34% (15)
OTC self-medicated (Table 2)	
Analgesics	5%–94% (26)
Vitamins/supplements	3%–83% (28)
Antiallergic	2%–82% (5)
Cough and cold	.5%–71% (13)
Dermatologic	3%–37% (5)
Gastrointestinal	6%–33% (6)
POMs self-medicated (Table 2)	
Systemic antibiotics	4%–58% (7)
Opioids	2%–35% (29)
Sedative/hypnotics	.4%–27% (21)
Stimulant medication	.9%–26% (28)
Antianxiety/tranquilizers	.5%–20.4% (25)
Anabolic–androgenic steroids	.1%–14% (20)
Antimalarial drugs	14% (1)
Hormones	9%–13% (2)
Ophthalmic drugs	9%–11% (2)
Self-medicated health complaints (Table 3)	
Headache/muscle ache	7.2%–89% (13)
Allergy/hay fever	57%–85% (2)
Fever	3%–84% (3)
Flu/cough/cold	3%–81% (9)
Menstrual complaints	14%–74% (5)
GI complaints	9%–59% (8)
Skin complaints	10%–53% (6)
Sleep disorders	15%–51% (5)
Eye complaints	12%–44% (3)
Nervousness	16%–39% (3)

Sources (Table 4)	Drug recommendation	Drug Procurement	Drug information
Parents	16%–69% (8)	32%–73% (5)	7%–88% (5)
Pharmacist	4%–46% (5)	7%–80% (7)	10%–68% (5)
Relatives	15%–51% (3)	29%–53% (4)	3.8%–39% (3)
Friends	2%–10% (5)	1%–63% (14)	5%–20% (4)
School teacher/coach	36%–67% (3)	NA	2%–33% (5)
Media	2%–34% (4)	1% (1)	6%–61% (6)
Without adult guidance	11%–77% (12)	NA	NA
Doctor/school nurse/ dietician	4%–30% (3)	NA	8%–74% (7)
Previous prescriptions	NA	15%–80% (5)	NA
Home medicine cabinet	NA	20%–74% (7)	NA
Supermarkets/grocery stores/health food shops	NA	7%–53% (3)	NA
Diversion of prescription	NA	14%–28% (9)	NA
Drug dealers	NA	2%–19% (4)	NA
Package insert	NA	NA	8%–62% (6)

NA = not applicable; OTC = over-the-counter drugs; POMs = prescription-only medicines.

expired medicines will instill a responsible drug behavior among adolescents. They should also model appropriate drug use behavior (especially for POMs) as it influences the adolescent's attitude toward medicines [176,177]. The negligent attitude of parents toward drugs can make the adolescents believe that it is okay to self-medicate for common ailments. Educational programs to create awareness about the risks of OTC drugs/POMs among parents and ensure drug monitoring at home may reduce the demand and supply of drugs [177].

The awareness regarding possible risks and benefits of SM must be inculcated among the adolescents through various activities at home, school, and entertainment hubs [178,179]. The risks associated with sharing of prescription drugs among families and friends should also constitute a part of the awareness campaigns. Simple guidelines on "Dos and Don'ts" of SM can be prepared and displayed at strategic points. Schools could also provide a platform for imparting basic drug knowledge through health education activities [180]. A science education curriculum involving evidence-based information about the risks of POMs, expounding misconceptions and promoting attitudes toward rational use had also been suggested [177]. Educational interventions to promote rational drug use in adolescents had shown encouraging changes in attitudes, which seem to be long lasting [31,181–186].

Family physicians and community pharmacists can contribute to curb the dangers of SM through communication via repeated encounters [172], monitoring drug-associated risks, and identifying at-risk population having inclination toward drug abuse [76,88,159,187]. Correct interpretation of information in package inserts and improvised labeling can further help in reducing the misuse of OTC drugs [165]. Laws should also be implemented to address the issue by restricting the sale of medicines to unaccompanied adolescents and maintaining vigilance on the retailing of drugs through pharmacies.

The systematic review of articles published beyond 2000 elaborates the SM practices among adolescents. Although self-medication has been described as an important facet of health maintenance, it does not empower the adolescents to consume drugs independently. Understanding this global concern in a comprehensive manner will provide a lead in framing guidelines and policies to minimize the associated risks of self-medication. Moreover, it will aid in creating awareness among adolescents about the potential risks of using drugs without proper information and consultation. Studies need to be designed to assess the changing trend and identify new correlates of self-medication practices among adolescents, which pose fresh challenges to monitor the menace.

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