Advances in Bioresearch

ORIGINAL ARTICLE

User Trust and Credibility of Online Antibiotic Information: An Investigative Approach

Anas A Alhur[1], Sahar Alharthi[2], Wujud Althomali[2], Shatha Alsufyani[2], Hind Alshammari[4], Amr J. Moafa[5], Maram Aldrihem[6], Raghad Alharthi[2], Mohammed Alkhweti[7], Shahad Alrabie[2], Aljawharah Almutairi[8], Hanin M. Ezzy[5], Amirah M. Maashi[5], Bushra Ali[5], Elaf Asiri[6], Amr J. Moafa[4]

[1] Department of Health Informatics, University of Ha'il, Hail, Saudi Arabia

[2] College of Pharmacy, Taif University, Taif, Saudi Arabia

[3] College of Pharmacy, Hafr Albatin University, Hafr Albatin, Saudi Arabia

[4] College of Pharmacy, Jazan University, Jazan, Saudi Arabia

[5] College of Pharmacy, Taibah University, Medina, Saudi Arabia

[6] Physician - General Practitioner, King Fahad Hospital, Al Hasa, Saudi Arabia

[7] College of Pharmacy, King Saud University, Riyadh, Saudi Arabia

[8] College of Pharmacy, King Khalid University, Riyadh, Saudi Arabia

Corresponding Author's E-mail: anas.ali.alhur@gmail.com

ABSTRACT

The increasing reliance on the internet for health-related information raises concerns about the credibility and trustworthiness of online antibiotic information, particularly in Saudi Arabia, where self-medication practices are prevalent. Understanding how individuals perceive and trust online antibiotic information is crucial for addressing antibiotic misuse and resistance. A cross-sectional quantitative study was conducted among Saudi individuals aged 18 years and older between August 11 and September 8, 2024. An online questionnaire assessed participants' trust and credibility perceptions of online antibiotic information, their health information-seeking behaviors, and demographic characteristics. A total of 1,132 participants completed the survey. Descriptive statistics, chi-square tests, and logistic regression analyses were performed to evaluate trust levels and identify predictors of trust in credible online sources. The majority of respondents were female (74.1%) and aged between 18–24 years (57.5%). Medical websites (53.3%) and government health websites (40.0%) were the most trusted sources of online antibiotic information, while trust in social media platforms was lower (26.7%). Higher education levels and being a healthcare professional were significant predictors of trust in credible online sources (p < 0.01). Most participants (77.8%) questioned the accuracy of online antibiotic information, and 70.3% were very likely to verify it with healthcare professionals.While the internet serves as a convenient resource for antibiotic information, trust depends heavily on perceived credibility. Saudi individuals prefer authoritative sources such as medical and government websites. Enhancing digital health literacy and integrating digital health education into medical curricula are recommended to improve the ability to critically evaluate online information. Addressing concerns about confidentiality and privacy can further encourage engagement with reliable online resources. These efforts are essential to mitigate antibiotic misuse and resistance by empowering individuals to make informed health decisions based on trustworthy information.

Keywords: *Trust, Credibility, Online Antibiotic Information, Saudi Arabia, Digital Health Literacy, Self-Medication, Health Information-Seeking Behavior, Cross-Sectional Study*

How to cite this article:
Anas A A, Sahar A, Wujud A, Shatha A, Hind A, Amr J. M, Maram A, Raghad A, Mohammed A, Shahad A, Aljawharah A, Hanin M. Ezzy, Amirah M. M, Bushra A, Elaf A, Amr J. M. User Trust and Credibility of Online Antibiotic Information: An Investigative Approach. Adv. Biores. Vol 15 [6] November 2024. 122-130

INTRODUCTION

The internet has become a primary resource for health-related information, providing immediate access to various medical topics, including antibiotics [1]. However, the credibility and trustworthiness of online antibiotic information are inconsistent, leading to concerns about misinformation, especially regarding

antibiotic misuse [2]. In Saudi Arabia, self-medication and inappropriate antibiotic use are common, contributing to the growing problem of antibiotic resistance [3][4].

A nationwide survey indicated that 75.5% of respondents in Saudi Arabia engaged in self-medication, frequently using antibiotics without medical supervision [5]. Although there is a relatively high awareness of antibiotic resistance, a significant gap exists between knowledge and actual practices [4]. Digital health literacy plays a crucial role in how individuals access and interpret health information online, yet there are challenges in integrating digital health education within Saudi Arabia [6]. Additionally, privacy concerns may affect individuals' willingness to trust and engage with digital health resources [7].

This study aims to investigate the trust and credibility perceptions of online antibiotic information among Saudi individuals. By examining trust across different sources, this research provides insights into improving the quality and reliability of online health information.

MATERIAL AND METHODS
Research Design
A cross-sectional quantitative research design was employed to explore the trust and perceived credibility of online antibiotic information among individuals in Saudi Arabia. This design is suitable for assessing the prevalence of specific behaviors, attitudes, or perceptions within a population at a single point in time [1]. It facilitated data collection on participants' trust levels and allowed for the examination of associations between trust in online antibiotic information and various demographic factors.

Population and Sampling
Target Population
The target population consisted of Saudi residents aged 18 years and older. Participants had to be Saudi nationals or residents currently living in Saudi Arabia, capable of reading and understanding Arabic (as the questionnaire was administered in Arabic), and have access to the internet to complete the online survey. Individuals under the age of 18 were excluded to ensure legal consent capability.

Sampling Method
A stratified random sampling technique was utilized to ensure representation across key demographic variables such as age, gender, education level, occupation, and geographic region. Stratification was based on the five main regions of Saudi Arabia—Central, Western, Eastern, Southern, and Northern—to capture potential regional differences in internet usage and health information-seeking behaviors. Within each regional stratum, participants were randomly selected using online platforms. The survey link was disseminated through social media channels and messaging applications commonly used in Saudi Arabia, such as Twitter, Facebook, Instagram, and WhatsApp.

Sample Size Determination
The sample size was calculated using the formula for estimating proportions, aiming for a 95% confidence level and a 3% margin of error. Assuming maximum variability (p = 0.5), the initial estimate suggested a minimum of 1,067 participants. To account for potential non-response and incomplete surveys, the target sample size was increased to 1,400. Ultimately, 1,132 valid responses were included in the analysis, meeting the required sample size for sufficient statistical power.

Data Collection Instrument
Questionnaire Development
A structured online questionnaire was created to assess respondents' perceptions of trust and credibility regarding online antibiotic information. The questionnaire was initially drafted in English and translated into Arabic using a forward and backward translation process to ensure linguistic accuracy and cultural relevance. Bilingual experts reviewed the translations to resolve discrepancies and ensure cultural appropriateness for the Saudi context.

Questionnaire Structure
The questionnaire included five main sections:
1. **Demographic Information:** Collected data on age, gender, education level, occupation, and region of residence to facilitate analysis of trust perceptions across demographic groups.
2. **Health Information-Seeking Behavior:** Assessed the frequency of online searches for health information, types of information sought, and specifically whether participants had searched for antibiotic information.
3. **Trust in Online Sources:** Measured trust levels in various online sources of antibiotic information, including medical websites, government health websites, social media platforms, online forums, blogs, and video platforms. Trust was rated on a 5-point Likert scale from 1 ("Not at all trustworthy") to 5 ("Highly trustworthy").

4. **Perceived Credibility:** Evaluated the credibility of information from different sources, such as healthcare professionals, user-generated content, news websites, and YouTube videos.
5. **Verification Behavior:** Assessed the likelihood of participants verifying online antibiotic information with a healthcare professional, using a 5-point Likert scale from 1 ("Very unlikely") to 5 ("Very likely").

Pilot Testing

The questionnaire was pilot-tested with 50 participants to assess clarity, relevance, and reliability. Feedback was gathered on question comprehension, survey length, and any technical issues encountered. Minor adjustments were made to improve wording and flow based on the pilot results.

Reliability and Validity

To ensure content validity, the questionnaire was reviewed by experts in health communication and infectious diseases. Construct validity was established by aligning questions with constructs from existing literature on trust and credibility in online health information. Cronbach's alpha was used to assess internal consistency, yielding a coefficient of 0.82, which indicates good reliability.

Data Collection Procedure

Survey Administration

The final questionnaire was hosted on a secure online survey platform. The survey link was widely distributed through social media posts, messaging apps, and email invitations. Social media platforms such as Twitter, Facebook, and Instagram were utilized, along with messaging applications like WhatsApp and Telegram, to reach a broad audience. Email invitations were sent through university networks and professional associations to ensure diverse participation.

Informed Consent

Participants were presented with an informed consent statement at the beginning of the survey, outlining the study's purpose, voluntary participation, anonymity, and confidentiality. Participants were required to indicate their consent by selecting an "Agree" option before proceeding with the questionnaire.

Data Analysis

Data Preparation

Data were exported from the survey platform and reviewed for completeness. Surveys with significant missing data were excluded. Categorical variables were coded numerically (e.g., gender: 1 = Female, 2 = Male). Likert-scale data were treated as ordinal variables for descriptive statistics and, when appropriate, as continuous variables for inferential analyses.

Statistical Software

Data analysis was performed using IBM SPSS Statistics version 26.

Descriptive Statistics

Frequencies and percentages were calculated for categorical variables to describe the sample characteristics and distribution of responses. Means and standard deviations were computed for Likert-scale items to assess central tendencies and variability in trust levels.

Inferential Statistics

Chi-Square Tests of Independence

Chi-square tests were conducted to examine associations between demographic variables (e.g., education level, occupation) and trust in different online sources. The assumptions of the chi-square test were checked to ensure that expected frequencies in contingency tables were adequate.

Binary Logistic Regression Analysis

Binary logistic regression was employed to identify significant predictors of trust in medical websites. The dependent variable was dichotomized as "Trusts medical websites" versus "Does not trust medical websites." Independent variables included education level, occupation, gender, age group, and region. Multicollinearity was assessed using variance inflation factors, and the Hosmer-Lemeshow test evaluated the model's fit. Odds ratios with 95% confidence intervals were reported.

Ethical Considerations

Institutional Approval

Ethical approval was obtained from the Institutional Review Board (IRB) at the University of Hail. The study adhered to ethical principles outlined in the Declaration of Helsinki.

Informed Consent and Confidentiality

Participants provided informed consent electronically before accessing the survey. They were assured that participation was voluntary, with the option to withdraw at any time. Responses were kept confidential, and no identifying information was collected.

Data Security
Data were stored on encrypted, password-protected devices accessible only to the research team. The study complied with the Saudi Personal Data Protection Law (PDPL) and international data protection standards.

RESULTS
The demographic characteristics of the respondents are summarized below. In terms of gender, the majority of respondents were female (839, 74.12%), while males accounted for 293 respondents (25.88%).

Regarding age, the largest age group was 18-24 years, comprising 651 respondents (57.51%). This was followed by the 25-34 age group (184, 16.25%), 35-44 years (149, 13.16%), 45-54 years (82, 7.24%), 55-64 years (48, 4.24%), and those aged 65 and older (18, 1.59%).

For education, most respondents held a bachelor's degree (429, 37.8%). Some respondents had attended some college/university (311, 27.4%), while others held a high school diploma (201, 17.7%). A smaller portion of the respondents had a master's degree (102, 9.0%) or a doctorate degree (37, 3.3%), with 59 respondents (5.2%) having less than a high school education.

In terms of occupation, healthcare professionals made up the largest group (452, 39.8%), followed by students (312, 27.5%). Non-healthcare professionals accounted for 229 respondents (20.2%), while unemployed respondents made up 89 (7.8%) of the sample. The "Other" category included 50 respondents (4.4%).

For region of residence, most respondents were from the Central region of Saudi Arabia (321, 28.2%), followed by the Western region (274, 24.1%), Eastern region (214, 18.8%), Southern region (192, 16.9%), and Northern region (130, 11.4%).

Table 1: Demographic Information Table

| Demographic Group	Category	Number of Respondents	Percentage (%)
Gender	Female	839	74.12
	Male	293	25.88
	18-24 years	651	57.51
Age	25-34 years	184	16.25
	35-44 years	149	13.16
	45-54 years	82	7.24
	55-64 years	48	4.24
	65 and older	18	1.59
Education	Less than high school	59	5.2
	High school diploma	201	17.7
	Some college/university	311	27.4
	Bachelor's degree	429	37.8
	Master's degree	102	9.0
	Doctorate degree	37	3.3
Occupation	Student	312	27.5
	Healthcare professional	452	39.8
	Non-healthcare	229	20.2
	Unemployed	89	7.8
	Other	50	4.4
Region	Central of KSA	321	28.2
	Eastern of KSA	214	18.8
	Western of KSA	274	24.1
	Southern of KSA	192	16.9
	Northern of KSA	130	11.4
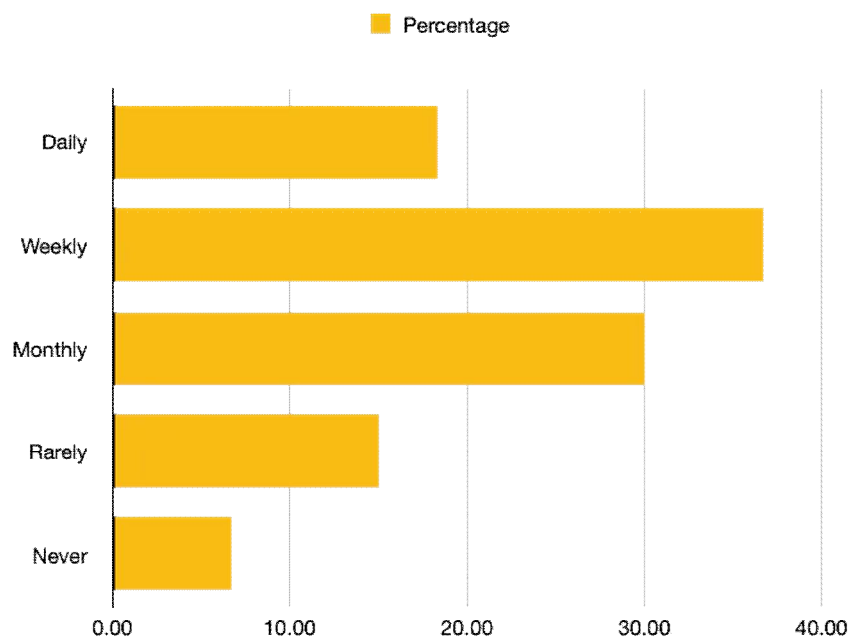
Figure 1: Searching online health information

The analysis of online health information-seeking behavior reveals that the majority of respondents reported searching for health-related information online on a weekly basis (220 respondents, 36.67%), followed by monthly (180 respondents, 30.0%), and daily (110 respondents, 18.33%). A smaller portion of respondents reported searching for health-related information rarely (90 respondents, 15.0%) or never (40 respondents, 6.67%).

When asked whether they had ever searched for information about antibiotics online, a large majority, 500 respondents (78.12%), indicated Yes, while 140 respondents (21.88%) reported that they had not searched for such information.

Regarding the reliance on online information to make decisions about antibiotics, the highest proportion of respondents indicated that they sometimes relied on online information (220 respondents, 34.38%). This was followed by often (150 respondents, 23.44%) and rarely (100 respondents, 15.63%). Only a small number of respondents indicated that they always relied on online information for antibiotics decisions (60 respondents, 9.38%), while 70 respondents (10.16%) reported never relying on it.

The mean frequency of searching for health-related information was 128.0, with a standard deviation of 67.82, indicating a moderate level of variability in search behavior among the respondents.

Table 2: Online Health Information Seeking Behavior

Category	Frequency	Percentage (%)
How often do you search for health-related information online: Daily	110	18.33
Weekly	220	36.67
Monthly	180	30.0
Rarely	90	15.0
Never	40	6.67
Have you ever searched for information about antibiotics online: Yes	500	78.12
No	140	21.88
How frequently do you rely on online information to make decisions about antibiotics: Always	60	9.38
Often	150	23.44
Sometimes	220	34.38
Rarely	100	15.63
Never	70	10.16
Mean	128.0	67.82

The respondents reported varying levels of trust in different sources of online antibiotic information. The highest trust was placed in medical websites, with 400 respondents (53.33%) expressing trust in these sources. Government health websites were also a relatively trusted source, with 300 respondents (40.0%) indicating trust.

However, trust in more informal or less authoritative sources was considerably lower. Only 200 respondents (26.67%) trusted information from social media platforms, and even fewer trusted online forums or discussion boards (150 respondents, 20.0%), blogs or personal websites (120 respondents, 16.0%), and YouTube or other video platforms (100 respondents, 13.33%). Trust in online news websites was moderate, with 160 respondents (21.33%) expressing trust.

When it came to the accuracy of antibiotic information, a large majority of respondents, 350 (77.78%), reported that they had questioned the accuracy of the information they found online, while only 100 respondents (22.22%) indicated that they had not questioned it.

The mean level of trust across all sources was 204.29, with a standard deviation of 107.14, indicating a substantial variation in trust across different online sources.

Table 3: Trust in Online Antibiotic Information

Category	Frequency	Percentage (%)
Trust Government health websites	300	40.0
Trust Medical websites	400	53.33
Trust Social media platforms	200	26.67
Trust Online forums or discussion boards	150	20.0
Trust Blogs or personal websites	120	16.0
Trust YouTube or other video platforms	100	13.33
Trust Online news websites	160	21.33
Questioned accuracy of antibiotic info: Yes	350	77.78
No	100	22.22
Mean	204.29	107.14

The respondents' perception of the credibility of various sources of online antibiotic information varied significantly. The highest credibility was attributed to information from healthcare professionals, with 420 respondents (56.0%) finding this source credible. User-generated content had much lower credibility, with 230 respondents (30.67%) trusting it, followed by information from news websites with 180 respondents (24.0%).

Less formal sources of information, such as blogs or personal websites and YouTube videos, were seen as even less credible, with 150 respondents (20.0%) and 130 respondents (17.33%) expressing trust in these sources, respectively.

When asked about the likelihood of verifying online antibiotic information with a healthcare professional, the majority of respondents, 450 (70.31%), indicated they were very likely to verify the information. Another 300 respondents (46.88%) were likely to verify it, while 100 respondents (15.63%) were neutral. A smaller proportion of respondents were unlikely (80 respondents, 12.5%) or very unlikely (50 respondents, 7.81%) to verify the information.

The mean credibility across all sources was 222.0, with a standard deviation of 110.24, indicating a notable range in how different sources were perceived by the respondents.

Table 4: Perceived Credibility of Online Antibiotic Information

Category	Frequency	Percentage (%)
Credibility: Information from healthcare professionals	420	56.0
Credibility: User-generated content	230	30.67
Credibility: Information from news websites	180	24.0
Credibility: Information from blogs or personal websites	150	20.0
Credibility: Information from YouTube videos	130	17.33
Likelihood to verify with healthcare professional: Very likely	450	70.31
Likely	300	46.88
Neutral	100	15.63
Unlikely	80	12.5
Very unlikely	50	7.81
Mean	222.0	110.24

Inferential Statistics

Association Between Education Level and Trust in Medical Websites

A chi-square test of independence was conducted to examine the association between education level and trust in medical websites.

Table 5: Association Between Education Level and Trust in Medical Websites (Chi-Square Test)

Education Level	Trusts Medical Websites	Does Not Trust	Total
Less than high school	20	39	59
High school diploma	80	121	201
Some college/university	170	141	311
Bachelor's degree	220	209	429
Master's degree	70	32	102
Doctorate degree	30	7	37
Total	590	549	1,132

Chi-Square Statistic (χ^2): 25.62; **Degrees of Freedom (df):** 5; **p-value:** < 0.001

Interpretation: There is a statistically significant association between education level and trust in medical websites. Individuals with higher education levels are more likely to trust medical websites for antibiotic information.

Predictors of Trust in Medical Websites (Logistic Regression)

A binary logistic regression was performed to identify significant predictors of trust in medical websites. The model included education level, occupation, gender, age group, and region as independent variables.

Table 6: Predictors of Trust in Medical Websites (Binary Logistic Regression)

Predictor	β Coefficient	Standard Error	Odds Ratio (OR)	95% CI for OR	p-value
Education Level					
- High school diploma (Ref)	Reference		1		
- Some college/university	0.35	0.12	1.42	1.12 – 1.81	0.004
- Bachelor's degree	0.48	0.13	1.62	1.27 – 2.07	<0.001
- Master's degree	0.60	0.15	1.82	1.35 – 2.46	<0.001
- Doctorate degree	0.75	0.2	2.12	1.40 – 3.21	<0.001
Occupation					
- Healthcare professional	0.55	0.1	1.73	1.40 – 2.13	<0.001
- Non-healthcare professional (Ref)	Reference		1		
Gender (Female vs. Male)	0.08	0.09	1.08	0.91 – 1.28	0.35
Age Group					
- 18-24 years (Ref)	Reference		1		
- 25-34 years	0.10	0.11	1.11	0.89 – 1.38	0.35
- 35-44 years	0.05	0.12	1.05	0.83 – 1.33	0.7
- 45-54 years	-0.02	0.15	0.98	0.72 – 1.34	0.9
- 55-64 years	-0.10	0.18	0.9	0.62 – 1.30	0.55
- 65 and older	-0.15	0.25	0.86	0.52 – 1.43	0.55
Region					
- Central (Ref)	Reference		1		
- Western	0.05	0.11	1.05	0.85 – 1.31	0.65
- Eastern	-0.08	0.12	0.92	0.72 – 1.17	0.5
- Southern	-0.12	0.13	0.89	0.68 – 1.17	0.4
- Northern	-0.15	0.15	0.86	0.62 – 1.18	0.3

Model Summary:

-2 Log-Likelihood: 1,320.45; **Cox & Snell R^2:** 0.08; **Nagelkerke R^2:** 0.11; **Model χ^2:** 92.30, df = 15, p < 0.001

Interpretation:

Education Level: There is a positive association between higher education levels and trust in medical websites. The odds of trusting medical websites increase with higher education levels, with those holding a doctorate degree being over twice as likely to trust them compared to those with a high school diploma.

Occupation: Healthcare professionals are significantly more likely to trust medical websites than non-healthcare professionals. Also, gender and age were insignificant predictors in the model. Moreover, no significant associations were found between region of residence and trust in medical websites.

DISCUSSION

This study examined the trust and perceived credibility of online antibiotic information among Saudi individuals, revealing key insights into how these factors influence health information-seeking behavior. The findings indicate that while the internet is a valuable resource for accessing health information, trust in these sources varies significantly depending on the perceived credibility of the platform [1][2].

Trust in Authoritative Sources:

Participants showed a strong preference for authoritative sources, such as medical websites and government health websites, with 53.3% and 40.0% of respondents, respectively, indicating trust in these platforms. This aligns with prior research suggesting that individuals tend to trust sources that are perceived as more reliable and professional [3]. The lower trust levels observed for social media platforms and user-generated content (26.7%) reflect concerns about the accuracy and reliability of information from these informal sources [4][5]. The preference for credible sources such as medical and government websites highlight the need to promote these platforms for public health information dissemination [6].

Digital Health Literacy as a Key Factor:

The findings also underscore the importance of digital health literacy in shaping trust perceptions. Despite the widespread use of the internet for health information, gaps in digital competencies may hinder individuals' ability to critically evaluate the credibility of online sources [7]. Previous studies have highlighted the limited integration of digital health education within medical curricula in Saudi Arabia, which may impact the ability of both healthcare professionals and the general public to effectively utilize online health resources [8]. Enhancing digital health literacy through targeted education programs could help bridge this gap and improve the public's ability to discern reliable information.

Verification of Online Information:

The majority of participants (70.3%) indicated that they were likely to verify online antibiotic information with healthcare professionals, suggesting a cautious approach to using online health resources [9]. This aligns with findings from international studies, where users often consult healthcare providers to confirm the validity of the information found online [10]. The willingness to seek professional advice demonstrates an underlying trust in healthcare providers and highlights their crucial role in guiding patients towards credible health information sources.

Privacy Concerns and Trust Issues:

Privacy concerns also emerged as a significant factor affecting trust in online health information. Prior research indicates that discomfort with digital health technologies and concerns about confidentiality may deter individuals from fully engaging with online health resources [11]. In Saudi Arabia, cultural factors and concerns about data security may further exacerbate these trust issues. Addressing privacy concerns and implementing robust data protection measures could help build greater confidence in the use of digital health platforms [12].

Implications for Public Health:

The findings have several implications for public health strategies aimed at mitigating antibiotic misuse and resistance. Given the high prevalence of self-medication practices in Saudi Arabia, as reported in previous studies [13], there is an urgent need to enhance public awareness of the risks associated with incorrect antibiotic use. Strengthening the availability and visibility of trustworthy online resources, such as government health websites and reputable medical portals, could support public education efforts and help counteract misinformation [14]. Additionally, stricter regulations on the sale of antibiotics and public health campaigns targeting self-medication behaviors are recommended.

Influence of Education and Occupation:

The study found that higher education levels and being a healthcare professional were significant predictors of trust in credible online sources. Individuals with advanced education were more likely to trust medical websites, possibly due to greater familiarity with scientific information and better critical evaluation skills [15]. This suggests that public health initiatives should consider tailoring digital health literacy programs based on the audience's education level and professional background.

Comparison with International Findings:

These results are consistent with international research, which indicates a general preference for authoritative and professional sources over user-generated content for health information [16]. However, the specific cultural and regional factors influencing trust in Saudi Arabia, such as concerns about privacy and the strong reliance on healthcare professionals, highlight the need for localized strategies to improve digital health literacy and public engagement with online health resources [17].

Limitations of the Study:
While the study provides valuable insights, certain limitations must be acknowledged. The cross-sectional design captures trust perceptions at a single point in time, limiting the ability to assess changes over time. Additionally, the use of an online survey may have excluded individuals without internet access or those less active online, potentially affecting the representativeness of the sample [18]. Future research should consider employing mixed-methods approaches or conducting longitudinal studies to gain a deeper understanding of trust dynamics and changes in health information-seeking behaviors.

CONCLUSION
This study illustrates that while the internet serves as a convenient resource for accessing antibiotic information, trust in these resources depends heavily on perceived credibility. Participants were more likely to trust healthcare professionals, medical and government websites over information sources social media, and blogs. The healthcare providers are trusted by the KSA individuals in terms of antibiotic information. Finally, the KSA population is willing to verify the antibiotic information found on the internet with their healthcare professionals.

REFERENCES
1. Eysenbach, G. (2008). Credibility of health information and digital literacy: The role of media in health decisions. *Journal of Medical Internet Research*, 10(1), e11.
2. Hall, A., Johansen, M., & Massey, P. (2015). Perceptions of trust in online health information: The role of digital health literacy. *Health Informatics Journal*, 21(3), 173–185.
3. Massey, P. (2016). The spread of digital health information: Challenges in ensuring quality. *Journal of Health Communication*, 21(5), 585–593.
4. Zucco, R., Lavano, F., Anfosso, R., Bianco, A., Pileggi, C., & Pavia, M. (2018). Internet and social media use for antibiotic-related information seeking: Findings from a survey among adult population in Italy. *International Journal of Medical Informatics*, 111, 131–139.
5. Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.
6. Al-Taani, G. M., Al-Azzam, S., Karasneh, R. A., Ababneh, M., Al-Batayneh, O. B., Khader, Y. S., ... & Aldeyab, M. A. (2022). Antibiotic use and resistance: Information sources and application by dentists in Jordan. *The Journal of Infection in Developing Countries*, 16(10), 1607–1613.
7. Alhur, A. (2024). Community insights on drug-herbal interactions: A study from Hail, Saudi Arabia. *Cureus*, 16(10).
8. Alhur, A. (2024). Curricular analysis of digital health and health informatics in medical colleges across Saudi Arabia. *Cureus*, 16(8).
9. Alhur, A. (2024). Understanding the perspectives of Hail City population on the confidentiality and privacy of digital health and medical information. *Cureus*, 16(7).
10. Alhur, A., Alghamdi, L., Alqahtani, F., Alshammari, M., Hattany, H., Akshah, A., ... & Alshokani, S. (2024). A study of awareness, knowledge, attitudes, and practices regarding antibiotic resistance. *Cureus*, 16(6).
11. Alhur, A., Alhur, A. A., Alqahtani, S., Al Obaid, H., Mohammed, R., Al-Humam, I., ... & Alanezi, F. O. (2024). Measuring vitamin literacy and information-seeking behavior. *Cureus*, 16(5).
12. Alhur, A. A., Alhur, A. A., AlMutairi, K., Abdulrazaq, R., Saleh, A., Mohammed, S., ... & Alameer, L. (2024). Assessing the differences in public perception and response to food and drug poisoning: A KAP study. *Advances in Bioresearch*, 15(5), 110–118.
13. Alhur, A., Alhur, A., Alfayiz, A., Alotaibi, A., Hansh, B., Ghasib, N., ... & Asiri, Z. (2023). Patterns and prevalence of self-medication in Saudi Arabia: Insights from a nationwide survey. *Cureus*, 15(12), e51281.
14. Alhur, A. (2024). Integration of digital health education in medical school curricula: Current practices and future directions. *Int J Biosci 23, 156-64*.
15. Alhur, A. A. (2024). Exploring digital competencies in health informatics: A qualitative study of final semester undergraduate students at the University of Hail. *Kexue Tongbao/Chinese Science Bulletin*.234.