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Research article

Quality, Reliability and Stewardship-Message Completeness of Arabic-Language Web Content on Antibiotic Use: A Cross-Sectional Infodemiological Study

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Abstract: Arabic-language web pages on antibiotic use remain unevaluated despite widespread non-prescription use in the Eastern Mediterranean Region. This cross-sectional infodemiological study assessed reliability, stewardship-message completeness, and their association. Six patient-style Arabic searches conducted in September 2026 covered colds, treatment duration, non-prescription purchase, antibiotic selection for sore throat, resistance, and leftovers. Consumer-facing pages were assessed using four JAMA benchmarks and six stewardship messages derived from WHO and Saudi Ministry of Health guidance. Messages were coded as fully addressed, partially addressed, or absent. Site type, named antibiotics, and dosing information were recorded. Sixteen pages were assessed; three additional eligible pages were inaccessible. Authorship and dates appeared on 15/16 pages each, references on 4/16 and conflict-of-interest or sponsorship disclosure on 1/16. Mean JAMA score was 2.19/4; four pages scored ≥3. Mean stewardship coverage was 3.59/6; only one page conveyed all six messages. Warnings against leftover or shared antibiotics were absent from 12/16 pages. Coverage was highest among health portals (mean 5.50) and lowest among news media (3.07). Reliability and coverage were not significantly associated (Spearman $\rho = -0.29$; $p = 0.28$). Commercial pharmacy pages had the highest mean reliability score and exclusively provided specific doses, including weight-based pediatric tables alongside purchase prompts. These findings indicate incomplete stewardship communication, limited referencing and minimal disclosure. Formal reliability markers did not correspond to message completeness, limiting their standalone assessment value. Apparent credibility combined with prescribing-level content on commercial pharmacy websites warrants regulatory and stewardship attention.

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Introduction

Non-prescription acquisition of antibiotics is a well-documented feature of health systems across the Eastern Mediterranean Region, and the most recent WHO surveillance data place median resistance in the region at 30.0% across infection types, the highest of any region alongside South-East Asia [1, 2]. Public understanding of appropriate antibiotic use is therefore not a peripheral concern but a determinant of regional resistance, and the internet is among the principal sources from which that understanding is formed [3].

A body of infodemiological research has assessed the quality of Arabic-language online health information, covering diabetic retinopathy, low back pain, periodontal disease, halitosis and colon cancer [4, 5]. For antimicrobials specifically, one study has examined Arabic YouTube videos on antimicrobial resistance, finding median quality scores of 3 on a 5-

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point scale and no difference between official and unofficial sources [6]. Web pages about antibiotic use itself, as distinct from video content, and as distinct from resistance as an abstract topic, have not been evaluated in Arabic [7, 8].

The scale of the exposure is not trivial. Internet penetration across the Gulf states exceeds ninety per cent, and health information is among the most frequently searched categories. Where antibiotics can in practice be obtained from a community pharmacy with limited enforcement of prescription requirements, the distance between reading a web page and consuming an antibiotic is short [9, 10]. In health systems with strictly enforced prescription-only dispensing, inaccurate online content produces an argument with a clinician; where enforcement is incomplete, it can produce a purchase [11].

That gap matters for a practical reason. A person who searches in Arabic for whether antibiotics will help a cold, or for the best antibiotic for a sore throat, is at a decision point. What they find may determine whether they visit a clinician, pressure one for a prescription, purchase an antibiotic directly from a pharmacy, or take a leftover course [12]. The content encountered at that moment is a modifiable determinant of antibiotic consumption, and it is measurable. There is a second reason the Arabic-language environment deserves separate study rather than extrapolation from English findings [6]. The volume of high-quality, professionally curated consumer health content differs sharply between the two languages. In English, a searcher seeking antibiotic advice is likely to reach material produced by national public health agencies, large academic medical centres or established non-commercial health publishers.

In Arabic, the same search competes with regional news coverage of ministry announcements, with commercially operated health portals, and with the content-marketing output of online pharmacies. The mix of publishers is different, and so, plausibly, is the mix of messages. Findings from English-language audits cannot be assumed to transfer [11]. Existing instruments assess two things: formal reliability, conventionally through the JAMA benchmarks of authorship, attribution, currency and disclosure, and overall quality, conventionally through DISCERN. Neither asks whether the content conveys the specific advice that public health guidance considers essential. For antibiotics that question is answerable, because the core messages are well defined and few. This study therefore pairs a conventional reliability assessment with an explicit, claim-level audit of stewardship-message completeness, and asks whether the two correspond.

Methods

Design

Cross-sectional infodemiological study of publicly accessible Arabic-language web pages, conducted in September 2026 and reported in accordance with STROBE. No human participants were involved, and no ethical approval was required.

Search strategy

Six search queries were constructed in Modern Standard Arabic to reflect how a member of the public, rather than a clinician, would search. They addressed: whether antibiotics treat colds; when to stop taking an antibiotic; purchasing antibiotics without a prescription; the best antibiotic for a sore throat; the causes and prevention of antibiotic resistance; and the use of leftover antibiotics. Using multiple patient-style queries rather than a single clinical term is a deliberate departure from the prevailing method in this literature, which has typically relied on one formal term and therefore samples the content reached by clinically literate searchers rather than by patients.

Results were retrieved for each query and screened in order. The sixth query, concerning leftover antibiotics, returned predominantly English-language academic content and translation services and yielded no eligible consumer pages; this is reported as a finding rather than excluded silently.

Eligibility

Pages were included where they were written primarily in Arabic, directed at the public rather than health professionals, and contained substantive written content about antibiotic use. Excluded were non-Arabic pages, professional or academic literature, video-only content, social media, retail product listings without accompanying text, tag or index pages carrying no article content, and duplicate renderings of the same article at different URLs.

Assessment

Each page was assessed against the four JAMA benchmarks, scored one point each: identifiable authorship, citation of references or sources, display of a publication or update date, and disclosure of sponsorship, ownership or conflict of interest. A score of three or more is conventionally taken to indicate high reliability.

Each page was then audited against six core stewardship messages derived from WHO and Saudi Ministry of Health public guidance: that antibiotics do not treat viral illness; that a prescribed course should be taken as directed; that antibiotics should not be obtained without a prescription; that leftover or shared antibiotics should not be used; that misuse causes antimicrobial resistance; and that a health professional should be consulted. Each message was coded as fully addressed, partially addressed, not mentioned, or contradicted. For the coverage score, full credit was one point and partial credit half a point, giving a range of 0 to 6.

Pages were classified by site type as government or official, health portal, commercial pharmacy, or news media. Two additional features were recorded because of their direct relevance to self-medication: whether specific antibiotic products were named, and whether specific doses were given.

Analysis

Analyses are descriptive. The association between JAMA score and message coverage using Spearman rank correlation. Given the sample size, no subgroup hypothesis testing was performed. Analyses used Python 3.13 with SciPy. The coded dataset is supplied as a supplementary file.

Coding procedure and its limitation

Coding was performed by a single assessor with artificial-intelligence assistance in text extraction and structured feature identification. This departs from the two-independent-rater procedure used in comparable studies, and no inter-rater agreement statistic can therefore be reported. The coded dataset is provided in full so that a second rater can recode the corpus independently; such recoding should be completed before these findings are treated as definitive, and the claim-level coding in particular involves judgements on which reasonable assessors may differ.

Results

Corpus

Sixteen pages met the eligibility criteria and were coded. Three further pages that met the criteria on inspection of the search results could not be retrieved for assessment: the WHO Regional Office for the Eastern Mediterranean Arabic resistance page returned a server error, and two regional news sites returned client errors. Retrieval failure of official content is itself relevant to accessibility and is reported here rather than omitted.

The corpus comprised five government or official pages, two health portal pages, two commercial pharmacy pages and seven news media pages. Substantive content length ranged from approximately 120 to 2,300 words.

Reliability

Two JAMA benchmarks were almost always satisfied and two almost never. Authorship was identifiable on 15 of 16 pages, although in six cases only institutionally, and a publication or update date appeared on 15 of 16. References or sources were cited on only 4 of 16. A disclosure of sponsorship, ownership or conflict appeared on 1 of 16, a leaflet produced by a United States academic medical center, which carried a standard clinical disclaimer. The mean JAMA score was 2.19 of 4, and 4 of 16 pages reached the conventional threshold of three or more. The absence of disclosure is the most consequential of these gaps, because the corpus includes commercial pharmacy content in which the publisher sells the products discussed.

Stewardship-message completeness

Mean coverage was 3.59 of 6. A single-page antimicrobial resistance guide published by the Gulf Health Council fully conveyed all six messages. Coverage was uneven across messages. The advice to consult a health professional was the most consistently present, fully addressed on 13 of 16 pages, and the attribution of resistance to misuse appeared fully on 11. The statement that antibiotics do not treat viral illness was fully addressed on only 5 pages and not mentioned on 7. The least-covered message by a wide margin was the warning against using leftover or shared antibiotics, fully addressed on 2 pages and absent from 12. Given that reuse of leftover courses and sharing within households are among the principal routes to non-prescription antibiotic exposure in the region, its near-absence from the content a searcher encounters is the most actionable finding of this study. Page-level results are shown in Figure 1.

Named products and dosing information

Specific antibiotic products were named on 5 of 16 pages: both commercial pharmacy pages, both health portal pages and one news page. No government page named a product. Specific doses were given on 2 pages, and both were commercial pharmacy content; no government, health portal or news page gave a dose. The distinction matters because naming a drug class

while explaining how antibiotics work is educational, whereas naming branded products alongside milligram-per-kilogram paediatric dosing is prescribing information, and that was supplied only by publishers with a direct financial interest in the sale of those products.

Table 1. Coverage of six core antibiotic-stewardship messages across 16 Arabic-language web pages.

Core stewardship message	Fully addressed, n (%)	Partially addressed, n (%)	Not mentioned, n (%)
Consult a health professional	13 (81)	3 (19)	0 (0)
Misuse causes antimicrobial resistance	11 (69)	2 (12)	3 (19)
Do not obtain antibiotics without a prescription	9 (56)	4 (25)	3 (19)
Take the course as prescribed	8 (50)	4 (25)	4 (25)
Antibiotics do not treat viral illness	5 (31)	4 (25)	7 (44)
Do not use leftover or shared antibiotics	2 (12)	2 (12)	12 (75)

Fully addressed = the message is stated explicitly; partially addressed = the message is implied or stated incompletely; not mentioned = absent. No page contradicted any message. n = 16.



Figure 1. Page-level coverage of the six core stewardship messages, grouped by site type (n = 16).

Variation by site type

Health portals achieved the highest mean coverage at 5.50 of 6, followed by commercial pharmacy pages at 4.50, government pages at 3.20 and news media at 3.07. The government figure requires interpretation, because that category is heterogeneous. It contains two short ministry news items announcing regulatory action rather than educating (coverage 2.5 and 1.0) and one Arabic patient leaflet from a United States academic medical center written as a discharge instruction sheet (1.5). The two government pages actually written for public education, the Saudi Ministry of Health awareness platform and the Gulf Health Council guide, scored 5.0 and 6.0. The weakness therefore lies not in official health education but in the content that official sources most often surface in search results.

News media, the largest single category at seven pages, were the weakest on message completeness at a mean of 3.07, and their failure mode was characteristic. Most were reports of an event, a ministry circular, a regulatory penalty, a World Antimicrobial Awareness Week statement, or a published study rather than guidance. They reliably conveyed that misuse causes resistance, because that is the news hook, and they reliably advised consulting a doctor, because that is the conventional closing line. They rarely explained that antibiotics do not treat viral illness, and almost never addressed leftover or shared

courses. A reader arriving at one of these pages learns that antibiotic misuse is a problem without learning what, concretely, not to do.

Health portals scored highest on coverage but lowest on sourcing: neither of the two portal pages cited any reference, and neither carried a disclosure. Their advantage lies in format rather than rigour they are written as explanatory articles covering a topic systematically, so the stewardship messages appear as a by-product of comprehensiveness rather than by design.

Table 2. Reliability and stewardship-message coverage by site type.

Site type	Pages, n	Mean JAMA score (0–4)	Pages with JAMA ≥3, n	Mean coverage score (0–6)	Pages naming a specific antibiotic, n	Pages giving a specific dose, n
Government	5	2.20	1	3.20	0	0
Health portal	2	2.00	0	5.50	2	0
Commercial pharmacy	2	3.00	2	4.50	2	2
News media	7	2.00	1	3.07	1	0
All pages	16	2.19	4	3.59	5	2

JAMA score is the sum of four benchmarks (authorship, references, currency, disclosure), range 0–4. Coverage score awards 1.0 for a fully addressed message and 0.5 for a partially addressed message, range 0–6. Values are means. The government category includes three short regulatory press releases; the two government pages written for public education scored 5.0 and 6.0 on coverage.

Reliability and completeness are dissociated

The two measures did not correspond. Spearman correlation between JAMA score and message coverage was negative and not statistically significant ($\rho = -0.29$; $p = 0.28$). The page with the highest coverage, the Gulf Health Council guide, scored 1 of 4 on reliability, having no author byline, no references, no date, and no disclosure. Conversely, the page with the highest reliability score in the government category, the United States leaflet, conveyed only 1.5 of 6 messages because it is a discharge instruction sheet rather than a stewardship resource.

The practical implication is that a quality appraisal confined to conventional reliability instruments would not identify the content of greatest public-health concern, and might actively mislead. Figure 2B shows the relationship.

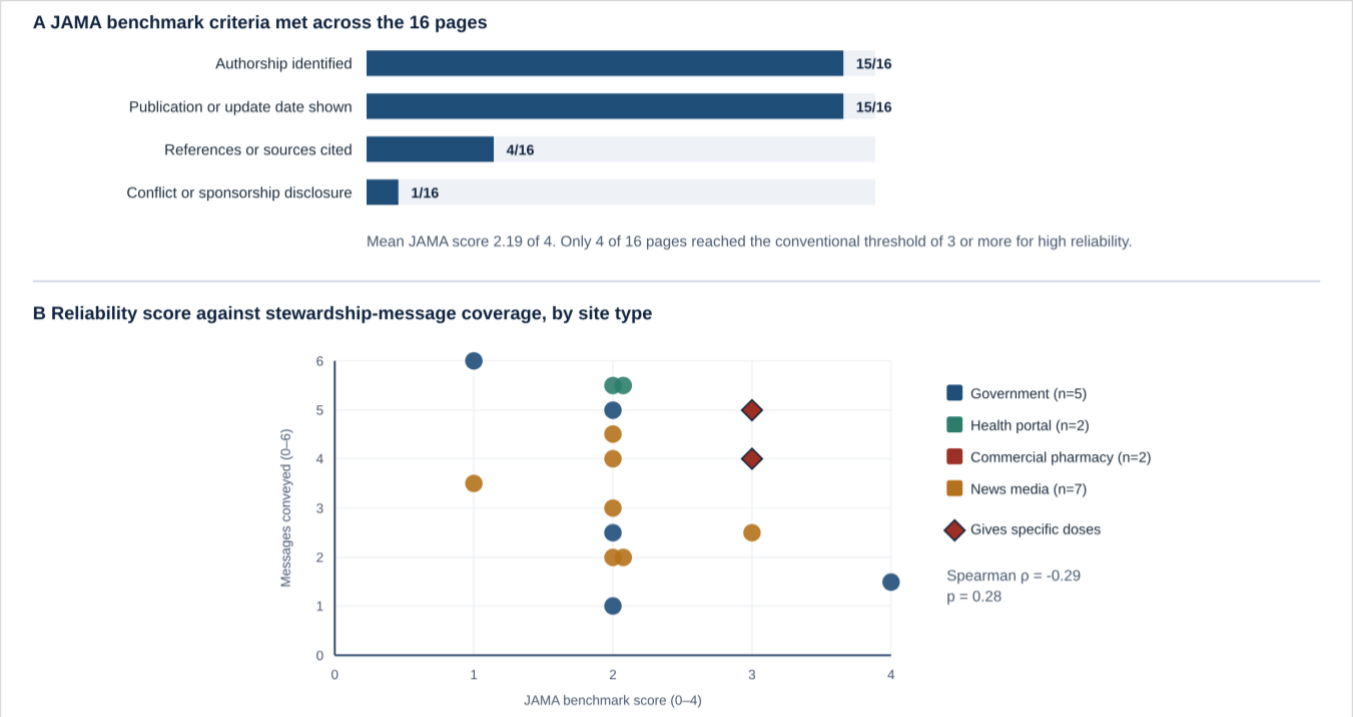


Figure 2. (A) Proportion of pages satisfying each of the four JAMA reliability benchmarks. (B) Relationship between JAMA reliability score and stewardship-message coverage score, with Spearman correlation.

Commercial pharmacy content

The two commercial pharmacy pages warrant separate description. Both are published on the blog of an online pharmacy that sells the products discussed. Both carried named pharmacist authors, publication and modification dates, and some external links, giving them the highest mean JAMA score of any site type at 3.00, and neither disclosed the commercial relationship between the publisher and the products.

Both named specific antibiotic products, and both were the only pages in the corpus to give doses. The page addressing children's throat infection listed amoxicillin-clavulanate, amoxicillin, azithromycin, clarithromycin, cefixime and several cephalosporins by brand name, provided weight-based and age-based dosing in milligrams per kilogram, ranked products by perceived strength, and identified amoxicillin as first-line for streptococcal pharyngitis. The same page advised readers not to take any medicine without a prescription from a specialist, and was interspersed with purchase prompts and price listings.

That combination- a formally credible presentation, prescribing-level clinical detail, an instruction not to self-prescribe, and a mechanism to purchase immediately is the single most important observation in this study. It is not misinformation in the conventional sense: the clinical content is broadly accurate, and the stewardship messages are largely present. The concern is structural rather than factual, and it is not detected by instruments designed to find inaccuracy.

Table 3. Characteristics of the two commercial pharmacy pages.

Feature	Page 1	Page 2
Topic	Chefaa, antibiotics for sore throat	Chefaa, antibiotics for children
Named author	Yes (pharmacist)	Yes (pharmacist)
Publication/update date	Yes	Yes
References or external sources	Yes	Yes
Commercial-interest disclosure	No	No
JAMA score (0–4)	3	3
Stewardship coverage (0–6)	5.0	4.0
Specific antibiotics named	Yes	Yes
Specific doses given	Yes	Yes
Purchase prompts on page	Yes	Yes

Both pages are published on the editorial blog of an online pharmacy that retails the products discussed. Neither disclosed that relationship.

Discussion

Three findings stand out. Arabic-language web content on antibiotics is poorly referenced and almost never discloses commercial interest. It conveys core stewardship messages incompletely, with the warning against leftover and shared antibiotics missing from three-quarters of pages [6, 11]. And formal reliability does not track message completeness, so the conventional appraisal toolkit does not locate the content that matters most.

The last of these has a methodological implication for the wider infodemiology literature [13]. Studies in this field typically report DISCERN and JAMA scores and conclude that quality is adequate or inadequate. The present findings suggest that for a topic with defined public-health messages, such scores can be close to orthogonal to whether the content actually says what guidance requires. Where a condition has a clear set of actionable messages, a claim-level audit should accompany the instruments rather than being displaced by them.

The negative correlation is not a statistical artifact to be explained away, and its mechanism is visible in the corpus. The JAMA benchmarks reward editorial infrastructure: a named author, a date stamp, a reference list, a disclosure statement [14]. Such infrastructure is characteristic of organizations that publish at volume and professionally, which in this corpus means news outlets and commercial publishers. Message completeness, by contrast, rewards editorial intent: content written specifically to change antibiotic-related behavior. That intent is concentrated in public health education material, which in the Arabic-language environment is often published institutionally, without bylines, without dates, and without reference lists precisely the pattern that depresses a JAMA score.

The Gulf Health Council guide illustrates the point exactly: it is the most complete stewardship resource in the corpus and scores one of four on reliability, not because it is unreliable but because an institution publishing authoritative guidance under its own name does not sign, date or footnote it. A benchmark set designed to distinguish credible from non-credible

publishers performs poorly when the most credible publishers do not use the conventions the benchmark measures [11].

The one prior study of Arabic antimicrobial content examined YouTube videos and concluded that they were generally of adequate quality and reliability, with no difference between official and unofficial sources [6]. The present study reaches a more qualified conclusion for web pages, and the divergence may be partly definitional: that study assessed quality in general terms, whereas this one asks whether specific messages are present. A page can be clear, current and well written while omitting the advice that would change behaviour. For regional stewardship programmes, the specific gap is addressable at low cost. The message most often missing is also the simplest to state, and official sources already produce high-coverage material: the Gulf Health Council guide conveyed all six messages [4]. The difficulty is not content production but visibility, since that guide appeared in search results below commercial and news content.

For regulators, the commercial pharmacy finding is the more pressing. Content that provides pediatric dosing tables alongside purchase functionality, without disclosing the commercial relationship, sits uneasily with the same jurisdictions' public warnings against dispensing antibiotics without a prescription. Requiring explicit disclosure where a publisher sells the products discussed would be a minimal first step, and would also raise the JAMA scores of precisely the pages where the benchmark currently carries least information [4]. For researchers, the retrieval failures encountered here, including an official WHO regional page, indicate that accessibility deserves measurement in its own right. Content that cannot be retrieved reliably cannot serve the public that it is written for.

One of the four JAMA benchmarks was performed in a way that deserves comment. Disclosure was satisfied by exactly one page, and that page satisfied it with a generic clinical disclaimer rather than a statement of commercial interest [3]. Meanwhile, the two pages with an unambiguous commercial interest a pharmacy writing about the drugs it sells disclosed nothing and were scored as failing that benchmark, which is correct but blunt: a scoring system that awards one point for an absent disclosure treats a non-commercial page with no interests to declare and a commercial page concealing them as equivalent. For content audits in domains with a retail dimension, the presence of a commercial interest should be recorded as a separate variable rather than folded into a reliability score, as was done here.

Study limitations: The sample is small. Sixteen pages is at the lower end of this literature, and the corpus should be regarded as a feasibility-scale assessment of a method rather than a definitive description of the Arabic-language information environment. A larger corpus across more queries would permit the subgroup comparisons that are reported here only descriptively. A single assessor coded the data with AI assistance rather than two independent human raters, so no agreement statistic can be reported. This is the principal limitation and the reason the coded dataset is supplied in full for independent recoding. Search results are personalized, geographically variable, and unstable over time. Searches were not conducted from within a single specified country, so the corpus may not reflect what a user in Saudi Arabia or any other particular state would encounter, and the same queries run later would return a different set. Readability was not assessed; validated Arabic readability measures are less standardized than their English equivalents, and this remains a gap in the field. Finally, the authors selected the six stewardship messages from public guidance. They are defensible and few, but another reasonable selection would yield different coverage scores, and the coding of partial credit involves judgment.

Conclusion

Arabic-language web pages on antibiotic use are current and attributable but poorly sourced, almost never disclose commercial interest, and convey the core messages of antibiotic stewardship incompletely. One page in sixteen conveyed all six, and three-quarters of the corpus lacked the warning that leftover and shared antibiotics are a principal route to non-prescription use in the region. Because formal reliability did not track message completeness, appraisal by conventional instruments alone would miss the content of greatest concern: commercial pharmacy pages that look credible, carry accurate clinical detail including pediatric dosing, advise against self-prescription, and offer immediate purchase. Addressing that configuration requires disclosure requirements and search visibility for official content, not corrections of factual error.

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