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Prevalence of self-medication in Ghana: a systematic review and meta-analysis

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Abstract

Objectives: This study estimates the prevalence of self-medication and provides an understanding of the reasons for self-medication in Ghana.

Methods: A systematic search was conducted in PubMed, Science Direct, and African Journals Online (AJOL) to identify observational studies published from inception to March 2022. Google scholar and institutional websites were searched for grey literature. We included studies reporting primary data on the prevalence and/or reasons for self-medication in Ghana. Random-effects meta-analysis was used to estimate the prevalence of self-medication. Subgroup analysis was performed with the study population (pregnant women, patients and students), geopolitical zone (coastal, middle, and northern), and study setting (rural and urban). Using inductive thematic analysis, reasons for self-medication were classified and tallied under key themes.

Results: Thirty (30) studies involving 9,271 participants were included in this review. The pooled prevalence of self-medication in Ghana was 53.7% (95% CI = 46.2%–61.0%; I^2 = 98.51%, p < .001). Prevalence of self-medication was highest among pregnant women (65.5%; 95% CI = 58.1%–72.5%; I^2 = 88%), in the middle belt of the country (62.1%; 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), and in rural settings (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001). The most cited reasons for self-medication included long waiting time at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unseriousness of diseases (53.3%).

Conclusion: The high prevalence of self-medication in Ghana is influenced by inconveniencies associated with accessing healthcare coupled with poor perceptions of drug use, and an attitude of downplaying the need for early medical attention. There is the need for improved access to quality healthcare and the promotion of rational health-seeking behaviours.

Keywords: Self-medication, prevalence, reasons, systematic review and meta-analysis, Ghana.

Key questions

What is already known?

In Ghana, inappropriate use of medicines costs the healthcare sector at least US$ 20 million annually, yet evidence on the practice of self-medication in Ghana is disjointed.

What this study adds?

There is a high prevalence of self-medication in Ghana; the prevalence is higher among pregnant women, in the middle belt of the country, and rural areas than in the general population.

Most cited reasons for self-medication in Ghana include long waiting times at health facilities, previous use of drugs, and the perceived unseriousness of diseases.

How this study might affect research, practice, or policy?

There is the need to have a relook at the strategies of the Ghana National Drug Policy on patient compliance and self-medication, and to ensure improved access to quality healthcare and the promotion of rational health-seeking behaviours among Ghanaians.

Future research needs to implement strong qualitative methodologies to produce findings that provide an in-depth account of the reasons for self-medication in Ghana.

Introduction

The practice of self-medication has received considerable attention as a major public health challenge in low and middle-income countries (LMICs).[1,2] The median prevalence of self-medication is estimated to be 55.7% in Africa and 70.1% in West Africa. [3] Also, the World Health Organization estimates that 20-50% of all antibiotics in LMICs are inappropriately used. [4] The high prevalence of self-medication in low and middle-income countries is mainly due to the limited access to healthcare, high cost of healthcare, poor conditions of health facilities, and inappropriate health-seeking behaviours in the general population. [5,6]

Although self-medication is known to reduce the pressure on healthcare systems, [7] is associated with severe challenges, particularly in countries where health literacy is low (Muflih et al., 2022). Key among these challenges include the development of antimicrobial resistance, increased morbidity, rising costs of healthcare services, [10] foetal malformations, maternal deaths, psychopathological symptoms among pregnant women, [11,12] drug addiction, toxicity, and drug-drug contraindications. [13]

In Ghana, the practice of self-medication is associated with massive health system costs. Antimicrobial resistance attributable to self-medication in Ghana is high. [14,15] Annually, an estimated cost of US$ 20 million is incurred in the Ghanaian healthcare system as a result of inappropriate antibiotic use for upper respiratory tract infections alone. [16] Also, recent studies have reported a high prevalence of self-medication among pregnant women in Ghana [17,18] and this could lead to foetal malformation and maternal deaths; [19] derailing Ghana's efforts toward promoting safe motherhood and improving maternal and neonatal health outcomes. [20]

Despite the above concerns, evidence on the practice of self-medication in Ghana is disjointed. Although several primary studies have reported different proportions and reasons for self-medication in Ghana, there has been no systematic review providing a comprehensive report on the prevalence and reasons for self-medication in Ghana. This paper, therefore, sought to determine the prevalence of self-medication and to identify the reasons for its practice in Ghana. This work significantly contributes to the existing knowledge

on the practice of self-medication in Ghana and also informs policies in the fight against this public health menace in the country.

Methods

Search strategy

PubMed, Science Direct, and African Journals Online (AJOL) were searched for observational studies published from the dates of inception to March 2022. The search terms included: ("self-medication" OR "non-prescription drug*" OR "over-the-counter drug*" OR "OTC drug*" OR "home remed*" OR "herbal medication" OR "herbal drug*" OR "Analgesic*" OR "Antibiotic*") AND ("Ghana" OR "Ghanaian"). Google Scholar was used in searching for grey literature. Also, we searched the websites of the Ministry of Health (https://www.moh.gov.gh) and the Ghana Health Service (https://www.ghanahealthservic.org) for institutional reports. Additionally, to reduce the possibility of missing studies, the reference lists of relevant studies were manually inspected for additional records. The literature search began on October 10, 2021 and ended on April 5, 2022. This review is not associated with a registered protocol and the study reporting followed the 2020 statement of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [21].

Eligibility criteria and study selection

The population-intervention-comparison-outcome-context (PICOC) framework was used to select studies for inclusion (see Table 1). Studies qualified for inclusion if they were observational studies and presented primary results on the prevalence and/or reasons for self-medication in Ghana. Studies were excluded if they reported intervention(s) on the use of prescribed medicines, multiple publications of the same study (in which case only the first publication is retained), or studies that did not present primary results on either prevalence or reasons for self-medication in Ghana. Also, opinion papers and commentaries were not included in this review. We did not limit the review to any specific subpopulation or time since the goal was to provide a comprehensive account of the prevalence and reasons for self-medication in Ghana.

Guided by the already established eligibility criteria, two authors screened the titles and eligible titles were exported into a Microsoft Excel file. Two authors independently applied the eligibility criteria to select studies for inclusion. The remaining authors were consulted in the event of disagreements in the selection of studies. Also, three authors independently confirmed the justifications for the exclusion of studies after the full-text screening. The list of the excluded studies can be found in the supplementary material, Table S1.

Table 1. Framework for determining the eligibility of studies

Criteria	Description of criteria
Population	All populations
Intervention	Self-medication
Comparison	Not applicable
Outcome	Prevalence of self-medication and reasons for self-medication.
Context	Ghana

Quality assessment and data extraction

The Mixed Methods Appraisal Tool (MMAT) Version 2018 [22] was used to assess the methodological quality of studies. The tool is used to assess the quality of primary studies based on seven (7) questions. Reviewers answered *"Yes"*, *"No"* or *"Can't tell"* to each question and studies that received a *"Yes"* on 6-7 questions were judged as high quality, 4-5 as moderate quality, and 1-3 as low quality. Three reviewers independently assessed the quality of the studies and disagreements were resolved through consultation with the other reviewers. Details on the risk of bias assessment can be found in the supplementary material, Table S2 (qualitative studies), Table S3 (quantitative studies), and Table S4 (mixed-methods studies).

Data were extracted using an Excel spreadsheet to complete the following information about the selected studies: author and year of publication, study location (region, geopolitical zone, and setting), sample size, study design, study year, age of respondents, the prevalence of self-medication, and reasons for self-medication. Data extraction was done by three authors independently and was checked by the remaining authors for completeness and accuracy.

Data analysis

Meta-analytic techniques were used to estimate the pooled prevalence of self-medication in Ghana using MetaXL [23] in Microsoft Excel and OpenMeta [Analyst]. [24] A random-effects model [25] was selected over fixed-effects models since the assumption of functional equivalence among studies was violated. [26] The Freeman-Tukey double arcsine transformed proportions were used to stabilize the variance of individual studies. [27] The results of the meta-analysis were presented visually using a forest plot. Heterogeneity was examined using the I^2 statistic; where I^2 is the percentage of the total variability in the pooled estimate explained by heterogeneity. [28] Values of $I^2 < 50\%$, 50-70%, and > 70% were interpreted as low, moderate, and high heterogeneity respectively. [29] A leave-one-out sensitivity analysis was used to evaluate the influence of individual studies on the pooled estimate of the prevalence of self-medication. [30] The risk of publication bias was assessed by visually inspecting the funnel plot and Egger's regression test of funnel plot asymmetry. [31] Subgroup analyses were performed using interest populations (pregnant women, patients, and tertiary students), geopolitical zones (northern belt, middle belt, and coastal belt) and study setting (urban and rural) to explore the potential sources of heterogeneity. All statistical analyses were conducted at a 95% confidence level.

The data on reasons for self-medication were synthesized using inductive thematic analysis [32] where reasons identified in the various studies were reclassified under key themes (such as "Long waiting time at health facility", "Previous use of drugs", "Perceived unserious nature of diseases", "Drugs affordable", "High cost of healthcare" etc). For instance, *"long delays at clinics/hospitals"* [33] and *"spending long hours at health facility"* [34] were reclassified under the key theme *"long waiting time at health facility"*. Simple counts (tallying) of distribution [3] were used to summarize the evidence available from the studies reporting on reasons for self-medication in Ghana.

Patients and public involvement

Patients and members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

Search results

We identified a combined total of 1,174 studies through the database and manual search for evidence. After removing duplicates, 749 records were left for screening. After title and abstract screening, a total of 713 articles that were not relevant to the review were removed, leaving 36 articles for full-text screening. A total of 30 articles qualified for inclusion after the full-text screening. Our decision to exclude Bonti (2017) [35] from the analysis was based on the lack of primary evidence (e.g. quotes, text excerpts, field notes, etc.) to back the study results. Since this reporting practice is not in line with the standards for reporting qualitative research [36,37] and does not allow for confirmation of the interpretations made, we excluded it from this study. The study selection results have been presented in Fig. 1.

Fig. 1. PRISMA flow chart showing the study selection process and results.

Characteristics of included studies

The characteristics of the studies have been shown in Table 2 (Full details in supplementary material, Table S5). Twenty (66.7%) of the studies were published peer-reviewed journal articles and ten (33.3%) were grey literature. Three (10.0%) of the studies were of low quality, ten (33.3%) were of moderate quality, and seventeen (56.7%) were of high quality. The studies were conducted in ten (62.5%) of the sixteen regions in Ghana. In terms of geopolitical zones, nineteen (63.3%) of the studies were conducted in the coastal belt, six (20.0%) were conducted in the middle belt, and five (16.7%) were conducted in the northern belt of Ghana. The majority of the studies were conducted in an urban setting (22, 73.3%), six (20%) were conducted in a rural setting, and two studies (6.7%) covered both urban and rural populations. Twenty-six (86.7%) of the studies were quantitative, three (10.0%) were qualitative, and one study implemented a mixed-methods design. Except for two qualitative longitudinal studies, the remainder of the studies were cross-sectional. All the 30 included studies had a combined sample size of 9,271.

Table 2. Characteristics of included studies

Study	Study year	Sample size	Region	Geopolitical zone	Setting	Quality grade
Agyei-Boateng (2015)[38]	2015	300	AR	Middle-belt	Urban	High
Donkor et al. (2019)[39]	2017	261	AR/ER	Middle-belt	Urban	High
Afari-Asiedu et al. (2020)[41]	2019	70	BER	Middle-belt	Rural	High
Enimah et al. (2022)[42]	2020	191	CR	Coastal-belt	Rural	High
Gbagbo & Nkrumah, (2020b)[43]	2018	100	CR	Coastal-belt	Rural	High
Kyei et al. (2014)[44]	2013	421	CR	Coastal-belt	Urban	High
Amponsah et al. (2022)[45]	2019	337	GAR	Coastal-belt	Urban	High
Kretchy et al. (2021)[46]	2016	350	GAR	Coastal-belt	Rural	High
Asante (2019)[34]	2019	319	GAR	Coastal-belt	Urban	High
Acheampong et al. (2019)[47]	2017	680	GAR	Coastal-belt	Urban	High
Acheampomaa (2018)[48]	2018	126	GAR	Coastal-belt	Urban	High
Gbadago (2017)[49]	2017	396	GAR	Coastal-belt	Urban	High
Sackey et al. (2018)[50]	2014-2016	33	GAR/CR	Coastal-belt	Mixed	High
Agblevor et al. (2016)[51]	2014-2016	51	GAR/CR	Coastal-belt	Mixed	High
Ameade, Amalba, et al. (2018)[52]	2015	293	NR	Northern-belt	Urban	High
Adama et al. (2021)[18]	2017	367	UWR	Northern-belt	Urban	High
Yendaw & Tampah-Naah, (2021)[53]	2020	122	UWR	Northern-belt	Urban	High
Asiedu et al. (2016)[54]	2016	469	CR	Coastal-belt	Urban	Moderate
Asamoah (2019)[55]	2019	356	ER	Middle-belt	Rural	Moderate
Ofori et al. (2021)[56]	2017	417	GAR	Coastal-belt	Urban	Moderate
Awuah et al. (2018)[57]	2013	707	GAR	Coastal-belt	Urban	Moderate
Ameko et al. (2012)[14]	2008	150	GAR	Coastal-belt	Urban	Moderate
Issaka (2021)[58]	2020	170	NR	Northern-belt	Urban	Moderate
Ameade, Zakaria, et al. (2018)[59]	2017	370	NR	Northern-belt	Urban	Moderate
Botchwey et al. (2022)[17]	2021	50	OR	Middle-belt	Rural	Moderate
Makam et al. (2021)[60]	2018	371	VR	Coastal-belt	Urban	Moderate
Ofosu (2020)[61]	2020	400	WR	Coastal-belt	Urban	Moderate
Owusu-Ofori et al. (2021)[62]	2019	264	AR	Middle-belt	Urban	Low
Tagoe & Attah (2010)[63]	2010	530	CR	Coastal-belt	Urban	Low
Donkor et al. (2012)[33]	2008	600	GAR	Coastal-belt	Urban	Low

Note: AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; VR = Volta Region WR = Western Region.

Prevalence of Self-medication in Ghana

A total of 27 out of the 30 studies with a combined sample size of 9,117 were included in the meta-analysis since three (3) of the included studies were qualitative studies. The pooled prevalence of self-medication was 53.7% (95% CI = 46.2%–61.0%) (Figure 2). Heterogeneity among the studies was high (I^2 = 98%, p

< .001). The funnel plot (Fig. 3) and the results of Egger's test (Z = 0.637; p = 0.524) showed that there was no evidence of publication bias. The sensitivity analysis showed that the pooled estimate of self-medication was not significantly impacted by any individual study (Fig. 4).

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

Fig. 3. Funnel plot for assessing the risk of publication bias

Fig. 4. Leave-one-out sensitivity plot

Subgroup analysis

The prevalence of self-medication by the categorical moderators (interest populations, geopolitical zones and study setting) have been presented in Table 3. The prevalence estimates were 65.5% (95% CI = 58.1%–72.5%; I^2 = 88%) among pregnant women, 46.5% (95% CI = 26.7%–66.9%; I^2 = 98%) among patients, and 44.1% (95% CI = 27.5%–61.3%; I^2 = 99%) among tertiary students. In terms of geopolitical zones, the highest prevalence of self-medication was estimated in the middle belt (62.1%, 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), followed by the coastal belt (52.1%; 95% CI = 43.5%–60.6%; I^2 = 98%, p < .001), and the northern belt (50.6%; 95% CI = 26.8%–74.4%; I^2 = 99%; p < .001). For study setting, the prevalence estimate was higher in the rural setting (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001) compared to the urban setting (52.0%; 95% CI = 44.0%–59.9%; I^2 = 98%; p < .001).

Table 3. Results of subgroup analysis

Moderator	Number of studies	Pooled prevalence	95% CI		I^2	p
			Lower	Upper		
Interest population						
Pregnant women	6	65.5%	58.1%	72.5%	88%	<.001
Patients	4	46.5%	26.7%	66.9%	98%	<.001
Tertiary students	6	44.1%	27.5%	61.3%	99%	<.001
Geopolitical zone						
Coastal belt	17	52.1%	43.5%	60.6%	98%	<.001
Middle belt	5	62.1%	40.9%	82.0%	98%	<.001
Northern belt	5	50.6%	26.8%	74.4%	99%	<.001
Study setting						
Rural	5	61.2%	36.5%	84.5%	98%	<.001
Urban	22	52.0%	44.0%	59.9%	98%	<.001

Reasons for self-medication in Ghana

Fifteen (15) studies reported data on the self-reported reasons for self-medication in Ghana. The reasons have been presented in descending order based on the proportion of studies reporting them (Table 4). The results show that the most commonly reported reasons for self-medication in Ghana were long waiting times at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unserious nature of diseases (53.3%). Other reported reasons for self-medication included drugs affordable (33.3%), high cost of healthcare (33.3%), and long-distance to a health facility (33.3%).

Table 4. Reasons for self-medication in Ghana

Key reasons identified	Number of studies reporting reason (%)
Long waiting time at health facility	11 (73.3)
Previous use of drugs	10 (66.7)
Perceived unserious nature of diseases	8 (53.3)
Drugs affordable	5 (33.3)
High cost of healthcare	5 (33.3)
Long-distance to a health facility	5 (33.3)
Relative/friend's recommendation	4 (26.7)
For quick relief of symptoms	4 (26.7)
Easy access to drugs	4 (26.7)
Poor healthcare provider behaviour	4 (26.7)

Good knowledge of disease/drug	4 (26.7)
Busy schedule	3 (20.0)
Lack of trust in healthcare workers	2 (13.3)
Negative societal perceptions of the sick	2 (13.3)
For emergencies	1 (6.7)
Convinced by radio/television adverts and drug peddlers	1 (6.7)

Discussion

In the public health literature, self-medication is a phenomenon that has been widely discussed. [3,64] A careful analysis of the included studies revealed that out of the 30 included studies, the majority of them (56.7%) were of high quality. This situation is promising as high-quality research serves as a benchmark for societal development. [65] The studies included in this review were conducted in ten out of the sixteen regions of Ghana and self-medication in the rural areas remains under-investigated, as evidenced by the paucity of literature in rural communities. The paucity of literature on self-medication from some regions and the rural setting in Ghana could be due to existing socio-cultural and economic constraints that make the conduct of research in these areas challenging. [66,67]

The results of this review indicate that self-medication is indeed an unresolved menace in Ghana which requires urgent attention. Approximately, 54% of Ghanaians have engaged in self-medication at one point in time. This prevalence estimate in Ghana is similar to prevalence estimates from other LMICs. For instance prevalence of self-medication was estimated to be 53.57% in India, [68] 53.3% in Pakistan, 51.5% in Sudan, and 49.5% in Saudi Arabia. [69] This combination of findings demonstrates that the practice of self-medication is a common phenomenon in LMICs. In LMICs, regulation of the pharmaceutical market is lax, there is poor access and suboptimal utilization of healthcare, and health literacy is low. [3,70] These factors could explain the high prevalence of self-medication in LMICs.

The results of the study showed that close to 66% of pregnant women self-medicate in Ghana. This proportion is more than twice the prevalence estimated by a recent global review (i.e., 32%). [5] Also, lower rates have been reported among pregnant women in Iran (38.46%), [71] in Mexico (21.9%), [72] and in Ethiopia

(26.6%). [73] The high prevalence of self-medication among pregnant women in Ghana is all the more a matter of public health concern because self-medication is associated with maternal death, premature birth, low birth weight, and foetal malformations. [11,12] The findings of the current review support earlier findings that the free maternal healthcare policy in Ghana is not effectively enforced, limiting access to maternal healthcare. [74,75]

Another population of interest in this review was patients receiving care in health facilities. The current study estimated the proportion of self-medication among patients to be 46.5%. This is consistent with the findings of a recent review that found self-medication among patients in sub-Saharan Africa to be within the range of 45–89%. [64] Like in most developing countries, Ghanaians are likely to try home remedies as the initial health-seeking behaviour and are likely to self-medicate while taking prescribed medicines [50,57]. Alarmingly, this practice could lead to drug toxicity, drug-drug contraindications, and reduced efficacy of prescribed medicines. [13,39]

Self-medication was relatively lower among tertiary students (44.1%). This is likely the case because of increased health literacy among this section of the population. Evidence suggests that people with higher levels of education are less likely to self-medicate compared with those with low levels of education. [9,13,76] However, the proportion of self-medication among tertiary students is still not desirable given the risk of drug addiction among this cohort of the population. [45] Therefore, regardless of the high level of education among this subpopulation, health education may be needed to promote the appropriate use of medicines among students.

The few studies conducted in rural communities revealed that the prevalence of self-medication in the rural setting (61.2%) was higher than in the urban setting (52.0%). In Ghana and most LMICs, rural communities are often characterized by a lack of healthcare facilities, low socioeconomic status, poor transportation systems, and suboptimal access and utilization of healthcare. [67,70,77] These factors could explain the high prevalence of self-medication in rural Ghana.

This study estimated the highest prevalence of self-medication in the middle belt of the country (62.1%), followed by the coastal belt (52.1%) and the northern belt (50.6%). The proportions of studies conducted in the urban setting could explain why self-medication was found to be lower in the northern and coastal belts compared to the middle belt. All five (100%), 14 (82.4%), and three (60%) of the studies included in the meta-analysis from the northern, coastal, and middle belts respectively were conducted in urban areas. Since self-medication is lower in urban areas, it is not surprising to have a lower prevalence of self-medication in the northern and coastal belts of the country where the proportions of urban-based studies were higher.

Another focus of this study was to identify the reasons for self-medication in Ghana. The results of the current study have revealed that the most common reason for self-medication was the long waiting time in health facilities. In Ghana, most healthcare facilities are still grappling with long patient waiting times as a result of high patient-to-healthcare staff ratios, limited material resources, and poor environmental and design issues. [79–81] Patient waiting time is negatively associated with patient satisfaction [80,82]; and since customer satisfaction is positively related to customer loyalty, [83] people are likely to self-medicate or seek alternative care when they are not satisfied with the formal healthcare system.

Previous use of drugs was another common reason for self-medication in Ghana. This finding is not surprising because anecdotal evidence suggests that some Ghanaians tend to restock previously received prescriptions in an attempt to continue the dosage even without their prescriber's consent. [35] In an environment where there is easy access to over-the-counter drugs, people are likely to rely on their past successful experiences with a drug with the hope that they will have the same outcomes as previously. [3] Self-medication with previously used drugs is usually without the professional guidance of a healthcare worker, [64] making it a very risky practice, especially among vulnerable groups such as pregnant women and patients who are receiving care.

Also, the perception that some disease conditions are not severe to warrant a hospital visit was a commonly reported reason for self-medication from the results of this review. In Ghana, people are likely to

underestimate disease conditions since most Ghanaians have limited knowledge of diseases and their symptoms. [29,84,85] As such the self-ascribed severity of disease conditions may be tricky since people are likely to disregard important clinical symptoms and delay seeking appropriate and timely medical care. This could lead to poor treatment outcomes and prognosis. [86]

Additionally, affordability of drugs, high cost of healthcare, and long-distance to health facilities were found in this review as common reasons why Ghanaians self-medicate. These concerns have been reported by other studies as contributing to the high prevalence of self-medication in LMICs [3,6]. Healthcare systems in many LMICs like Ghana have several challenges including limited access to care, poor quality of care, and lack of affordability due to high levels of poverty and poor social support systems. [67,70,87–89] These challenges influence the health-seeking behaviours of people, turning them away from the formal healthcare system. [90]

Strengths and limitations of the study

The main strength of this study is that the risk of bias assessment showed that the majority of the included studies were of high quality and there was no evidence of publication bias in this review. This implies that this review is based on the best available evidence on self-medication in Ghana and thus, offers valuable insights into this important topic of public health concern in Ghana. Also, the adherence to the 2020 PRISMA checklist in the reporting of the study gave credence to the study methodology. However, inherent limitations of this review included the paucity of literature from some regions of the country and rural areas; and the use of interviewer-administered questionnaires by some primary studies for data collection which may come with social desirability bias in the primary evidence. Additionally, this review did not distinguish between self-medication with prescription, non-prescription, and herbal drugs due to the unavailability of data in most of the primary studies.

Implications for practice, policy, and future research

This review has estimated a high prevalence of self-medication in Ghana, highlighting the need for a renewed focus on the promotion of the rational use of medicines in Ghana. Section 6.3.5 of the Ghana

National Drug Policy [91] provides four strategies for ensuring patient compliance to prescribed medicines and preventing self-medication in the country. Three of these strategies mainly focus on patient and public education and the remainder on the promotion of research on inappropriate drug use. [91] However, nearly two decades after the adoption of this policy, research has shown that Ghanaians are still either ignorant about or disregard the adverse effects of self-medication. [44,62] There is, therefore, the need to have a relook at the four strategies; to ensure their effective implementation or review them to match the available evidence on the reasons for self-medication as revealed in this study. The Ministry of Health through its agencies should resource and encourage health professionals to intensify public education to address the perceptions that drive self-medication, and healthcare facilities must adopt innovative strategies to reduce patient waiting times and enhance access to quality healthcare.

Since this study is limited to some extent by inadequate data and/ or information covering the entire country, comprehensive studies across the country could be warranted especially in the regions where little or no information exists including the rural setting. Also, future research needs to implement strong qualitative methodologies to produce findings that provide an in-depth account of the existing practices. Additionally, longitudinal study approaches are needed to investigate how self-medication changes over time as well as assess the effectiveness of interventions that are implemented. All these aforementioned studies will provide representative data and a rounded in-depth understanding of self-medication in Ghana for informed practice and policy direction including any necessary reviews.

Conclusions

This study has revealed that the prevalence of self-medication in Ghana is high; most Ghanaians (close to 54%) have self-medicated at a particular point in time. Self-medication is disproportionately higher among pregnant women compared to the general population, and also highest among the populace in the middle belt and rural areas of Ghana. Most cited reasons for self-medication in Ghana include long waiting times at health facilities, previous use of drugs, and the perceived unseriousness of diseases. There is a need for

evidence-based health interventions to promote the rational use of medicines in Ghana in addition to further research studies that need to be carried out in the country.

Declarations

- **Ethics approval**

Not applicable since the data used are secondary data, already available in the public domain.

- **Consent for publication**

Not applicable

- **Availability of data and materials**

The data for the study are within the manuscript and online supplementary material, Tables S1-S5. The MetaXL codes used for the meta-analytic estimations are available upon reasonable request from the corresponding author.

- **Competing interests**

We declare that there is no conflict of interest in this study.

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The authors received no external funding for this study.

- **Authors' contributions**

Study conception and design: All authors
Literature search and data extraction: R.O, L.A.B, N.E.A, P.F.A, A.A.I
Data analysis and synthesis: R.O, B.D-A, F.A, M.A
Writing (first draft of the manuscript): R.O, B.D-A, L.A.B
Writing (review and editing): All authors
Final approval for publication: All authors

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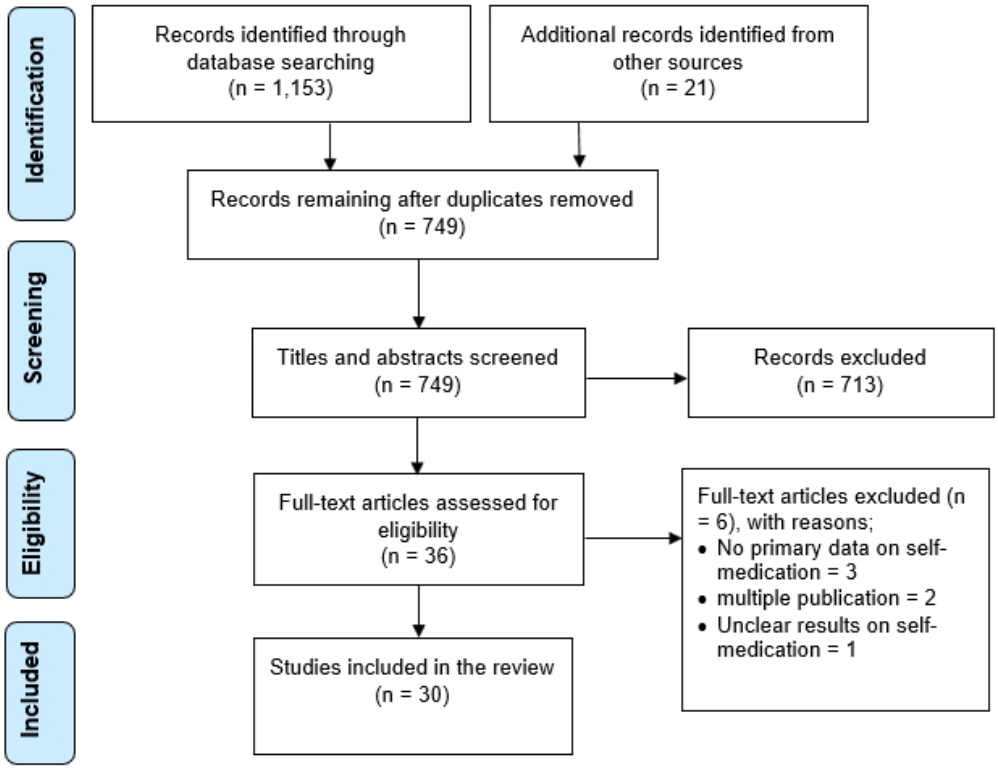

Fig. 1. PRISMA flow chart showing the study selection process and results

413x323mm (38 x 38 DPI)

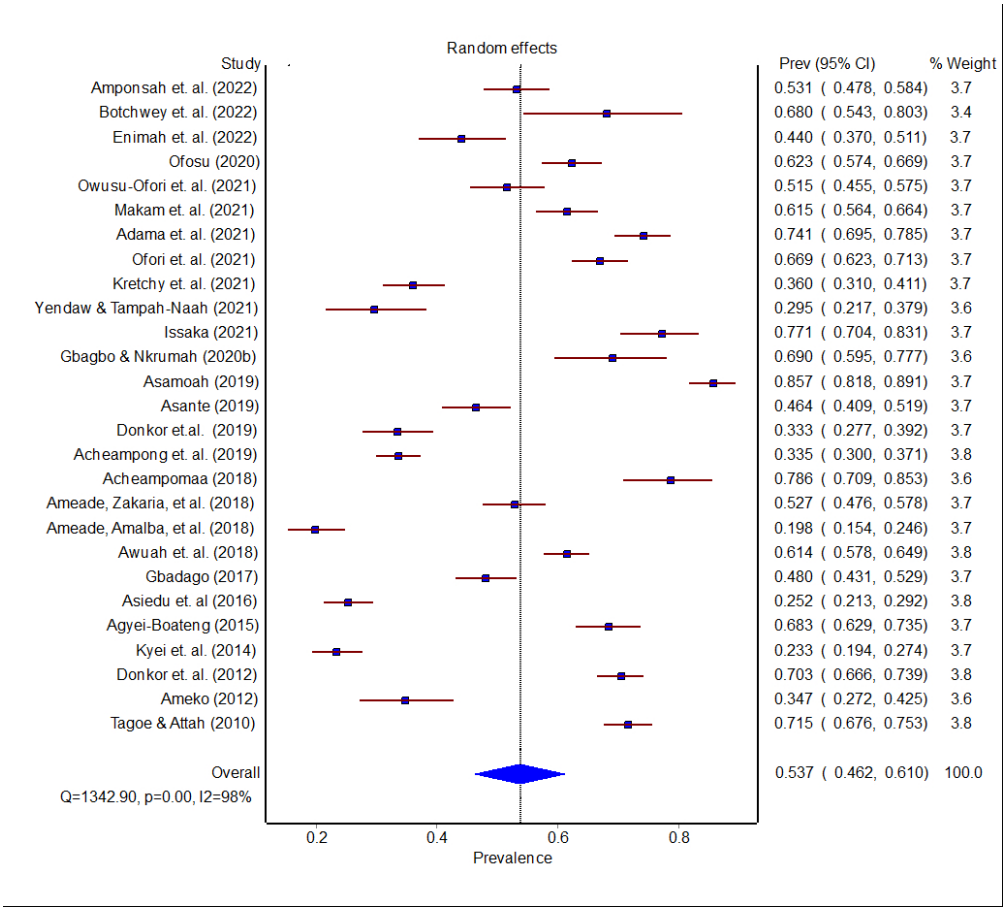

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

273x246mm (96 x 96 DPI)

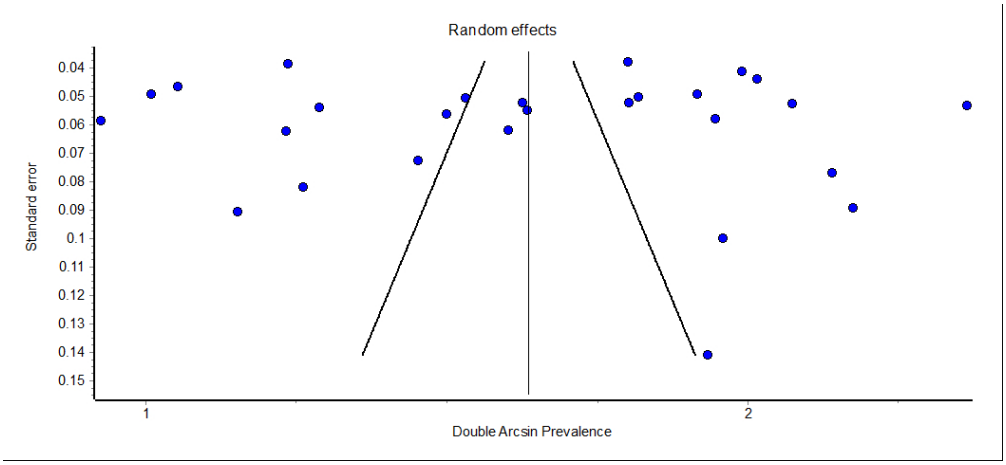

Fig. 3. Funnel plot for assessing the risk of publication bias

278x127mm (96 x 96 DPI)

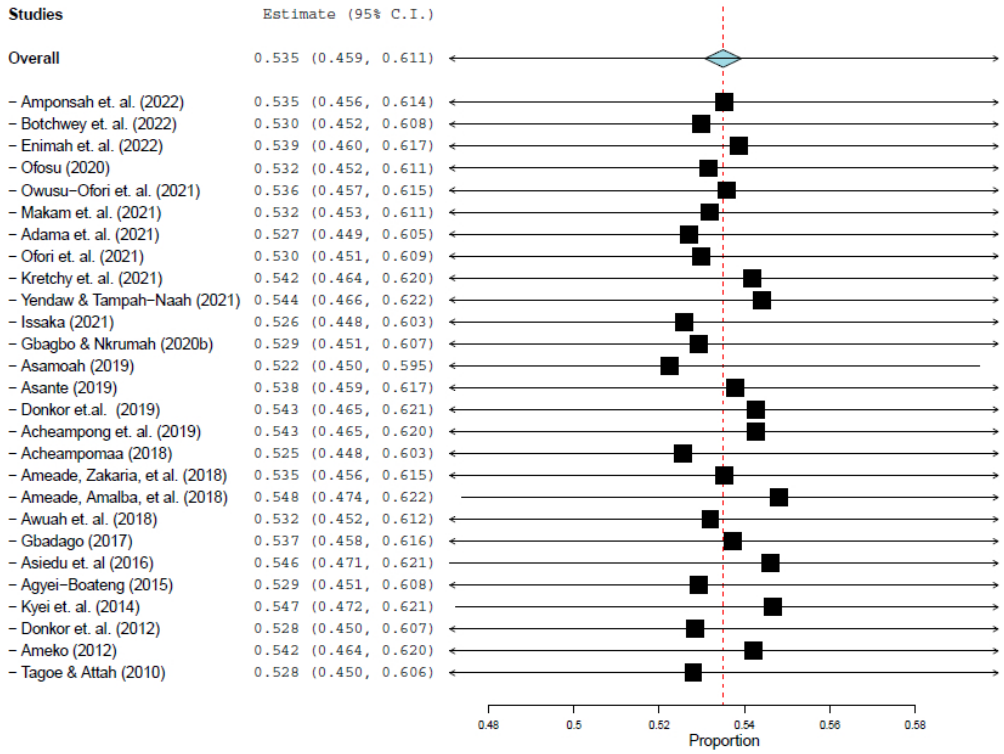

Fig. 4. Leave-one-out sensitivity plot

550x417mm (38 x 38 DPI)

SUPPLEMENTARY MATERIAL

Prevalence of self-medication in Ghana: A systematic review and meta-analysis

Richmond Opoku, Bismark Dwumfour-Asare, Lawrencia Agrey-Bluwey, Nana Esi Appiah, Michael Ackah, Francis Acquah, Priscilla Fordjour Asenso, Abdul-Aziz Issaka

Table S1: List of articles excluded after full-text review.

SN	Author	Year	Title	Decision	Reasons for exclusion
1.	Kretchy et. al.	2021	Prevalence, patterns, and beliefs about the use of herbal medicinal products in Ghana: a multi-center community-based cross-sectional study	Excluded	Unclear results on the prevalence of self-medication.
2.	Bonti, D.	2017	Bridging the gap between self-medication and access to healthcare in Ghana	Excluded	No primary data on prevalence or reasons for self-medication
3.	Gbagbo & Nkrumah	2020	Implications of self-medication in pregnancy for Safe Motherhood and Sustainable Development Goal-3 in selected Ghanaian communities	Excluded	Multiple publications of the same study
4.	Darko & Owusu-Ofori	2020	Antimicrobial resistance and self-medication: A survey among first-year health students at a tertiary institution in Ghana	Excluded	Multiple publications of the same study
5.	Nonvignon et. al.	2010	Treatment choices for fevers in children under-five years in a rural Ghanaian district	Excluded	No primary data on prevalence or reasons for self-medication
6.	Agblevor E.A.	2016	“I am now a doctor”: self-medication practices among households in Accra	Excluded	No primary data on prevalence or reasons for self-medication

Methodological Quality Assessments using the Mixed Methods Appraisal Tool (MMAT) Version 2018

Table S2: Qualitative studies

Study	S1.	S2.	1.1	1.2	1.3	1.4	1.5	Quality Grade
Sackey et. al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Afari-Asiedu et. al. (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Agblevor et. al. (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Table S3: Quantitative studies

Study	S1	S2	4.1	4.2	4.3	4.4	4.5	Quality Grade
Botchwey et. al. (2022)	Yes	Yes	No	Can't tell	Yes	No	Yes	Moderate
Issaka (2021)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Ofosu (2020)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Owusu-Ofori et. al. (2021)	Yes	Yes	No	No	Yes	No	No	Low
Asamoah (2019)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Asante (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Makam et. al. (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	No	Moderate
Acheampomaa (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Adama et. al. (2021)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Ofori et. al. (2021)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Ameade, Zakaria, et al. (2018)	Yes	Yes	Yes	Yes	Yes	No	No	Moderate
Kretchy et. al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Asiedu et. al (2016)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Agyei-Boateng (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Kyei et. al. (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Amponsah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Donkor et. al. (2012)	Yes	No	Yes	No	Yes	No	No	Low
Ameko et. al (2012)	Yes	Yes	No	No	Yes	No	Yes	Moderate
Yendaw & Tampah-Naah (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	High
Donkor et. al. (2019)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	High
Enimah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Gbadago (2017)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Acheampong et. al. (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Awuah et. al. (2018)	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Moderate
Ameade, Amalba, et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Tagoe & Attah (2010)	Yes	Yes	No	No	Yes	Can't tell	No	Low

Table S4: Mixed-Methods studies

Study	S1	S2	5.1	5.2	5.3	5.4	5.5	Quality Grade
Gbagbo & Nkrumah (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	High

Table S5: Detailed characteristics of studies used in the systematic review

Reference	Study Design	Year of study	Sample size	Reported prevalence (%)	Age of study population (mean±sd)	Study population	Study region	Geopolitical zone	Setting	Peer review status	Quality grade
Owusu-Ofori et. al. (2021)	CS (Quantitative)	2019	264	56.2%	19.5±1.88	Tertiary students	AR	Middle-Belt	Urban	Peer-reviewed	Low
Agyei-Boateng (2015)	CS (Quantitative)	2015	300	68.3%	<15-50	Pregnant Women	AR	Middle-Belt	Urban	Grey	High
Donkor et.al. (2019)	CS (Quantitative)	2017	261	33.3%	36.26±14.94	Patients	AR/ER	Middle-Belt	Urban	Peer-reviewed	High
Afari-Asiedu et. al. (2020)	CS (Qualitative)	2019	70	High prevalence	20-50	Health workers/General public	BER	Middle-Belt	Rural	Peer-reviewed	High
Enimah et. al. (2022)	CS (Quantitative)	2020	191	44.00%	44.32±16.27	General public	CR	Coastal-Belt	Rural	Peer-reviewed	High
Gbagbo & Nkrumah (2020b)	CS (Mixed-method)	2018	100	69.0%	29 ± 5	Pregnant Women	CR	Coastal-Belt	Rural	Peer-reviewed	High
Asiedu et. al (2016)	CS (Quantitative)	2016	469	25.2%	22 ±2.5	Tertiary students	CR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Kyei et. al. (2014)	CS (Quantitative)	2013	421	23.3%	39.8±18.6	General public	CR	Coastal-Belt	Urban	Peer-reviewed	High
Tagoe & Attah (2010)	CS (Quantitative)	2010	530	71.50%	≥15	Patients	CR	Coastal-Belt	Urban	Peer-reviewed	Low
Asamoah (2019)	CS (Quantitative)	2019	356	86.0%	35 (median)	General public	ER	Middle-Belt	Rural	Grey	Moderate
Amponsah et. al. (2022)	CS (Quantitative)	2019	337	53.10%	18-41	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	High

Ofori et. al. (2021)	CS (Quantitative)	2017	417	66.7%	35.6 ±10.6	Traders	GAR	Coastal-Belt	Urban	Grey	Moderate
Kretchy et. al. (2021)	CS (Quantitative)	2016	350	36.0%	18-65	General public	GAR	Coastal-Belt	Rural	Peer-reviewed	High
Asante (2019)	CS (Quantitative)	2019	319	46.4%	35.6±13.6	Patients	GAR	Coastal-Belt	Urban	Grey	High
Acheampong et. al. (2019)	CS (Quantitative)	2017	680	33.5%	16.7±1.98	Adolescents	GAR	Coastal-Belt	Urban	Peer-reviewed	High
Acheampomaa (2018)	CS (Quantitative)	2018	126	78.6%	<19-40+	General public	GAR	Coastal-Belt	Urban	Grey	High
Awuah et. al. (2018)	CS (Quantitative)	2013	707	61.40%	15-59	General public	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Gbadago (2017)	CS (Quantitative)	2017	396	48.0%	22.6±0.17	Tertiary students	GAR	Coastal-Belt	Urban	Grey	High
Donkor et. al. (2012)	CS (Quantitative)	2008	600	70.3%	n.s	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	Low
Ameko (2012)	CS (Quantitative)	2008	150	34.7%	n.s	Patients	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Sackey et. al. (2018)	Long. (Qualitative)	2014-2016	33	High prevalence	n.s	General public	GAR/CR	Coastal-Belt	Mixed	Grey	High
Agblevor et. al (2016)	Long. (Qualitative)	2014-2016	51	High prevalence	n.s	General public/chemical shop owners	GAR/CR	Coastal-Belt	Mixed	Grey	High
Issaka (2021)	CS (Quantitative)	2020	170	77.1%	18-54	Nurses	NR	Northern-Belt	Urban	Grey	Moderate
Ameade, Zakaria, et al. (2018)	CS (Quantitative)	2017	370	52.7%	10-50	Pregnant Women	NR	Northern-Belt	Urban	Peer-reviewed	Moderate
Ameade, Amalba, et al. (2018)	CS (Quantitative)	2015	293	19.80%	23±5.07	Tertiary students	NR	Northern-Belt	Urban	Peer-reviewed	High
Botchwey et. al. (2022)	CS (Quantitative)	2021	50	68.0%	13-49	Pregnant Women	OR	Middle-Belt	Rural	Peer-reviewed	Moderate
Adama et. al. (2021)	CS (Quantitative)	2017	367	74.0%	28.6 ±4.9	Pregnant Women	UWR	Northern-Belt	Urban	Peer-reviewed	High
Yendaw & Tampah-Naah (2021)	CS (Quantitative)	2020	122	29.5%	14-54	Migrants	UWR	Northern-Belt	Urban	Peer-reviewed	High
Makam et. al. (2021)	CS (Quantitative)	2018	371	62.0%	27 ±6.4	Pregnant Women	VR	Coastal-Belt	Urban	Peer-reviewed	Moderate

Ofosu (2020)	CS (Quantitative)	2020	400	62.3%	36.9 ±14.8	General public	WR	Coastal-Belt	Urban	Grey	Moderate

Note: CS = cross-sectional; Long. = longitudinal; n.s = not specified; AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; WR = Western Region.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5 & 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 7
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 8
Study characteristics	17	Cite each included study and present its characteristics.	Page 8 & 9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplementary material Table S3-S5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figure 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Figure 3
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 2 & Table 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Table 3
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Figure 4
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Figure 3
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 12-15
	23b	Discuss any limitations of the evidence included in the review.	Page 16
	23c	Discuss any limitations of the review processes used.	Page 16
	23d	Discuss implications of the results for practice, policy, and future research.	Page 15-16
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 17
Competing interests	26	Declare any competing interests of review authors.	Page 17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 17

PRISMA 2020 Checklist

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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Prevalence of self-medication in Ghana: a systematic review and meta-analysis

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Abstract

Objectives: This study estimates the prevalence of self-medication in Ghana and provides an understanding of the reasons for self-medication through the synthesis of relevant literature.

Methods: A systematic search was conducted in PubMed, Science Direct, and African Journals Online (AJOL) to identify observational studies published from inception to March 2022. Google scholar and institutional websites were searched for grey literature. We included studies reporting primary data on the prevalence and/or reasons for self-medication in Ghana. Random-effects meta-analysis was used to estimate the prevalence of self-medication. Subgroup analysis was performed with the study population (pregnant women, patients and students), geopolitical zone (coastal, middle, and northern), and study setting (rural and urban). Using inductive thematic analysis, reasons for self-medication were classified and tallied under key themes.

Results: Thirty (30) studies involving 9,271 participants were included in this review. The pooled prevalence of self-medication in Ghana was 53.7% (95% CI = 46.2%–61.0%; I^2 = 98.51%, p < .001). Prevalence of self-medication was highest among pregnant women (65.5%; 95% CI = 58.1%–72.5%; I^2 = 88%), in the middle belt of the country (62.1%; 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), and in rural settings (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001). The most cited reasons for self-medication included long waiting time at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unseriousness of diseases (53.3%).

Conclusion: This study has revealed that self-medication is still an unresolved public health challenge in Ghana, with a high prevalence estimate. Self-medication is influenced by inconveniencies associated with accessing healthcare coupled with poor health seeking behaviours. There is the need for improved access to quality healthcare and the promotion of appropriate health-seeking behaviours.

Keywords: Self-medication, prevalence, reasons, systematic review and meta-analysis, Ghana.

Strengths and limitations of this study

- The main strength of this study is that the risk of bias assessment showed that the majority of the included studies were of high quality and there was no evidence of publication bias in this review.
- The adherence to the 2020 PRISMA checklist in the reporting of the study gave credence to the study methodology.
- The use of interviewer-administered questionnaires by primary studies for data collection might have introduced recall and social desirability bias into the primary evidence used in this review.
- This review could not make a distinction between responsible self-medication and irresponsible self-medication due to the lack of such distinction in the included primary studies.
- There was still unexplained heterogeneity after the sub-group analysis due to the limited number of variables we were able to explore from the limited data reported in the primary studies.

Introduction

The practice of self-medication has received considerable attention as a major public health challenge in low and middle-income countries (LMICs).[1,2] The median prevalence of self-medication is estimated to be 55.7% in Africa and 70.1% in West Africa. [3] Also, the World Health Organization estimates that 20-50% of all antibiotics in LMICs are inappropriately used. [4] The high prevalence of self-medication in low and middle-income countries is mainly due to the limited access to healthcare, high cost of healthcare, poor conditions of health facilities, and inappropriate health-seeking behaviours in the general population. [5,6]

Although self-medication is known to reduce the pressure on healthcare systems, [7] is associated with severe challenges, particularly in countries where health literacy is low (Muflih et al., 2022). Key among these challenges include the development of antimicrobial resistance, increased morbidity, rising costs of healthcare services, [10] foetal malformations, maternal deaths, psychopathological symptoms among pregnant women, [11,12] drug addiction, toxicity, and drug-drug contraindications. [13]

In Ghana, the practice of self-medication is associated with massive health system costs. Antimicrobial resistance attributable to self-medication in Ghana is high. [14,15] Annually, an estimated cost of US$ 20 million is incurred in the Ghanaian healthcare system as a result of inappropriate antibiotic use for upper respiratory tract infections alone. [16] Also, recent studies have reported a high prevalence of self-medication among pregnant women in Ghana [17,18] and this could lead to foetal malformation and maternal deaths; [19] derailing Ghana's efforts toward promoting safe motherhood and improving maternal and neonatal health outcomes. [20]

Despite the above concerns, evidence on the practice of self-medication in Ghana is disjointed. Although several primary studies have reported different proportions and reasons for self-medication in Ghana, there has been no systematic review providing a comprehensive report on the prevalence and reasons for self-medication in Ghana. The only available review study on self-medication focused solely on pregnant women. [21] This paper, therefore, sought to determine the prevalence of self-medication and to identify the reasons for its practice in Ghana. This work significantly contributes to the existing knowledge on the

practice of self-medication in Ghana and also informs policies in the fight against this public health menace in the country.

Methods

Search strategy

PubMed, Science Direct, and African Journals Online (AJOL) were searched for observational studies published from the dates of inception to March 2022. The search strategy for this review included a combination of MeSH terms and free text words. Google Scholar and the websites of the Ministry of Health (https://www.moh.gov.gh) and the Ghana Health Service (https://www.ghanahealthservic.org) for grey literature. The full search strategy and the terms used have been included in the supplementary material, Table S1. Additionally, to reduce the possibility of missing studies, the reference lists of relevant studies were manually inspected for additional records. The literature search began on October 10, 2021 and ended on April 5, 2022. This review is not associated with a registered protocol and the study reporting followed the 2020 statement of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [22].

Eligibility criteria and study selection

The population-intervention-comparison-outcome-context (PICOC) framework was used to select studies for inclusion (see Table 1). Studies qualified for inclusion if they were observational studies and presented primary results on the prevalence and/or reasons for self-medication in Ghana. Studies were excluded if they reported intervention(s) on the use of prescribed medicines, multiple publications of the same study (in which case only the first publication is retained), or studies that did not present primary results on either prevalence or reasons for self-medication in Ghana. Also, opinion papers and commentaries were not included in this review. We did not limit the review to any specific subpopulation or time since the goal was to provide a comprehensive account of the prevalence and reasons for self-medication in Ghana.

Guided by the already established eligibility criteria, two authors screened the titles and eligible titles were exported into a Microsoft Excel file. Two authors independently applied the eligibility criteria to select

studies for inclusion. The remaining authors were consulted in the event of disagreements in the selection of studies. Also, three authors independently confirmed the justifications for the exclusion of studies after the full-text screening. The list of the excluded studies can be found in the supplementary material, Table S2.

Table 1. Framework for determining the eligibility of studies

Criteria	Description of criteria
Population	All populations
Intervention	Self-medication
Comparison	Not applicable
Outcome	Prevalence of self-medication and reasons for self-medication.
Context	Ghana

Quality assessment and data extraction

The Mixed Methods Appraisal Tool (MMAT) Version 2018 [23] was used to assess the methodological quality of studies. The tool is used to assess the quality of primary studies based on seven (7) questions. Reviewers answered *"Yes"*, *"No"* or *"Can't tell"* to each question and studies that received a *"Yes"* on 6-7 questions were judged as high quality, 4-5 as moderate quality, and 1-3 as low quality. Three reviewers independently assessed the quality of the studies and disagreements were resolved through consultation with the other reviewers. Details on the risk of bias assessment can be found in the supplementary material, Table S3 (qualitative studies), Table S4 (quantitative studies), and Table S5 (mixed-methods studies).

Data were extracted using an Excel spreadsheet to complete the following information about the selected studies: author and year of publication, study location (region, geopolitical zone, and setting), sample size, study design, study year, age of respondents, the prevalence of self-medication, and reasons for self-medication. Data extraction was done by three authors independently and was checked by the remaining authors for completeness and accuracy.

Data analysis

Meta-analytic techniques were used to estimate the pooled prevalence of self-medication in Ghana using MetaXL [24] in Microsoft Excel and OpenMeta [Analyst]. [25] A random-effects model [26] was selected over fixed-effect models since the assumption of functional equivalence among studies was violated. [27] The Freeman-Tukey double arcsine transformed proportions were used to stabilize the variance of individual studies. [28] The results of the meta-analysis were presented visually using a forest plot. Heterogeneity was examined using the I^2 statistic; where I^2 is the percentage of the total variability in the pooled estimate explained by heterogeneity. [29] Values of $I^2 < 50\%$, 50-70%, and > 70% were interpreted as low, moderate, and high heterogeneity respectively. [30] A leave-one-out sensitivity analysis was used to evaluate the influence of individual studies on the pooled estimate of the prevalence of self-medication. [31] The risk of publication bias was assessed by visually inspecting the funnel plot and Egger's regression test of funnel plot asymmetry. [32] Subgroup analyses were performed using interest populations (pregnant women, patients, and tertiary students), geopolitical zones (northern belt, middle belt, and coastal belt) and study setting (urban and rural) to explore the potential sources of heterogeneity. All statistical analyses were conducted at a 95% confidence level.

The data on reasons for self-medication were synthesized using inductive thematic analysis [33] where reasons identified in the various studies were reclassified under key themes (such as "Long waiting time at health facility", "Previous use of drugs", "Perceived unserious nature of diseases", "Drugs affordable", "High cost of healthcare" etc). For instance, *"long delays at clinics/hospitals"* [34] and *"spending long hours at health facility"* [35] were reclassified under the key theme *"long waiting time at health facility"*. Simple counts (tallying) of distribution [3] were used to summarize the evidence available from the studies reporting on reasons for self-medication in Ghana.

Patients and public involvement

Patients and members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

Search results

We identified a combined total of 1,174 studies through the database and manual search for evidence. After removing duplicates, 749 records were left for screening. After title and abstract screening, a total of 713 articles that were not relevant to the review were removed, leaving 36 articles for full-text screening. A total of 30 articles qualified for inclusion after the full-text screening. Our decision to exclude Bonti (2017) [36] from the analysis was based on the lack of primary evidence (e.g. quotes, text excerpts, field notes, etc.) to back the study results. Since this reporting practice is not in line with the standards for reporting qualitative research [37,38] and does not allow for confirmation of the interpretations made, we excluded it from this study. The study selection results have been presented in Fig. 1.

Fig. 1. PRISMA flow chart showing the study selection process and results.

Characteristics of included studies

The characteristics of the studies have been shown in Table 2 (Full details in supplementary material, Table S6). Twenty (66.7%) of the studies were published peer-reviewed journal articles and ten (33.3%) were grey literature. Three (10.0%) of the studies were of low quality, ten (33.3%) were of moderate quality, and seventeen (56.7%) were of high quality. The studies were conducted in ten (62.5%) of the sixteen regions in Ghana. In terms of geopolitical zones, nineteen (63.3%) of the studies were conducted in the coastal belt, six (20.0%) were conducted in the middle belt, and five (16.7%) were conducted in the northern belt of Ghana. The majority of the studies were conducted in an urban setting (22, 73.3%), six (20%) were conducted in a rural setting, and two studies (6.7%) covered both urban and rural populations. Twenty-six (86.7%) of the studies were quantitative, three (10.0%) were qualitative, and one study implemented a mixed-methods design. Except for two qualitative longitudinal studies, the remainder of the studies were cross-sectional. All the 30 included studies had a combined sample size of 9,271.

Table 2. Characteristics of included studies

Study	Study year	Sample size	Region	Geopolitical zone	Setting	Quality grade
Agyei-Boateng (2015)[39]	2015	300	AR	Middle-belt	Urban	High
Donkor et al. (2019)[40]	2017	261	AR/ER	Middle-belt	Urban	High
Afari-Asiedu et al. (2020)[42]	2019	70	BER	Middle-belt	Rural	High
Enimah et al. (2022)[43]	2020	191	CR	Coastal-belt	Rural	High
Gbagbo & Nkrumah, (2020b)[44]	2018	100	CR	Coastal-belt	Rural	High
Kyei et al. (2014)[45]	2013	421	CR	Coastal-belt	Urban	High
Amponsah et al. (2022)[46]	2019	337	GAR	Coastal-belt	Urban	High
Kretchy et al. (2021)[47]	2016	350	GAR	Coastal-belt	Rural	High
Asante (2019)[35]	2019	319	GAR	Coastal-belt	Urban	High
Acheampong et al. (2019)[48]	2017	680	GAR	Coastal-belt	Urban	High
Acheampomaa (2018)[49]	2018	126	GAR	Coastal-belt	Urban	High
Gbadago (2017)[50]	2017	396	GAR	Coastal-belt	Urban	High
Sackey et al. (2018)[51]	2014-2016	33	GAR/CR	Coastal-belt	Mixed	High
Agblevor et al. (2016)[52]	2014-2016	51	GAR/CR	Coastal-belt	Mixed	High
Ameade, Amalba, et al. (2018)[53]	2015	293	NR	Northern-belt	Urban	High
Adama et al. (2021)[18]	2017	367	UWR	Northern-belt	Urban	High
Yendaw & Tampah-Naah, (2021)[54]	2020	122	UWR	Northern-belt	Urban	High
Asiedu et al. (2016)[55]	2016	469	CR	Coastal-belt	Urban	Moderate
Asamoah (2019)[56]	2019	356	ER	Middle-belt	Rural	Moderate
Ofori et al. (2021)[57]	2017	417	GAR	Coastal-belt	Urban	Moderate
Awuah et al. (2018)[58]	2013	707	GAR	Coastal-belt	Urban	Moderate
Ameko et al. (2012)[14]	2008	150	GAR	Coastal-belt	Urban	Moderate
Issaka (2021)[59]	2020	170	NR	Northern-belt	Urban	Moderate
Ameade, Zakaria, et al. (2018)[60]	2017	370	NR	Northern-belt	Urban	Moderate
Botchwey et al. (2022)[17]	2021	50	OR	Middle-belt	Rural	Moderate
Makam et al. (2021)[61]	2018	371	VR	Coastal-belt	Urban	Moderate
Ofosu (2020)[62]	2020	400	WR	Coastal-belt	Urban	Moderate
Owusu-Ofori et al. (2021)[63]	2019	264	AR	Middle-belt	Urban	Low
Tagoe & Attah (2010)[64]	2010	530	CR	Coastal-belt	Urban	Low
Donkor et al. (2012)[34]	2008	600	GAR	Coastal-belt	Urban	Low

Note: AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; VR = Volta Region WR = Western Region.

Prevalence of Self-medication in Ghana

A total of 27 out of the 30 studies with a combined sample size of 9,117 were included in the meta-analysis since three (3) of the included studies were qualitative studies. The pooled prevalence of self-medication was 53.7% (95% CI = 46.2%–61.0%) (Figure 2). Heterogeneity among the studies was high (I^2 = 98%, p

< .001). The funnel plot (Fig. 3) and the results of Egger's test (Z = 0.637; p = 0.524) showed that there was no evidence of publication bias. The sensitivity analysis showed that the pooled estimate of self-medication was not significantly impacted by any individual study (Fig. 4).

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

Fig. 3. Funnel plot for assessing the risk of publication bias

Fig. 4. Leave-one-out sensitivity plot

Subgroup analysis

The prevalence of self-medication by the categorical moderators (interest populations, geopolitical zones and study setting) have been presented in Table 3. The prevalence estimates were 65.5% (95% CI = 58.1%–72.5%; I^2 = 88%) among pregnant women, 46.5% (95% CI = 26.7%–66.9%; I^2 = 98%) among patients, and 44.1% (95% CI = 27.5%–61.3%; I^2 = 99%) among tertiary students. In terms of geopolitical zones, the highest prevalence of self-medication was estimated in the middle belt (62.1%, 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), followed by the coastal belt (52.1%; 95% CI = 43.5%–60.6%; I^2 = 98%, p < .001), and the northern belt (50.6%; 95% CI = 26.8%–74.4%; I^2 = 99%; p < .001). For study setting, the prevalence estimate was higher in the rural setting (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001) compared to the urban setting (52.0%; 95% CI = 44.0%–59.9%; I^2 = 98%; p < .001).

Table 3. Results of subgroup analysis

Moderator	Number of studies	Pooled prevalence	95% CI		I^2	p
			Lower	Upper		
Interest population						
Pregnant women	6	65.5%	58.1%	72.5%	88%	<.001
Patients	4	46.5%	26.7%	66.9%	98%	<.001
Tertiary students	6	44.1%	27.5%	61.3%	99%	<.001
Geopolitical zone						
Coastal belt	17	52.1%	43.5%	60.6%	98%	<.001
Middle belt	5	62.1%	40.9%	82.0%	98%	<.001
Northern belt	5	50.6%	26.8%	74.4%	99%	<.001
Study setting						
Rural	5	61.2%	36.5%	84.5%	98%	<.001
Urban	22	52.0%	44.0%	59.9%	98%	<.001

Reasons for self-medication in Ghana

Fifteen (15) studies reported data on the self-reported reasons for self-medication in Ghana. The reasons have been presented in descending order based on the proportion of studies reporting them (Table 4). The results show that the most commonly reported reasons for self-medication in Ghana were long waiting times at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unserious nature of diseases (53.3%). Other reported reasons for self-medication included drugs affordable (33.3%), high cost of healthcare (33.3%), and long-distance to a health facility (33.3%).

Table 4. Reasons for self-medication in Ghana

Key reasons identified	Number of studies reporting reason (%)
Long waiting time at health facility	11 (73.3)
Previous use of drugs	10 (66.7)
Perceived unserious nature of diseases	8 (53.3)
Drugs affordable	5 (33.3)
High cost of healthcare	5 (33.3)
Long-distance to a health facility	5 (33.3)
Relative/friend's recommendation	4 (26.7)
For quick relief of symptoms	4 (26.7)
Easy access to drugs	4 (26.7)
Poor healthcare provider behaviour	4 (26.7)

Good knowledge of disease/drug	4 (26.7)
Busy schedule	3 (20.0)
Lack of trust in healthcare workers	2 (13.3)
Negative societal perceptions of the sick	2 (13.3)
For emergencies	1 (6.7)
Convinced by radio/television adverts and drug peddlers	1 (6.7)

Discussion

In the public health literature, self-medication is a phenomenon that has been widely discussed. [3,65] A careful analysis of the included studies revealed that out of the 30 included studies, the majority of them (56.7%) were of high quality. This situation is promising as high-quality research serves as a benchmark for societal development. [66] The studies included in this review were conducted in ten out of the sixteen regions of Ghana and self-medication in the rural areas remains under-investigated, as evidenced by the paucity of literature in rural communities. The paucity of literature on self-medication from some regions and the rural setting in Ghana could be due to existing socio-cultural and economic constraints that make the conduct of research in these areas challenging. [67,68]

The results of this review indicate that self-medication is indeed an unresolved menace in Ghana which requires urgent attention. Approximately, 54% of Ghanaians have engaged in self-medication at one point in time. This prevalence estimate in Ghana is similar to prevalence estimates from other LMICs. For instance prevalence of self-medication was estimated to be 53.57% in India, [69] 53.3% in Pakistan, 51.5% in Sudan, and 49.5% in Saudi Arabia. [70] This combination of findings demonstrates that the practice of self-medication is a common phenomenon in LMICs. In LMICs, regulation of the pharmaceutical market is lax, there is poor access and suboptimal utilization of healthcare, and health literacy is low. [3,71] These factors could explain the high prevalence of self-medication in LMICs.

The results of the study showed that close to 66% of pregnant women self-medicate in Ghana. This proportion is more than twice the prevalence estimated by a recent global review (i.e., 32%). [5] Also, lower rates have been reported among pregnant women in Iran (38.46%), [72] in Mexico (21.9%), [73] and in Ethiopia

(26.6%). [74] The high prevalence of self-medication among pregnant women in Ghana is all the more a matter of public health concern because self-medication is associated with maternal death, premature birth, low birth weight, and foetal malformations. [11,12] The findings of the current review support earlier findings that the free maternal healthcare policy in Ghana is not effectively enforced, limiting access to maternal healthcare. [75,76]

Another population of interest in this review was patients receiving care in health facilities. The current study estimated the proportion of self-medication among patients to be 46.5%. This is consistent with the findings of a recent review that found self-medication among patients in sub-Saharan Africa to be within the range of 45–89%. [65] Like in most developing countries, Ghanaians are likely to try home remedies as the initial health-seeking behaviour and are likely to self-medicate while taking prescribed medicines [51,58]. Alarmingly, this practice could lead to drug toxicity, drug-drug contraindications, and reduced efficacy of prescribed medicines. [13,40]

Self-medication was relatively lower among tertiary students (44.1%). This is likely the case because of increased health literacy among this section of the population. Evidence suggests that people with higher levels of education are less likely to self-medicate compared with those with low levels of education. [9,13,77] However, the proportion of self-medication among tertiary students is still not desirable given the risk of drug addiction among this cohort of the population. [46] Therefore, regardless of the high level of education among this subpopulation, health education may be needed to promote the appropriate use of medicines among students.

The few studies conducted in rural communities revealed that the prevalence of self-medication in the rural setting (61.2%) was higher than in the urban setting (52.0%). In Ghana and most LMICs, rural communities are often characterized by a lack of healthcare facilities, low socioeconomic status, poor transportation systems, and suboptimal access and utilization of healthcare. [68,71,78] These factors could explain the high prevalence of self-medication in rural Ghana.

This study estimated the highest prevalence of self-medication in the middle belt of the country (62.1%), followed by the coastal belt (52.1%) and the northern belt (50.6%). The proportions of studies conducted in the urban setting could explain why self-medication was found to be lower in the northern and coastal belts compared to the middle belt. All five (100%), 14 (82.4%), and three (60%) of the studies included in the meta-analysis from the northern, coastal, and middle belts respectively were conducted in urban areas. Since self-medication is lower in urban areas, it is not surprising to have a lower prevalence of self-medication in the northern and coastal belts of the country where the proportions of urban-based studies were higher.

Another focus of this study was to identify the reasons for self-medication in Ghana. The results of the current study have revealed that the most common reason for self-medication was the long waiting time in health facilities. In Ghana, most healthcare facilities are still grappling with long patient waiting times as a result of high patient-to-healthcare staff ratios, limited material resources, and poor environmental and design issues. [79–81] Patient waiting time is negatively associated with patient satisfaction [80,82]; and since customer satisfaction is positively related to customer loyalty, [83] people are likely to self-medicate or seek alternative care when they are not satisfied with the formal healthcare system.

Previous use of drugs was another common reason for self-medication in Ghana. This finding is not surprising because anecdotal evidence suggests that some Ghanaians tend to restock previously received prescriptions in an attempt to continue the dosage even without their prescriber's consent. [36] In an environment where there is easy access to over-the-counter drugs, people are likely to rely on their past successful experiences with a drug with the hope that they will have the same outcomes as previously. [3] Self-medication with previously used drugs is usually without the professional guidance of a healthcare worker, [65] making it a very risky practice, especially among vulnerable groups such as pregnant women and patients who are receiving care.

Also, the perception that some disease conditions are not severe to warrant a hospital visit was a commonly reported reason for self-medication from the results of this review. In Ghana, people are likely to

underestimate disease conditions since most Ghanaians have limited knowledge of diseases and their symptoms. [30,84,85] As such the self-ascribed severity of disease conditions may be tricky since people are likely to disregard important clinical symptoms and delay seeking appropriate and timely medical care. This could lead to poor treatment outcomes and prognosis. [86]

Additionally, affordability of drugs, high cost of healthcare, and long-distance to health facilities were found in this review as common reasons why Ghanaians self-medicate. These concerns have been reported by other studies as contributing to the high prevalence of self-medication in LMICs [3,6]. Healthcare systems in many LMICs like Ghana have several challenges including limited access to care, poor quality of care, and lack of affordability due to high levels of poverty and poor social support systems. [68,71,87–89] These challenges influence the health-seeking behaviours of people, turning them away from the formal healthcare system. [90]

Implications for practice, policy, and future research

This review has estimated a high prevalence of self-medication in Ghana, highlighting the need for a renewed focus on the promotion of the rational use of medicines in Ghana. Section 6.3.5 of the Ghana National Drug Policy [91] provides four strategies for ensuring patient compliance to prescribed medicines and preventing self-medication in the country. Three of these strategies mainly focus on patient and public education and the remainder on the promotion of research on inappropriate drug use. [91] However, nearly two decades after the adoption of this policy, research has shown that Ghanaians are still either ignorant about or disregard the adverse effects of self-medication. [45,63] There is, therefore, the need to have a relook at the four strategies; to ensure their effective implementation or review them to match the available evidence on the reasons for self-medication as revealed in this study. The Ministry of Health through its agencies should resource and encourage health professionals to intensify public education to address the perceptions that drive self-medication, and healthcare facilities must adopt innovative strategies to reduce patient waiting times and enhance access to quality healthcare.

Since this study is limited to some extent by inadequate data and/ or information covering the entire country, comprehensive studies across the country could be warranted especially in the regions where little or no information exists including the rural setting. Also, future research needs to implement strong qualitative methodologies to produce findings that provide an in-depth account of the existing practices. Additionally, longitudinal study approaches are needed to investigate how self-medication changes over time as well as assess the effectiveness of interventions that are implemented. All these aforementioned studies will provide representative data and a rounded in-depth understanding of self-medication in Ghana for informed practice and policy direction including any necessary reviews.

Conclusions

This study has revealed that the prevalence of self-medication in Ghana is high; most Ghanaians (close to 54%) have self-medicated at a particular point in time. Self-medication is disproportionately higher among pregnant women compared to the general population, and also highest among the populace in the middle belt and rural areas of Ghana. Most cited reasons for self-medication in Ghana include long waiting times at health facilities, previous use of drugs, and the perceived unseriousness of diseases. There is a need for evidence-based health interventions to promote the rational use of medicines in Ghana in addition to further studies that need to be carried out in the country.

Declarations

- **Ethics approval**

Not applicable since the data used are secondary data, already available in the public domain.

- **Consent for publication**

Not applicable

- **Availability of data and materials**

The data for the study are within the manuscript and online supplementary material, Tables S1-S6. The MetaXL codes used for the meta-analytic estimations are available upon reasonable request from the corresponding author.

- **Competing interests**

We declare that there is no conflict of interest in this study.

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• **Authors' contributions**

R.O: conception, design, data collection, analysis, writing (draft & review). B.D-A: conception, design, analysis, writing (draft & review) L.A.B: conception, design, data collection, writing (draft & review). N.E.A: conception, design, data collection, writing (review). M.A: conception, design, analysis, writing (review). F.A: conception, design, analysis, writing (review). P.F.A: conception, design, data collection, writing (review). A.A.I: conception, design, data collection, writing (review).

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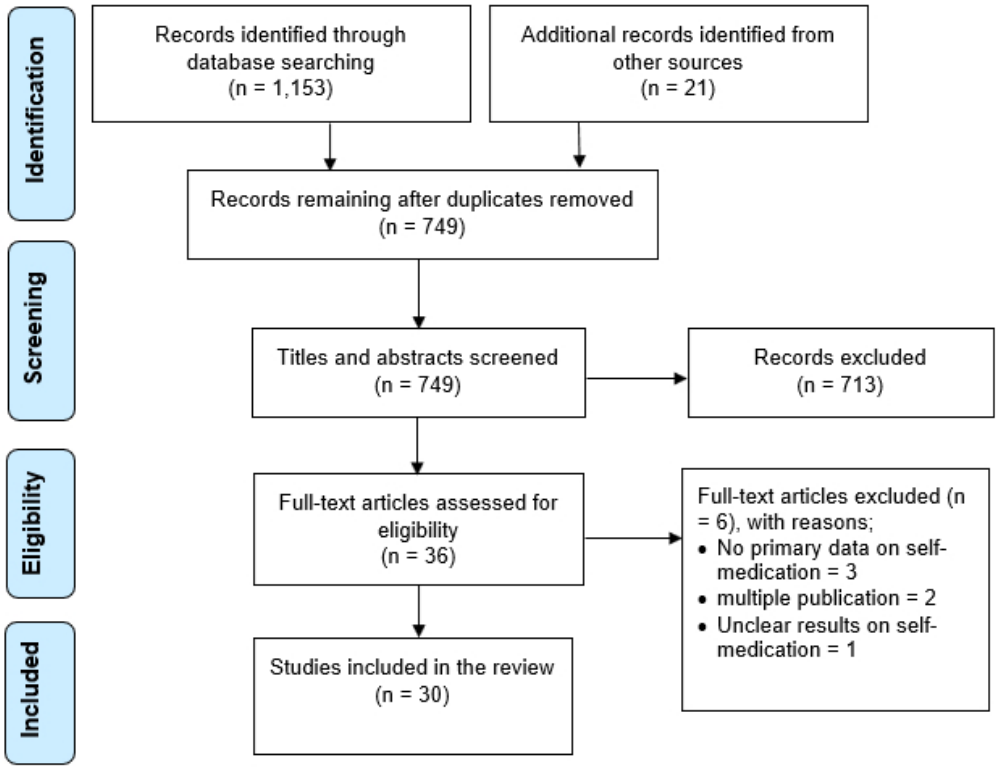

Fig. 1. PRISMA flow chart showing the study selection process and results

413x323mm (38 x 38 DPI)

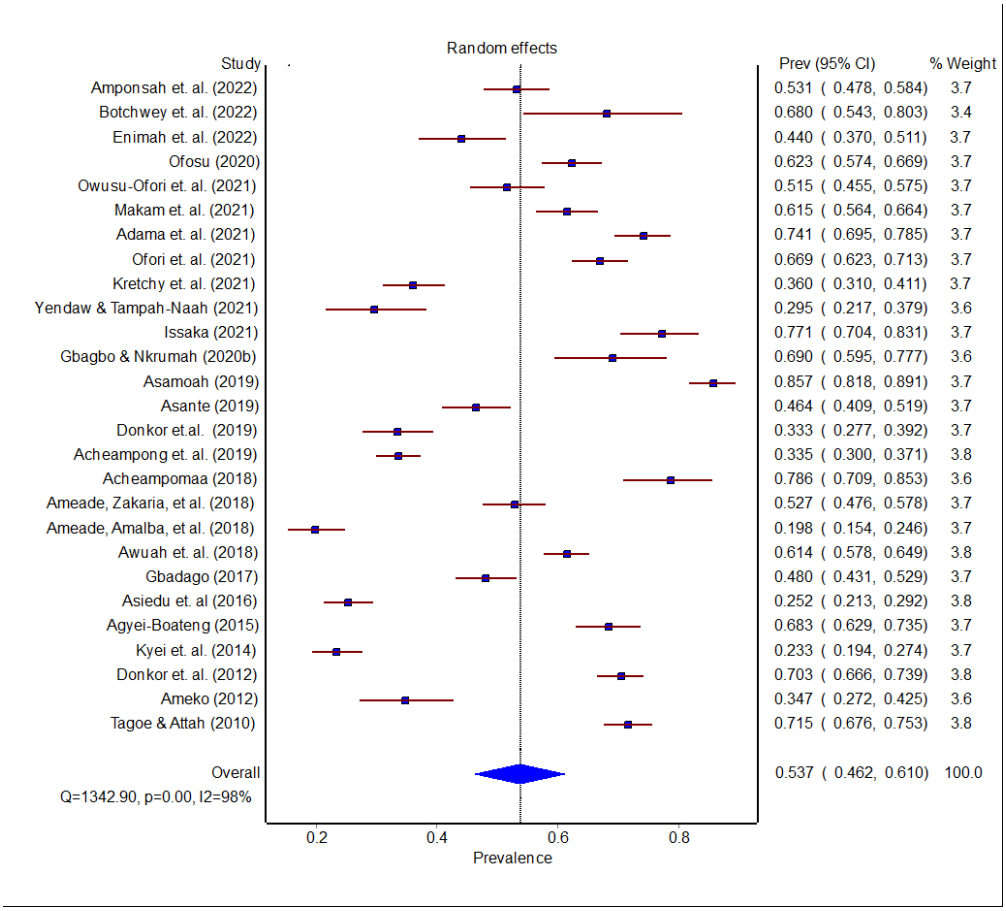

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

273x246mm (96 x 96 DPI)

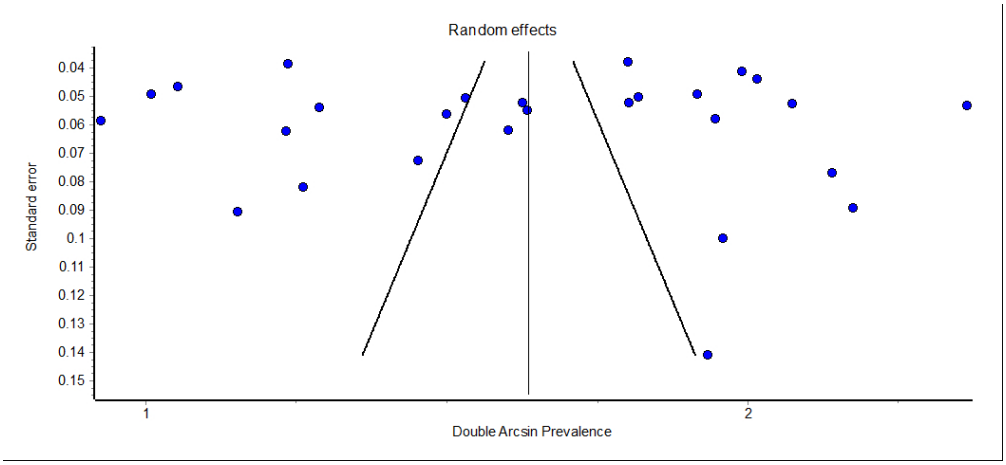

Fig. 3. Funnel plot for assessing the risk of publication bias

278x127mm (96 x 96 DPI)

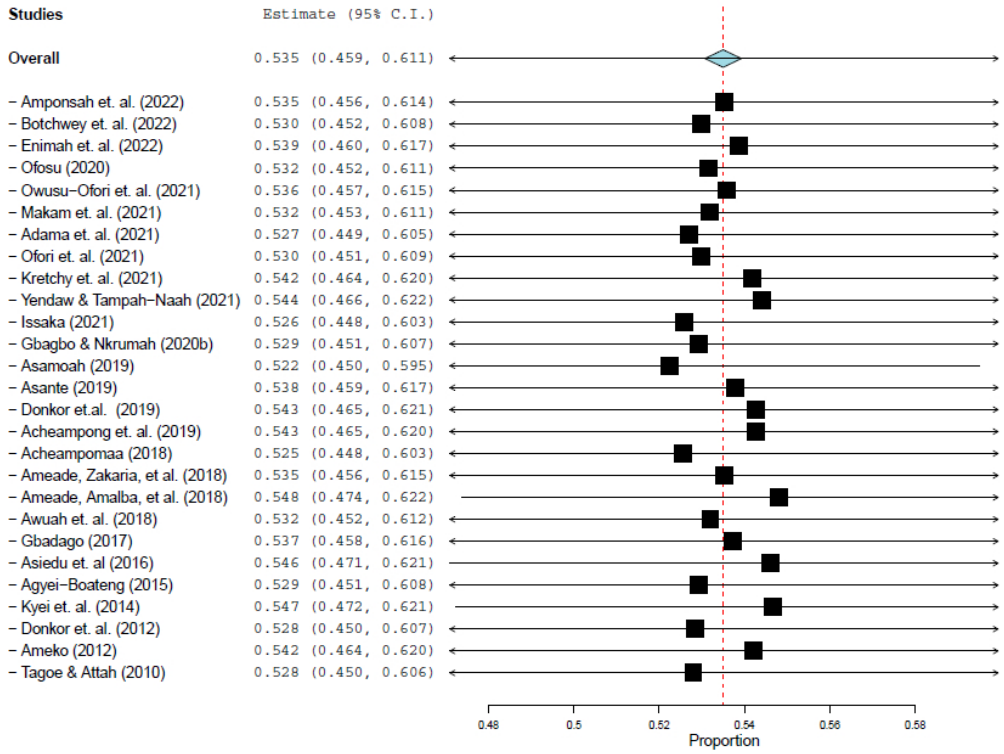

Fig. 4. Leave-one-out sensitivity plot

550x417mm (38 x 38 DPI)

SUPPLEMENTARY MATERIAL

Prevalence of self-medication in Ghana: A systematic review and meta-analysis

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Table S1: Search strategies

PubMed	
Step	Search query
#1	(((((((("Self Medication"[Mesh]) OR ("Self Medication"[Text Word])) OR ("Nonprescription Drugs"[Mesh])) OR ("Nonprescription Drugs"[Title/Abstract])) OR ("Drug Misuse"[Mesh])) OR ("Drug Misuse"[Text Word])) OR (Antibiotic[Title/Abstract]) OR ("Medicine, Traditional"[Mesh])) OR ("Herbal Medicine"[Mesh])) OR ("Herbal Medicine"[Title/Abstract]))
#2	("Ghana"[Mesh]) OR (“Ghanaian”[Title/Abstract])
#3	#1 AND #2

bmjopen-2022-064624 on 24 March 2023. Downloaded from

Science Direct/African Journals Online/Google Scholar	
Terms	"self medication" OR "non prescription drug" OR "over the counter drug" OR "OTC drug" OR "home remedy" OR "herbal medication" OR "herbal drug" OR "Analgesic" OR "Antibiotic" AND "Ghana"
Websites of Ministry of Health (https://www.moh.gov.gh) and Ghana Health Service (https://www.ghanahealthservic.org)	
Terms	*self-medication OR nonprescription drug OR over-the-counter drug OR herbal medicine*

Table S2: List of articles excluded after full-text review.

SN	Author	Year	Title	Decision	Reasons for exclusion
1.	Kretchy et. al.	2021	Prevalence, patterns, and beliefs about the use of herbal medicinal products in Ghana: a multi-center community-based cross-sectional study	Excluded	Unclear results on the prevalence of self-medication.
2.	Bonti, D.	2017	Bridging the gap between self-medication and access to healthcare in Ghana	Excluded	No primary data on prevalence or reasons for self-medication
3.	Gbagbo & Nkrumah	2020	Implications of self-medication in pregnancy for Safe Motherhood and Sustainable Development Goal-3 in selected Ghanaian communities	Excluded	Multiple publications of the same study
4.	Darko & Owusu-Ofori	2020	Antimicrobial resistance and self-medication: A survey among first-year health students at a tertiary institution in Ghana	Excluded	Multiple publications of the same study
5.	Nonvignon et. al.	2010	Treatment choices for fevers in children under-five years in a rural Ghanaian district	Excluded	No primary data on prevalence or reasons for self-medication
6.	Agblevor E.A.	2016	"I am now a doctor": self-medication practices among households in Accra	Excluded	No primary data on prevalence or reasons for self-medication

Methodological Quality Assessments using the Mixed Methods Appraisal Tool (MMAT) Version 2018

Table S3: Qualitative studies

Study	S1.	S2.	1.1	1.2	1.3	1.4	1.5	Quality Grade
Sackey et. al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Afari-Asiedu et. al. (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Agblevor et. al. (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Table S4: Quantitative studies

Study	S1	S2	4.1	4.2	4.3	4.4	4.5	Quality Grade
Botchwey et. al. (2022)	Yes	Yes	No	Can't tell	Yes	No	Yes	Moderate
Issaka (2021)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Ofosu (2020)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Owusu-Ofori et. al. (2021)	Yes	Yes	No	No	Yes	No	No	Low
Asamoah (2019)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Asante (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Makam et. al. (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	No	Moderate
Acheampomaa (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Adama et. al. (2021)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Ofori et. al. (2021)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Ameade, Zakaria, et al. (2018)	Yes	Yes	Yes	Yes	Yes	No	No	Moderate
Kretchy et. al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Asiedu et. al (2016)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Agyei-Boateng (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Kyei et. al. (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Amponsah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Donkor et. al. (2012)	Yes	No	Yes	No	Yes	No	No	Low
Ameko et. al (2012)	Yes	Yes	No	No	Yes	No	Yes	Moderate
Yendaw & Tampah-Naah (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	High
Donkor et. al. (2019)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	High
Enimah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Gbadago (2017)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Acheampong et. al. (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Awuah et. al. (2018)	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Moderate
Ameade, Amalba, et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Tagoe & Attah (2010)	Yes	Yes	No	No	Yes	Can't tell	No	Low

Table S5: Mixed-Methods studies

Study	S1	S2	5.1	5.2	5.3	5.4	5.5	Quality Grade
Gbagbo & Nkrumah (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	High

Table S6: Detailed characteristics of studies used in the systematic review

Reference	Study Design	Year of study	Sample size	Reported prevalence (%)	Age of study population (mean±sd)	Study population	Study region	Geopolitical zone	Setting	Peer review status	Quality grade
Owusu-Ofori et. al. (2021)	CS (Quantitative)	2019	264	56.2%	19.5±1.88	Tertiary students	AR	Middle-Belt	Urban	Peer-reviewed	Low
Agyei-Boateng (2015)	CS (Quantitative)	2015	300	68.3%	<15-50	Pregnant Women	AR	Middle-Belt	Urban	Grey	High
Donkor et.al. (2019)	CS (Quantitative)	2017	261	33.3%	36.26±14.94	Patients	AR/ER	Middle-Belt	Urban	Peer-reviewed	High
Afari-Asiedu et. al. (2020)	CS (Qualitative)	2019	70	High prevalence	20-50	Health workers/General public	BER	Middle-Belt	Rural	Peer-reviewed	High
Enimah et. al. (2022)	CS (Quantitative)	2020	191	44.00%	44.32±16.27	General public	CR	Coastal-Belt	Rural	Peer-reviewed	High
Gbagbo & Nkrumah (2020b)	CS (Mixed-method)	2018	100	69.0%	29 ± 5	Pregnant Women	CR	Coastal-Belt	Rural	Peer-reviewed	High
Asiedu et. al (2016)	CS (Quantitative)	2016	469	25.2%	22 ±2.5	Tertiary students	CR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Kyei et. al. (2014)	CS (Quantitative)	2013	421	23.3%	39.8±18.6	General public	CR	Coastal-Belt	Urban	Peer-reviewed	High
Tagoe & Attah (2010)	CS (Quantitative)	2010	530	71.50%	≥15	Patients	CR	Coastal-Belt	Urban	Peer-reviewed	Low
Asamoah (2019)	CS (Quantitative)	2019	356	86.0%	35 (median)	General public	ER	Middle-Belt	Rural	Grey	Moderate
Amponsah et. al. (2022)	CS (Quantitative)	2019	337	53.10%	18-41	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	High

Ofori et. al. (2021)	CS (Quantitative)	2017	417	66.7%	35.6 ±10.6	Traders	GAR	Coastal-Belt	Urban	Grey	Moderate
Kretchy et. al. (2021)	CS (Quantitative)	2016	350	36.0%	18-65	General public	GAR	Coastal-Belt	Rural	Peer-reviewed	High
Asante (2019)	CS (Quantitative)	2019	319	46.4%	35.6±13.6	Patients	GAR	Coastal-Belt	Urban	Grey	High
Acheampong et. al. (2019)	CS (Quantitative)	2017	680	33.5%	16.7±1.98	Adolescents	GAR	Coastal-Belt	Urban	Peer-reviewed	High
Acheampomaa (2018)	CS (Quantitative)	2018	126	78.6%	<19-40+	General public	GAR	Coastal-Belt	Urban	Grey	High
Awuah et. al. (2018)	CS (Quantitative)	2013	707	61.40%	15-59	General public	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Gbadago (2017)	CS (Quantitative)	2017	396	48.0%	22.6±0.17	Tertiary students	GAR	Coastal-Belt	Urban	Grey	High
Donkor et. al. (2012)	CS (Quantitative)	2008	600	70.3%	n.s	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	Low
Ameko (2012)	CS (Quantitative)	2008	150	34.7%	n.s	Patients	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Sackey et. al. (2018)	Long. (Qualitative)	2014-2016	33	High prevalence	n.s	General public	GAR/CR	Coastal-Belt	Mixed	Grey	High
Agblevor et. al (2016)	Long. (Qualitative)	2014-2016	51	High prevalence	n.s	General public/chemical shop owners	GAR/CR	Coastal-Belt	Mixed	Grey	High
Issaka (2021)	CS (Quantitative)	2020	170	77.1%	18-54	Nurses	NR	Northern-Belt	Urban	Grey	Moderate
Ameade, Zakaria, et al. (2018)	CS (Quantitative)	2017	370	52.7%	10-50	Pregnant Women	NR	Northern-Belt	Urban	Peer-reviewed	Moderate
Ameade, Amalba, et al. (2018)	CS (Quantitative)	2015	293	19.80%	23±5.07	Tertiary students	NR	Northern-Belt	Urban	Peer-reviewed	High
Botchwey et. al. (2022)	CS (Quantitative)	2021	50	68.0%	13-49	Pregnant Women	OR	Middle-Belt	Rural	Peer-reviewed	Moderate
Adama et. al. (2021)	CS (Quantitative)	2017	367	74.0%	28.6 ±4.9	Pregnant Women	UWR	Northern-Belt	Urban	Peer-reviewed	High
Yendaw & Tampah-Naah (2021)	CS (Quantitative)	2020	122	29.5%	14-54	Migrants	UWR	Northern-Belt	Urban	Peer-reviewed	High
Makam et. al. (2021)	CS (Quantitative)	2018	371	62.0%	27 ±6.4	Pregnant Women	VR	Coastal-Belt	Urban	Peer-reviewed	Moderate

Ofosu (2020)	CS (Quantitative)	2020	400	62.3%	36.9 ±14.8	General public	WR	Coastal-Belt	Urban	Grey	Moderate

Note: CS = cross-sectional; Long. = longitudinal; n.s = not specified; AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; WR = Western Region.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5 & 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 7
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 8
Study characteristics	17	Cite each included study and present its characteristics.	Page 8 & 9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplementary material Table S3-S5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figure 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Figure 3
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 2 & Table 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Table 3
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Figure 4
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Figure 3
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 12-15
	23b	Discuss any limitations of the evidence included in the review.	Page 16
	23c	Discuss any limitations of the review processes used.	Page 16
	23d	Discuss implications of the results for practice, policy, and future research.	Page 15-16
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 17
Competing interests	26	Declare any competing interests of review authors.	Page 17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 17

PRISMA 2020 Checklist

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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Prevalence of self-medication in Ghana: a systematic review and meta-analysis

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Abstract

Objectives: This study estimates the prevalence of self-medication and provides an understanding of the reasons for self-medication in Ghana through the synthesis of relevant literature.

Methods: A comprehensive search was conducted in PubMed, Science Direct, and African Journals Online (AJOL) to identify observational studies published from inception to March 2022. Google scholar and institutional websites were searched for grey literature. We included studies reporting primary data on the prevalence and/or reasons for self-medication in Ghana. Random-effects meta-analysis was used to estimate the prevalence of self-medication. Subgroup analysis was performed with the study population (pregnant women, patients and students), geopolitical zone (coastal, middle, and northern), and study setting (rural and urban). Using inductive thematic analysis, reasons for self-medication were classified and tallied under key themes.

Results: Thirty (30) studies involving 9,271 participants were included in this review. The pooled prevalence of self-medication in Ghana was 53.7% (95% CI = 46.2%–61.0%; I^2 = 98.51%, p < .001). Prevalence of self-medication was highest among pregnant women (65.5%; 95% CI = 58.1%–72.5%; I^2 = 88%), in the middle belt of the country (62.1%; 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), and in rural settings (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001). The most cited reasons for self-medication included long waiting time at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unseriousness of diseases (53.3%).

Conclusion: This study has revealed that self-medication is still an unresolved public health challenge in Ghana, with a high prevalence estimate. Self-medication is influenced by inconveniencies associated with accessing healthcare coupled with poor health seeking behaviours. There is the need for improved access to quality healthcare and the promotion of appropriate health-seeking behaviours.

Keywords: Self-medication, prevalence, reasons, systematic review and meta-analysis, Ghana.

Strengths and limitations of this study

- The risk of bias assessment showed that the majority of the included studies were of high quality and there was no evidence of publication bias in this review.
- The adherence to the 2020 PRISMA checklist in the reporting of the study gave credence to the study methodology.
- The use of interviewer-administered questionnaires by primary studies for data collection might have introduced recall and social desirability bias into the primary evidence used in this review.
- This review could not make a distinction between responsible self-medication and irresponsible self-medication due to the lack of such distinction in the included primary studies.
- There was still unexplained heterogeneity after the sub-group analysis due to the limited number of variables we were able to explore from the limited data reported in the primary studies.

Introduction

The practice of self-medication has received considerable attention as a major public health challenge in low and middle-income countries (LMICs) [1,2]. The median prevalence of self-medication is estimated to be 55.7% in Africa and 70.1% in West Africa [3]. Also, the World Health Organization estimates that 20-50% of all antibiotics in LMICs are inappropriately used [4]. The high prevalence of self-medication in low and middle-income countries is mainly due to the limited access to healthcare, high cost of healthcare, poor conditions of health facilities, and inappropriate health-seeking behaviours in the general population [5,6].

Although self-medication is known to reduce the pressure on healthcare systems [7], it is associated with severe challenges, particularly in countries where health literacy is low [8]. Key among these challenges include the development of antimicrobial resistance, increased morbidity, rising costs of healthcare services [9], foetal malformations, maternal deaths, psychopathological symptoms among pregnant women [10,11], drug addiction, toxicity, and drug-drug contraindications [12].

In Ghana, the practice of self-medication is associated with massive health system costs. Antimicrobial resistance attributable to self-medication in Ghana is high [13,14]. Annually, an estimated cost of US$ 20 million is incurred in the Ghanaian healthcare system as a result of inappropriate antibiotic use for upper respiratory tract infections alone [15]. Also, recent studies have reported a high prevalence of self-medication among pregnant women in Ghana [16,17], and this could lead to foetal malformation and maternal deaths [18]; derailing Ghana's efforts toward promoting safe motherhood and improving maternal and neonatal health outcomes [19].

Despite the above concerns, evidence on the practice of self-medication in Ghana is disjointed. Although several primary studies have reported different proportions and reasons for self-medication in Ghana, there has been no systematic review providing a comprehensive report on the prevalence and reasons for self-medication in Ghana. The only available review on self-medication focused solely on pregnant women [20]. This paper, therefore, sought to determine the prevalence of self-medication and to identify the reasons

for its practice in Ghana. This work significantly contributes to the existing knowledge on the practice of self-medication in Ghana and informs policies in the fight against this public health menace.

Methods

Search strategy

PubMed, Science Direct, and African Journals Online (AJOL) were searched for observational studies published from the dates of inception to March 2022. The search strategy for this review included a combination of MeSH terms and free text words. Google Scholar and the websites of the Ministry of Health (https://www.moh.gov.gh) and the Ghana Health Service (https://www.ghanahealthservic.org) for grey literature. The full search strategy and the terms used have been included in the supplementary material, Table S1. Additionally, to reduce the possibility of missing studies, the reference lists of relevant studies were manually inspected for additional records. The literature search began on October 10, 2021 and ended on April 5, 2022. This review is not associated with a registered protocol and the study reporting followed the 2020 statement of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [21].

Eligibility criteria and study selection

The population-intervention-comparison-outcome-context (PICOC) framework was used to select studies for inclusion (see Table 1). Studies qualified for inclusion if they were observational studies and presented primary results on the prevalence and/or reasons for self-medication in Ghana. Studies were excluded if they reported intervention(s) on the use of prescribed medicines, multiple publications of the same study (in which case only the first publication is retained), or studies that did not present primary results on either prevalence or reasons for self-medication in Ghana. Also, opinion papers and commentaries were not included in this review. We did not limit the review to any specific subpopulation or time since the goal was to provide a comprehensive account of the prevalence and reasons for self-medication in Ghana.

Guided by the already established eligibility criteria, two authors screened the titles and eligible titles were exported into a Microsoft Excel file. Two authors independently applied the eligibility criteria to select

studies for inclusion. The remaining authors were consulted in the event of disagreements in the selection of studies. Also, three authors independently confirmed the justifications for the exclusion of studies after the full-text screening. The list of the excluded studies can be found in the supplementary material, Table S2.

Table 1. Framework for determining the eligibility of studies

Criteria	Description of criteria
Population	All populations
Intervention	Self-medication
Comparison	Not applicable
Outcome	Prevalence of self-medication and reasons for self-medication.
Context	Ghana

Quality assessment and data extraction

The Mixed Methods Appraisal Tool (MMAT) Version 2018 [22] was used to assess the methodological quality of studies. The tool is used to assess the quality of primary studies based on seven (7) questions. Reviewers answered *"Yes"*, *"No"* or *"Can't tell"* to each question and studies that received a *"Yes"* on 6-7 questions were judged as high quality, 4-5 as moderate quality, and 1-3 as low quality. Three reviewers independently assessed the quality of the studies and disagreements were resolved through consultation with the other reviewers. Details on the risk of bias assessment can be found in the supplementary material, Table S3 (qualitative studies), Table S4 (quantitative studies), and Table S5 (mixed-methods studies).

Data were extracted using an Excel spreadsheet to complete the following information about the selected studies: author and year of publication, study location (region, geopolitical zone, and setting), sample size, study design, study year, age of respondents, the prevalence of self-medication, and reasons for self-medication. Data extraction was done by three authors independently and was checked by the remaining authors for completeness and accuracy.

Data analysis

Meta-analytic techniques were used to estimate the pooled prevalence of self-medication in Ghana using MetaXL [23] in Microsoft Excel and OpenMeta [Analyst] [24]. A random-effects model [25] was selected over fixed-effect models since the assumption of functional equivalence among studies was violated [26]. The Freeman-Tukey double arcsine transformed proportions were used to stabilize the variance of individual studies [27]. The results of the meta-analysis were presented visually using a forest plot. Heterogeneity was examined using the I^2 statistic; where I^2 is the percentage of the total variability in the pooled estimate explained by heterogeneity [28]. Values of $I^2 < 50\%$, 50-70%, and > 70% were interpreted as low, moderate, and high heterogeneity respectively [29]. A leave-one-out sensitivity analysis was used to evaluate the influence of individual studies on the pooled estimate of the prevalence of self-medication [30]. The risk of publication bias was assessed by visually inspecting the funnel plot and Egger's regression test of funnel plot asymmetry [31]. Subgroup analyses were performed using interest populations (pregnant women, patients, and tertiary students), geopolitical zones (northern belt, middle belt, and coastal belt) and study setting (urban and rural) to explore the potential sources of heterogeneity. All statistical analyses were conducted at a 95% confidence level.

The data on reasons for self-medication were synthesized using inductive thematic analysis [32] where reasons identified in the various studies were reclassified under key themes (such as "Long waiting time at health facility", "Previous use of drugs", "Perceived unserious nature of diseases", "Drugs affordable", "High cost of healthcare" etc). For instance, *"long delays at clinics/hospitals"* [33] and *"spending long hours at health facility"* [34] were reclassified under the key theme *"long waiting time at health facility"*. Simple counts (tallying) of distribution [3] were used to summarize the evidence available from the studies reporting on reasons for self-medication in Ghana.

Patients and public involvement

Patients and members of the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

Results

Search results

We identified a combined total of 1,174 studies through the database and manual search for evidence. After removing duplicates, 749 records were left for screening. After title and abstract screening, a total of 713 articles that were not relevant to the review were removed, leaving 36 articles for full-text screening. A total of 30 articles qualified for inclusion after the full-text screening. Our decision to exclude Bonti (2017) [35] from the analysis was based on the lack of primary evidence (e.g. quotes, text excerpts, field notes, etc.) to back the study results. Since this reporting practice is not in line with the standards for reporting qualitative research [36,37] and does not allow for confirmation of the interpretations made, we excluded it from this study. The study selection results have been presented in Fig. 1.

Fig. 1. PRISMA flow chart showing the study selection process and results.

Characteristics of included studies

The characteristics of the studies are shown in Table 2 (Full details in supplementary material, Table S6). Twenty (66.7%) of the studies were published peer-reviewed journal articles and ten (33.3%) were grey literature. Three (10.0%) of the studies were of low quality, ten (33.3%) were of moderate quality, and seventeen (56.7%) were of high quality. The studies were conducted in ten (62.5%) of the sixteen regions in Ghana. In terms of geopolitical zones, nineteen (63.3%) of the studies were conducted in the coastal belt, six (20.0%) were conducted in the middle belt, and five (16.7%) were conducted in the northern belt of Ghana. The majority of the studies were conducted in an urban setting (22, 73.3%), six (20%) were conducted in a rural setting, and two studies (6.7%) covered both urban and rural populations. Twenty-six (86.7%) of the studies were quantitative, three (10.0%) were qualitative, and one study implemented a mixed-methods design. Except for two qualitative longitudinal studies, the remainder of the studies were cross-sectional. All the 30 included studies had a combined sample size of 9,271.

Table 2. Characteristics of included studies

Study	Study year	Sample size	Region	Geopolitical zone	Setting	Quality grade
Agyei-Boateng (2015)[38]	2015	300	AR	Middle-belt	Urban	High
Donkor et al. (2019)[39]	2017	261	AR/ER	Middle-belt	Urban	High
Afari-Asiedu et al. (2020)[40]	2019	70	BER	Middle-belt	Rural	High
Enimah et al. (2022)[41]	2020	191	CR	Coastal-belt	Rural	High
Gbagbo & Nkrumah, (2020b)[42]	2018	100	CR	Coastal-belt	Rural	High
Kyei et al. (2014)[43]	2013	421	CR	Coastal-belt	Urban	High
Amponsah et al. (2022)[44]	2019	337	GAR	Coastal-belt	Urban	High
Kretchy et al. (2021)[45]	2016	350	GAR	Coastal-belt	Rural	High
Asante (2019)[34]	2019	319	GAR	Coastal-belt	Urban	High
Acheampong et al. (2019)[46]	2017	680	GAR	Coastal-belt	Urban	High
Acheampomaa (2018)[47]	2018	126	GAR	Coastal-belt	Urban	High
Gbadago (2017)[48]	2017	396	GAR	Coastal-belt	Urban	High
Sackey et al. (2018)[49]	2014-2016	33	GAR/CR	Coastal-belt	Mixed	High
Agblevor et al. (2016)[50]	2014-2016	51	GAR/CR	Coastal-belt	Mixed	High
Ameade, Amalba, et al. (2018)[51]	2015	293	NR	Northern-belt	Urban	High
Adama et al. (2021)[17]	2017	367	UWR	Northern-belt	Urban	High
Yendaw & Tampah-Naah, (2021)[52]	2020	122	UWR	Northern-belt	Urban	High
Asiedu et al. (2016)[53]	2016	469	CR	Coastal-belt	Urban	Moderate
Asamoah (2019)[54]	2019	356	ER	Middle-belt	Rural	Moderate
Ofori et al. (2021)[55]	2017	417	GAR	Coastal-belt	Urban	Moderate
Awuah et al. (2018)[56]	2013	707	GAR	Coastal-belt	Urban	Moderate
Ameko et al. (2012)[13]	2008	150	GAR	Coastal-belt	Urban	Moderate
Issaka (2021)[57]	2020	170	NR	Northern-belt	Urban	Moderate
Ameade, Zakaria, et al. (2018)[58]	2017	370	NR	Northern-belt	Urban	Moderate
Botchwey et al. (2022)[16]	2021	50	OR	Middle-belt	Rural	Moderate
Makam et al. (2021)[59]	2018	371	VR	Coastal-belt	Urban	Moderate
Ofosu (2020)[60]	2020	400	WR	Coastal-belt	Urban	Moderate
Owusu-Ofori et al. (2021)[61]	2019	264	AR	Middle-belt	Urban	Low
Tagoe & Attah (2010)[62]	2010	530	CR	Coastal-belt	Urban	Low
Donkor et al. (2012)[33]	2008	600	GAR	Coastal-belt	Urban	Low

Note: AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; VR = Volta Region WR = Western Region.

Prevalence of Self-medication in Ghana

A total of 27 out of the 30 studies with a combined sample size of 9,117 were included in the meta-analysis since three (3) of the included studies were qualitative studies. The pooled prevalence of self-medication

was 53.7% (95% CI = 46.2%–61.0%) (Figure 2). Heterogeneity among the studies was high (I^2 = 98%, p < .001). The funnel plot (Fig. 3) and the results of Egger's test (Z = 0.637; p = 0.524) showed that there was no evidence of publication bias. The sensitivity analysis showed that the pooled estimate of self-medication was not significantly impacted by any individual study (Fig. 4).

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

Fig. 3. Funnel plot for assessing the risk of publication bias

Fig. 4. Leave-one-out sensitivity plot

Subgroup analysis

The prevalence of self-medication by the categorical moderators (interest populations, geopolitical zones and study setting) have been presented in Table 3. The prevalence estimates were 65.5% (95% CI = 58.1%–72.5%; I^2 = 88%) among pregnant women, 46.5% (95% CI = 26.7%–66.9%; I^2 = 98%) among patients, and 44.1% (95% CI = 27.5%–61.3%; I^2 = 99%) among tertiary students. In terms of geopolitical zones, the highest prevalence of self-medication was estimated in the middle belt (62.1%, 95% CI = 40.9%–82.0%; I^2 = 98%; p < .001), followed by the coastal belt (52.1%; 95% CI = 43.5%–60.6%; I^2 = 98%, p < .001), and the northern belt (50.6%; 95% CI = 26.8%–74.4%; I^2 = 99%; p < .001). For study setting, the prevalence estimate was higher in the rural setting (61.2%; 95% CI = 36.5%–84.5%; I^2 = 98%; p < .001) compared to the urban setting (52.0%; 95% CI = 44.0%–59.9%; I^2 = 98%; p < .001).

Table 3. Results of subgroup analysis

Moderator	Number of studies	Pooled prevalence	95% CI		I^2	p
			Lower	Upper		
Interest population						
Pregnant women	6	65.5%	58.1%	72.5%	88%	<.001
Patients	4	46.5%	26.7%	66.9%	98%	<.001
Tertiary students	6	44.1%	27.5%	61.3%	99%	<.001
Geopolitical zone						
Coastal belt	17	52.1%	43.5%	60.6%	98%	<.001
Middle belt	5	62.1%	40.9%	82.0%	98%	<.001
Northern belt	5	50.6%	26.8%	74.4%	99%	<.001
Study setting						
Rural	5	61.2%	36.5%	84.5%	98%	<.001
Urban	22	52.0%	44.0%	59.9%	98%	<.001

Reasons for self-medication in Ghana

Fifteen (15) studies reported data on the self-reported reasons for self-medication in Ghana. The reasons have been presented in descending order based on the proportion of studies reporting them (Table 4). The results show that the most commonly reported reasons for self-medication in Ghana were long waiting times at health facilities (73.3%), previous use of drugs (66.7%), and the perceived unserious nature of diseases (53.3%). Other reported reasons for self-medication included drugs affordable (33.3%), high cost of healthcare (33.3%), and long-distance to a health facility (33.3%).

Table 4. Reasons for self-medication in Ghana

Key reasons identified	Number of studies reporting reason (%)
Long waiting time at health facility	11 (73.3)
Previous use of drugs	10 (66.7)
Perceived unserious nature of diseases	8 (53.3)
Drugs affordable	5 (33.3)
High cost of healthcare	5 (33.3)
Long-distance to a health facility	5 (33.3)
Relative/friend's recommendation	4 (26.7)
For quick relief of symptoms	4 (26.7)

Easy access to drugs	4 (26.7)
Poor healthcare provider behaviour	4 (26.7)
Good knowledge of disease/drug	4 (26.7)
Busy schedule	3 (20.0)
Lack of trust in healthcare workers	2 (13.3)
Negative societal perceptions of the sick	2 (13.3)
For emergencies	1 (6.7)
Convinced by radio/television adverts and drug peddlers	1 (6.7)

Discussion

In the public health literature, self-medication is a phenomenon that has been widely discussed [3,63]. A careful analysis of the included studies revealed that out of the 30 included studies, the majority of them (56.7%) were of high quality. This situation is promising as high-quality research serves as a benchmark for societal development [64]. The studies included in this review were conducted in ten out of the sixteen regions of Ghana and self-medication in the rural areas remains under-investigated, as evidenced by the paucity of literature in rural communities. The paucity of literature on self-medication from some regions and the rural setting in Ghana could be due to existing socio-cultural and economic constraints that make the conduct of research in these areas challenging [65,66].

The results of this review indicate that self-medication is indeed an unresolved menace in Ghana which requires urgent attention. Approximately, 54% of Ghanaians have engaged in self-medication at one point in time. This prevalence estimate in Ghana is similar to prevalence estimates from other LMICs. For instance prevalence of self-medication was estimated to be 53.57% in India [67], 53.3% in Pakistan, 51.5% in Sudan, and 49.5% in Saudi Arabia [68]. This combination of findings demonstrates that the practice of self-medication is a common phenomenon in LMICs. In LMICs, regulation of the pharmaceutical market is lax, there is poor access and suboptimal utilization of healthcare, and health literacy is low [3,69]. These factors could explain the high prevalence of self-medication in LMICs.

The results of the study showed that close to 66% of pregnant women self-medicate in Ghana. This proportion is more than twice the prevalence estimated by a recent global review (i.e., 32%). [5] Also, lower rates have been reported among pregnant women in Iran (38.46%) [70], in Mexico (21.9%) [71], and in Ethiopia (26.6%) [72]. The high prevalence of self-medication among pregnant women in Ghana is all the more a matter of public health concern because self-medication is associated with maternal death, premature birth, low birth weight, and foetal malformations [10,11]. The findings of the current review support earlier findings that the free maternal healthcare policy in Ghana is not effectively enforced, limiting access to maternal healthcare [73,74].

Another population of interest in this review was patients receiving care in health facilities. The current study estimated the proportion of self-medication among patients to be 46.5%. This is consistent with the findings of a recent review that found self-medication among patients in sub-Saharan Africa to be within the range of 45–89% [63]. Like in most developing countries, Ghanaians are likely to try home remedies as the initial health-seeking behaviour and are likely to self-medicate while taking prescribed medicines [49,56]. Alarmingly, this practice could lead to drug toxicity, drug-drug contraindications, and reduced efficacy of prescribed medicines [12,39].

Self-medication was relatively lower among tertiary students (44.1%). This is likely the case because of increased health literacy among this section of the population. Evidence suggests that people with higher levels of education are less likely to self-medicate compared with those with low levels of education [8,12,75]. However, the proportion of self-medication among tertiary students is still not desirable given the risk of drug addiction among this cohort of the population [44]. Therefore, regardless of the high level of education among this subpopulation, health education may be needed to promote the appropriate use of medicines among students.

The few studies conducted in rural communities revealed that the prevalence of self-medication in the rural setting (61.2%) was higher than in the urban setting (52.0%). In Ghana and most LMICs, rural communities are often characterized by a lack of healthcare facilities, low socioeconomic status, poor transportation

systems, and suboptimal access and utilization of healthcare [66,69,76]. These factors could explain the high prevalence of self-medication in rural Ghana.

This study estimated the highest prevalence of self-medication in the middle belt of the country (62.1%), followed by the coastal belt (52.1%) and the northern belt (50.6%). The proportions of studies conducted in the urban setting could explain why self-medication was found to be lower in the northern and coastal belts compared to the middle belt. All five (100%), 14 (82.4%), and three (60%) of the studies included in the meta-analysis from the northern, coastal, and middle belts respectively were conducted in urban areas. Since self-medication is lower in urban areas, it is not surprising to have a lower prevalence of self-medication in the northern and coastal belts of the country where the proportions of urban-based studies were higher.

Another focus of this study was to identify the reasons for self-medication in Ghana. The results of the current study have revealed that the most common reason for self-medication was the long waiting time in health facilities. In Ghana, most healthcare facilities are still grappling with long patient waiting times as a result of high patient-to-healthcare staff ratios, limited material resources, and poor environmental and design issues [77–79]. Patient waiting time is negatively associated with patient satisfaction [78,80]; and since customer satisfaction is positively related to customer loyalty [81], people are likely to self-medicate or seek alternative care when they are not satisfied with the formal healthcare system.

Previous use of drugs was another common reason for self-medication in Ghana. This finding is not surprising because anecdotal evidence suggests that some Ghanaians tend to restock previously received prescriptions in an attempt to continue the dosage even without their prescriber's consent [35]. In an environment where there is easy access to over-the-counter drugs, people are likely to rely on their past successful experiences with a drug with the hope that they will have the same outcomes as previously [3]. Self-medication with previously used drugs is usually without the professional guidance of a healthcare worker [63], making it a very risky practice, especially among vulnerable groups such as pregnant women and patients who are receiving care.

Also, the perception that some disease conditions are not severe to warrant a hospital visit was a commonly reported reason for self-medication from the results of this review. In Ghana, people are likely to underestimate disease conditions since most Ghanaians have limited knowledge of diseases and their symptoms [29,82,83], As such the self-ascribed severity of disease conditions may be tricky since people are likely to disregard important clinical symptoms and delay seeking appropriate and timely medical care. This could lead to poor treatment outcomes and prognosis [84].

Additionally, affordability of drugs, high cost of healthcare, and long-distance to health facilities were found in this review as common reasons why Ghanaians self-medicate. These concerns have been reported by other studies as contributing to the high prevalence of self-medication in LMICs [3,6]. Healthcare systems in many LMICs like Ghana have several challenges including limited access to care, poor quality of care, and lack of affordability due to high levels of poverty and poor social support systems [66,69,85–87]. These challenges influence the health-seeking behaviours of people, turning them away from the formal healthcare system [88].

This review has strengths that are worth mentioning. First, the risk of bias assessment showed that the majority of the included studies were of high quality and there was no evidence of publication bias in this review. In addition, the adherence to the 2020 PRISMA checklist in the reporting of the study gave credence to the study methodology. However, we note the following limitations: (1) the use of interviewer-administered questionnaires by primary studies for data collection might have introduced recall and social desirability bias into the primary evidence used in this review; (2) this review could not make a distinction between responsible self-medication and irresponsible self-medication due to the lack of such distinction in the included primary studies; (3) there was still unexplained heterogeneity after the sub-group analysis due to the limited number of variables we were able to explore from the limited data reported in the primary studies.

Implications for practice, policy, and future research

This review has estimated a high prevalence of self-medication in Ghana, highlighting the need for a renewed focus on the promotion of the rational use of medicines in Ghana. Section 6.3.5 of the Ghana National Drug Policy [89] provides four strategies for ensuring patient compliance to prescribed medicines and preventing self-medication in the country. Three of these strategies mainly focus on patient and public education and the remainder on the promotion of research on inappropriate drug use [89]. However, nearly two decades after the adoption of this policy, research has shown that Ghanaians are still either ignorant about or disregard the adverse effects of self-medication [43,61]. There is, therefore, the need to have a relook at the four strategies; to ensure their effective implementation or review them to match the available evidence on the reasons for self-medication as revealed in this study. The Ministry of Health should resource and encourage health professionals to intensify public education on the perceptions that drive self-medication. Healthcare facilities must adopt innovative strategies to reduce patient waiting times and enhance access to quality healthcare.

Since this study is limited to some extent by inadequate data and/ or information covering the entire country, comprehensive studies across the country could be warranted especially in the regions where little or no information exists including the rural setting. Also, future research needs to implement strong qualitative methodologies to produce findings that provide an in-depth account of the existing practices. Additionally, longitudinal study approaches are needed to investigate how self-medication changes over time as well as assess the effectiveness of interventions that are implemented. All these aforementioned studies will provide representative data and a rounded in-depth understanding of self-medication in Ghana for informed practice and policy direction including any necessary reviews.

Conclusions

This study has revealed that the prevalence of self-medication in Ghana is high; most Ghanaians (close to 54%) have self-medicated at a particular point in time. Self-medication is disproportionately higher among pregnant women compared to the general population and highest among the populace in the middle belt

and rural areas of Ghana. Most cited reasons for self-medication in Ghana include long waiting times at health facilities, previous use of drugs, and the perceived unseriousness of diseases. There is a need for evidence-based health interventions to promote the rational use of medicines in Ghana in addition to further studies that need to be carried out in the country.

Declarations

- **Ethics approval**

Not applicable since the data used are secondary data, already available in the public domain.

- **Consent for publication**

Not applicable

- **Availability of data and materials**

The data for the study are within the manuscript and online supplementary material, Tables S1-S6. The MetaXL codes used for the meta-analytic estimations are available upon reasonable request from the corresponding author.

- **Competing interests**

We declare that there is no conflict of interest in this study.

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The authors received no external funding for this study.

- **Authors' contributions**

R.O: conception, design, data collection, analysis, writing (draft & review). B.D-A: conception, design, analysis, writing (draft & review) L.A.B: conception, design, data collection, writing (draft & review). N.E.A: conception, design, data collection, writing (review). M.A: conception, design, analysis, writing (review). F.A: conception, design, analysis, writing (review). P.F.A: conception, design, data collection, writing (review). A.A.I: conception, design, data collection, writing (review).

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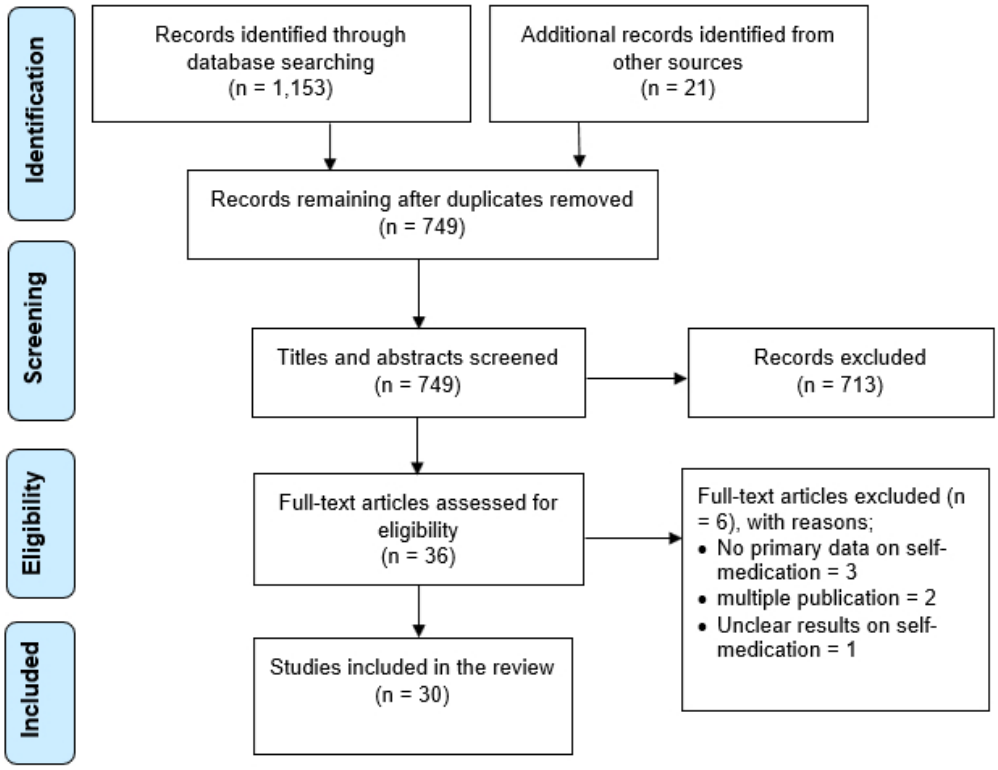

Fig. 1. PRISMA flow chart showing the study selection process and results

413x323mm (38 x 38 DPI)

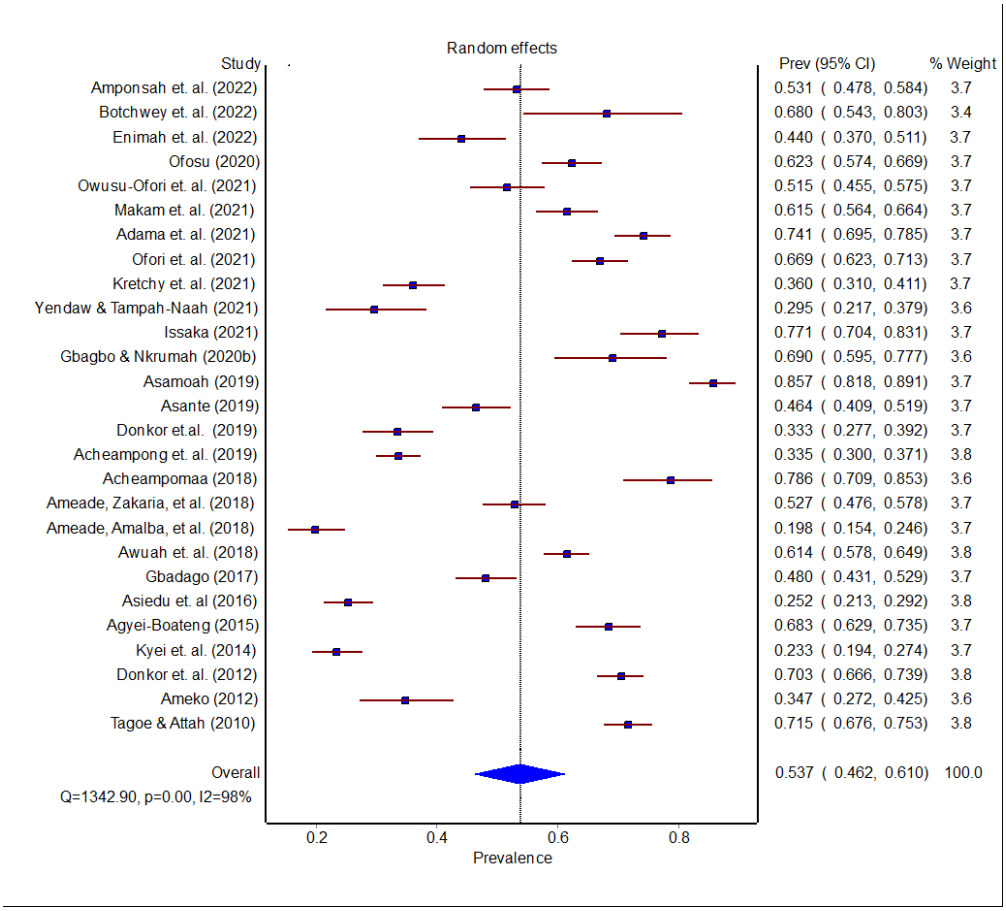

Fig. 2. Forest plot of the prevalence of self-medication in Ghana

273x246mm (96 x 96 DPI)

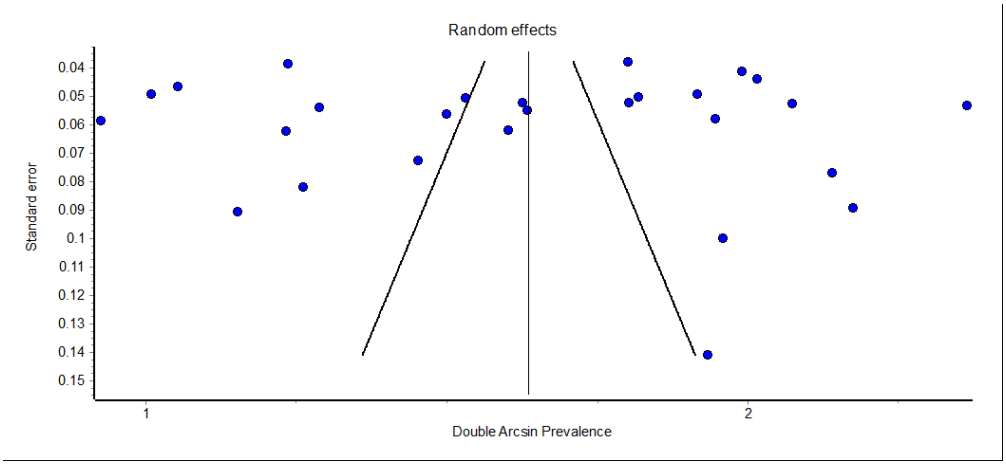

Fig. 3. Funnel plot for assessing the risk of publication bias

278x127mm (96 x 96 DPI)

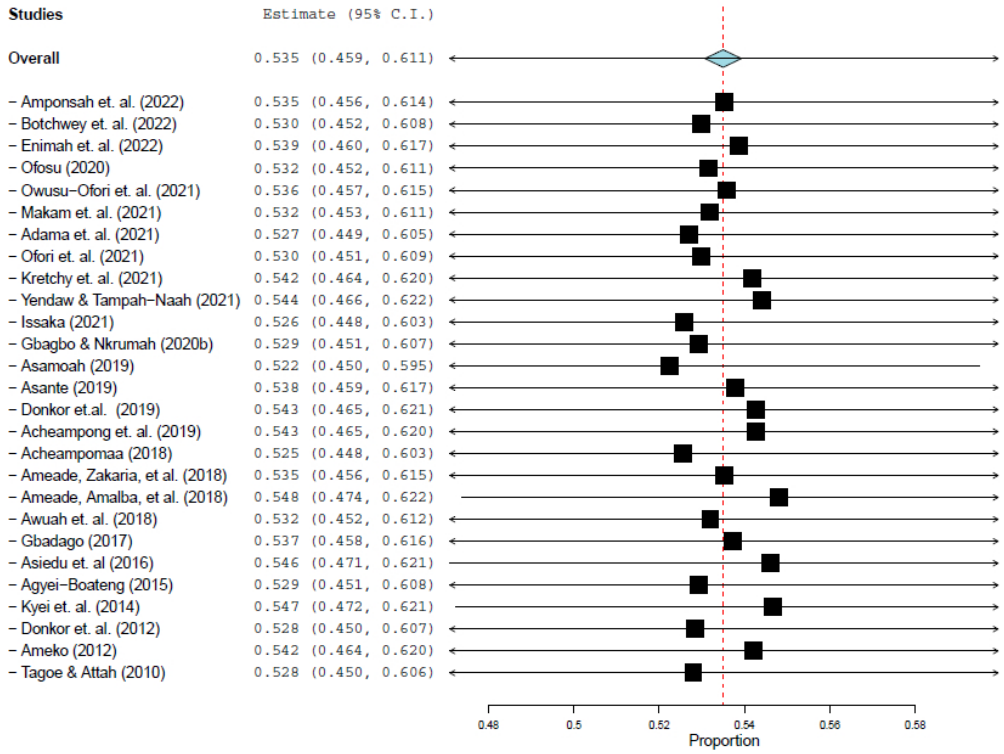

Fig. 4. Leave-one-out sensitivity plot

550x417mm (38 x 38 DPI)

SUPPLEMENTARY MATERIAL

Prevalence of self-medication in Ghana: A systematic review and meta-analysis

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Table S1: Search strategies

PubMed	
Step	Search query
#1	(((((((("Self Medication"[Mesh]) OR ("Self Medication"[Text Word])) OR ("Nonprescription Drugs"[Mesh])) OR ("Nonprescription Drugs"[Title/Abstract])) OR ("Drug Misuse"[Mesh])) OR ("Drug Misuse"[Text Word])) OR (Antibiotic[Title/Abstract]) OR ("Medicine, Traditional"[Mesh])) OR ("Herbal Medicine"[Mesh])) OR ("Herbal Medicine"[Title/Abstract]))
#2	("Ghana"[Mesh]) OR (“Ghanaian”[Title/Abstract])
#3	#1 AND #2

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Science Direct	
Strategy	"self medication" OR "non prescription drug" OR "over the counter drug" OR "OTC drug" OR "home remedy" OR "herbal medication" OR "herbal drug" OR "Analgesic" OR "Antibiotic" AND "Ghana"
African Journals Online	
Strategy	"self medication" OR "non prescription drug" OR "over the counter drug" OR "OTC drug" OR "home remedy" OR "herbal medication" OR "herbal drug" OR "Analgesic" OR "Antibiotic" AND "Ghana"
Google Scholar	
Strategy	"self medication" OR "non prescription drug*" OR "over the counter drug*" OR "OTC drug" OR "home remedy" OR "herbal medication" OR "herbal drug*" OR "Analgesic*" OR "Antibiotic*" AND "Ghana"
Websites of Ministry of Health (https://www.moh.gov.gh)	
Strategy	*self-medication OR nonprescription drug OR over-the-counter drug OR herbal medicine*
Websites of Ministry of Ghana Health Service (https://www.ghanahealthservic.org)	
Strategy	*self-medication OR nonprescription drug OR over-the-counter drug OR herbal medicine*

Table S2: List of articles excluded after full-text review.

SN	Author	Year	Title	Decision	Reasons for exclusion
1.	Kretchy et. al.	2021	Prevalence, patterns, and beliefs about the use of herbal medicinal products in Ghana: a multi-center community-based cross-sectional study	Excluded	Unclear results on the prevalence of self-medication.
2.	Bonti, D.	2017	Bridging the gap between self-medication and access to healthcare in Ghana	Excluded	No primary data on prevalence or reasons for self-medication
3.	Gbagbo & Nkrumah	2020	Implications of self-medication in pregnancy for Safe Motherhood and Sustainable Development Goal-3 in selected Ghanaian communities	Excluded	Multiple publications of the same study
4.	Darko & Owusu-Ofori	2020	Antimicrobial resistance and self-medication: A survey among first-year health students at a tertiary institution in Ghana	Excluded	Multiple publications of the same study
5.	Nonvignon et. al.	2010	Treatment choices for fevers in children under-five years in a rural Ghanaian district	Excluded	No primary data on prevalence or reasons for self-medication
6.	Agblevor E.A.	2016	"I am now a doctor": self-medication practices among households in Accra	Excluded	No primary data on prevalence or reasons for self-medication

Methodological Quality Assessments using the Mixed Methods Appraisal Tool (MMAT) Version 2018

Table S3: Qualitative studies

Study	S1.	S2.	1.1	1.2	1.3	1.4	1.5	Quality Grade
Sackey et. al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Afari-Asiedu et. al. (2020)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Agblevor et. al. (2016)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High

Table S4: Quantitative studies

Study	S1	S2	4.1	4.2	4.3	4.4	4.5	Quality Grade
Botchwey et. al. (2022)	Yes	Yes	No	Can't tell	Yes	No	Yes	Moderate
Issaka (2021)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Ofosu (2020)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Owusu-Ofori et. al. (2021)	Yes	Yes	No	No	Yes	No	No	Low
Asamoah (2019)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Asante (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Makam et. al. (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	No	Moderate
Acheampomaa (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Adama et. al. (2021)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Ofori et. al. (2021)	Yes	Yes	Can't tell	No	Yes	No	Yes	Moderate
Ameade, Zakaria, et al. (2018)	Yes	Yes	Yes	Yes	Yes	No	No	Moderate
Kretchy et. al. (2021)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Asiedu et. al (2016)	Yes	Yes	Yes	No	Yes	No	Yes	Moderate
Agyei-Boateng (2015)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Kyei et. al. (2014)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Amponsah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Donkor et. al. (2012)	Yes	No	Yes	No	Yes	No	No	Low
Ameko et. al (2012)	Yes	Yes	No	No	Yes	No	Yes	Moderate

Yendaw & Tampah-Naah (2021)	Yes	Yes	Yes	Can't tell	Yes	Yes	Yes	High
Donkor et. al. (2019)	Yes	Yes	Yes	Yes	Yes	Can't tell	Yes	High
Enimah et. al. (2022)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Gbadago (2017)	Yes	Yes	Yes	No	Yes	Yes	Yes	High
Acheampong et. al. (2019)	Yes	Yes	Yes	Yes	Yes	No	Yes	High
Awuah et. al. (2018)	Yes	Yes	Yes	Can't tell	Yes	Can't tell	Yes	Moderate
Ameade, Amalba, et al. (2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	High
Tagoe & Attah (2010)	Yes	Yes	No	No	Yes	Can't tell	No	Low

Table S5: Mixed-Methods studies

Study	S1	S2	5.1	5.2	5.3	5.4	5.5	Quality Grade
Gbagbo & Nkrumah (2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	High

Table S6: Detailed characteristics of studies used in the systematic review

Reference	Study Design	Year of study	Sample size	Reported prevalence (%)	Age of study population (mean±sd)	Study population	Study region	Geopolitical zone	Setting	Peer review status	Quality grade
Owusu-Ofori et. al. (2021)	CS (Quantitative)	2019	264	56.2%	19.5±1.88	Tertiary students	AR	Middle-Belt	Urban	Peer-reviewed	Low
Agyei-Boateng (2015)	CS (Quantitative)	2015	300	68.3%	<15-50	Pregnant Women	AR	Middle-Belt	Urban	Grey	High
Donkor et.al. (2019)	CS (Quantitative)	2017	261	33.3%	36.26±14.94	Patients	AR/ER	Middle-Belt	Urban	Peer-reviewed	High
Afari-Asiedu et. al. (2020)	CS (Qualitative)	2019	70	High prevalence	20-50	Health workers/General public	BER	Middle-Belt	Rural	Peer-reviewed	High
Enimah et. al. (2022)	CS (Quantitative)	2020	191	44.00%	44.32±16.27	General public	CR	Coastal-Belt	Rural	Peer-reviewed	High

Gbagbo & Nkrumah (2020b)	CS (Mixed-method)	2018	100	69.0%	29 ± 5	Pregnant Women	CR	Coastal-Belt	Rural	Peer-reviewed	High
Asiedu et. al (2016)	CS (Quantitative)	2016	469	25.2%	22 ±2.5	Tertiary students	CR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Kyei et. al. (2014)	CS (Quantitative)	2013	421	23.3%	39.8±18.6	General public	CR	Coastal-Belt	Urban	Peer-reviewed	High
Tagoe & Attah (2010)	CS (Quantitative)	2010	530	71.50%	≥15	Patients	CR	Coastal-Belt	Urban	Peer-reviewed	Low
Asamoah (2019)	CS (Quantitative)	2019	356	86.0%	35 (median)	General public	ER	Middle-Belt	Rural	Grey	Moderate
Amponsah et. al. (2022)	CS (Quantitative)	2019	337	53.10%	18-41	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	High
Ofori et. al. (2021)	CS (Quantitative)	2017	417	66.7%	35.6 ±10.6	Traders	GAR	Coastal-Belt	Urban	Grey	Moderate
Kretchy et. al. (2021)	CS (Quantitative)	2016	350	36.0%	18-65	General public	GAR	Coastal-Belt	Rural	Peer-reviewed	High
Asante (2019)	CS (Quantitative)	2019	319	46.4%	35.6±13.6	Patients	GAR	Coastal-Belt	Urban	Grey	High
Acheampong et. al. (2019)	CS (Quantitative)	2017	680	33.5%	16.7±1.98	Adolescents	GAR	Coastal-Belt	Urban	Peer-reviewed	High
Acheampomaa (2018)	CS (Quantitative)	2018	126	78.6%	<19-40+	General public	GAR	Coastal-Belt	Urban	Grey	High
Awuah et. al. (2018)	CS (Quantitative)	2013	707	61.40%	15-59	General public	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Gbadago (2017)	CS (Quantitative)	2017	396	48.0%	22.6±0.17	Tertiary students	GAR	Coastal-Belt	Urban	Grey	High
Donkor et. al. (2012)	CS (Quantitative)	2008	600	70.3%	n.s	Tertiary students	GAR	Coastal-Belt	Urban	Peer-reviewed	Low
Ameko (2012)	CS (Quantitative)	2008	150	34.7%	n.s	Patients	GAR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Sackey et. al. (2018)	Long. (Qualitative)	2014-2016	33	High prevalence	n.s	General public	GAR/CR	Coastal-Belt	Mixed	Grey	High
Agblevor et. al (2016)	Long. (Qualitative)	2014-2016	51	High prevalence	n.s	General public/chemical shop owners	GAR/CR	Coastal-Belt	Mixed	Grey	High
Issaka (2021)	CS (Quantitative)	2020	170	77.1%	18-54	Nurses	NR	Northern-Belt	Urban	Grey	Moderate

Ameade, Zakaria, et al. (2018)	CS (Quantitative)	2017	370	52.7%	10-50	Pregnant Women	NR	Northern-Belt	Urban	Peer-reviewed	Moderate
Ameade, Amalba, et al. (2018)	CS (Quantitative)	2015	293	19.80%	23±5.07	Tertiary students	NR	Northern-Belt	Urban	Peer-reviewed	High
Botchwey et. al. (2022)	CS (Quantitative)	2021	50	68.0%	13-49	Pregnant Women	OR	Middle-Belt	Rural	Peer-reviewed	Moderate
Adama et. al. (2021)	CS (Quantitative)	2017	367	74.0%	28.6 ±4.9	Pregnant Women	UWR	Northern-Belt	Urban	Peer-reviewed	High
Yendaw & Tampah-Naah (2021)	CS (Quantitative)	2020	122	29.5%	14-54	Migrants	UWR	Northern-Belt	Urban	Peer-reviewed	High
Makam et. al. (2021)	CS (Quantitative)	2018	371	62.0%	27 ±6.4	Pregnant Women	VR	Coastal-Belt	Urban	Peer-reviewed	Moderate
Ofosu (2020)	CS (Quantitative)	2020	400	62.3%	36.9 ±14.8	General public	WR	Coastal-Belt	Urban	Grey	Moderate

Note: CS = cross-sectional; Long. = longitudinal; n.s = not specified; AR = Ashanti Region; BER = Bono East Region; CR = Central Region; ER = Eastern Region; GAR = Greater Accra Region; NR = Northern Region; OR = Oti Region; UWR = Upper West Region; WR = Western Region.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title page
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 5
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5 & 6
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 6
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Page 7
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 7
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 7
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 7
Certainty	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
assessment			
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 8
Study characteristics	17	Cite each included study and present its characteristics.	Page 8 & 9
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Supplementary material Table S3-S5
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figure 2
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Figure 3
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 2 & Table 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Table 3
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Figure 4
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Figure 3
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 12-15
	23b	Discuss any limitations of the evidence included in the review.	Page 16
	23c	Discuss any limitations of the review processes used.	Page 16
	23d	Discuss implications of the results for practice, policy, and future research.	Page 15-16
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 17
Competing interests	26	Declare any competing interests of review authors.	Page 17
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 17

PRISMA 2020 Checklist

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

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