ISSN: 1343-4292
Volume 142, Issue 05, May, 2024

The Impact of Online Medication Information Resources on Patient Medication Knowledge and Safety: A Quantitative Study via Online Questionnaire

Anas Ali Alhur[1*], Sally Alhumaid[2], Ghufran Alhuthayfi[3], Sadeen Fallatah[4], Munirah Abdullah[5], Reema Al sager[6], Haneen Alharbi[7], Mohammed alhuzali[8], Meshari Alshammari[9], Norah Alamri[10], Njood Aloufi[11], Nouf Mohammed[12], Melaf Almutairi[13], Nada Abualamah[14], Haneen Ezzi[15]

Dept. of Health Informatics, College of Public Health and Health Informatics, University of Hail, KSA[1]
Qassim University[2]
King Abdulaziz University[3]
Jazan University[4]
Prince Sattam Bin Abdulaziz University[5]
King Khalid University[6]
Qassim University[7]
Nahdi medical company[8]
University of Hafr Al Batin[9]
Taibah University[10]
Al-Qussaim university[11]
King Khalid university[12]
Prince Sattam Bin Abdulaziz University[13]
Alamal pharmacy[14]
Jazan university[15]

Corresponding author: 1*

ABSTRACT— The internet has fundamentally transformed access to health information, with many patients increasingly relying on online resources for medication guidance. This study quantitatively assesses the impact of online medication information on patient knowledge and safety. Using a cross-sectional design, data were collected through an online questionnaire distributed to a diverse sample of adult patients prescribed medications within the past year. Our findings reveal that a significant proportion of patients frequently seek medication information online, highlighting the internet's critical role in contemporary healthcare. Participants reported moderate levels of knowledge gain across key areas such as general medication information, correct usage, potential interactions, and when to seek medical help. However, substantial variability in the quality and reliability of online information raises concerns about its influence on patient understanding and safety. Notably, 61.7% of participants encountered conflicting information online, and demographic factors such as age and education level significantly influenced information-seeking behaviors and comprehension. The study emphasizes the importance of digital literacy and the role of healthcare professionals in guiding patients to credible online resources. While access to online medication information can enhance patient knowledge, it also presents challenges in discerning accurate information, particularly for populations with lower health literacy. The findings suggest that targeted educational interventions and personalized counseling can bridge the gap between information availability and effective utilization, thereby improving medication adherence and patient outcomes. This research illustrates the necessity for healthcare systems to integrate digital health literacy into patient education

strategies, ensuring all patients can navigate online health information effectively. Future research should explore longitudinal impacts and develop robust frameworks for assessing the quality of online health information.

KEYWORDS: Online Medication Information Patient Knowledge Medication Safety Digital Health Literacy Health Information Quality

1. Introduction

The advent of the internet has revolutionized access to health information, with a significant number of patients turning to online resources for medication guidance. This study aims to quantitatively investigate the influence of these resources on patient knowledge and safety concerning medications exclusively through the deployment of an online questionnaire.

With the digitalization of health information, patients increasingly rely on the Internet for medication-related inquiries. The variable quality of online health information raises concerns about its impact on patient understanding and safety. This research seeks to elucidate the relationship between the utilization of online medication information and patient outcomes, focusing on the ease and reach of an online questionnaire to gather data [1- 3].

Various research studies have emphasized the significance of online medication information resources in enhancing patients' knowledge about medications and ensuring their safety [4], [5]. These studies collectively advocate for the pivotal role of patient education and effective counselling in bolstering medication adherence and comprehension.

Research indicates that while elevating a patient's understanding of health may not directly correlate with better adherence to medication regimens, fostering a sense of self-efficacy is vital [6], [7]. It has been noted that individuals with diminished health literacy, particularly older populations and certain demographic groups, are prone to inconsistencies in medication intake [8]. These findings recommend that healthcare professionals employ a multifaceted approach that educates and addresses broader issues such as social isolation and economic barriers to medication adherence. Utilizing digital tools and adapting dosing schedules to fit individual lifestyles are among the suggested strategies to enhance adherence [9]. Moreover, studies have highlighted that educational interventions, especially those that include behavioural support, tend to lead to improved adherence and a deeper understanding of medications [10].

A specific study explored the impact of allowing patients to use their own medications during hospital stays on their self-reported medication knowledge. This investigation targeted adult patients already on medication regimens before hospital admission. The results indicated that by discharge, a substantial number of patients reported a satisfactory level of understanding regarding their medication usage, with those in the patient's own medication (POM) group demonstrating a higher level of knowledge on medication usage compared to those receiving standard care [11]. The study established a significant association between POM use and enhanced medication knowledge at discharge. It also identified that a solid understanding of medication at admission and external support in medication management at home were crucial factors linked to improved medication knowledge at the point of discharge [12]. Furthermore, a notable percentage of participants believed that POM use contributed to reducing medication errors, signifying its positive influence on medication safety [13].

These findings illustrate the necessity of centering patient needs and preferences in healthcare strategies,

including medication management. Employing individualized counseling techniques such as motivational interviewing and structured questioning can further empower patients, leading to better adherence, understanding, and overall health outcomes [14], [15]. This study aims to investigate the role of online medication information resources in patient health outcomes by quantifying their usage, evaluating the perceived quality of the information obtained, assessing its impact on patient knowledge levels, and exploring its association with patient-reported medication safety incidents.

2. Research Questions

1. What proportion of patients seek medication information online?
2. How do patients perceive the quality of medication information found online?
3. Does accessing medication information online enhance patient knowledge about their medications?
4. Is there a link between the use of online medication information and reported medication errors or adverse events?

3. Methodology

Study Design This research was conducted as a quantitative, cross-sectional study utilizing an online questionnaire to gather data from patients who had been prescribed medication within the previous year.

Population and Sample The study targeted adult patients (18 and older) who had received at least one medication prescription in the past 12 months. Efforts were made to ensure a diverse sample in terms of age, gender, socioeconomic status, and geographic location to reflect a wide range of patient experiences and perspectives.

Data Collection A comprehensive online questionnaire was developed, consisting of various sections designed to capture a broad spectrum of information. These sections included demographic details, information about the medications prescribed, and questions regarding the frequency and nature of the patients' online medication information-seeking behaviors. Additionally, the questionnaire sought to assess the participants' self-evaluated medication knowledge and any self-reported incidents of medication errors or adverse events. To reach a wide audience, the questionnaire was disseminated through multiple channels, including social media platforms, healthcare forums, and patient networks, ensuring a broad and inclusive participant base.

Data Analysis The collected responses were carefully analyzed using statistical software, specifically SPSS. Descriptive statistics played a crucial role in summarizing the vast array of data, providing a clear overview of the key trends and patterns observed. Furthermore, inferential statistical methods, particularly logistic regression, were employed to delve deeper into the data. This analysis aimed to uncover the intricate relationships between patients' online information-seeking behaviours and their knowledge and safety regarding medications, shedding light on the potential impacts and implications of online health information.

Ethical Considerations Maintaining the highest ethical standards was a cornerstone of this research. Before participation, informed consent was obtained from all participants through an online process, ensuring they were fully aware of the study's nature and their role in it. The research received approval (No: H-2024-206) from the Research Ethics Committee at the University of Hail, reaffirming its adherence to ethical guidelines and standards. Throughout the study, stringent measures were in place to guarantee the anonymity and confidentiality of the data, safeguarding the privacy and rights of all participants.

4. Results

This study investigates the impact of online medication information on patient knowledge and safety. Analyzing data from 1,176 participants, the results are segmented into demographic characteristics, medication usage, online information-seeking behavior, and the impact of online information on understanding medication.

Participants were predominantly female (75.3%) and in the age group of 18-24 years (57.1%). Most had a college-level education (77.8%), and a significant majority (80.9%) reported being prescribed medication in the past 12 months.

Table 1: Demographic Characteristics and Medication Usage

Demographic Factor	Category	Frequency (n)	Percent (%)	Mean	SD
Gender	Male	290	24.7	-	-
	Female	885	75.3	-	-
Age Group	18-24	671	57.1	-	-
	25-34	246	20.9	-	-
Education Level	College Graduate	915	77.8	-	-
Medication Usage	Yes	951	80.9	1.19	0.939

The majority of participants 'Often' sought medication information online. Encounters with conflicting information were reported by 61.7%. Moreover, participants reported diverse frequencies of seeking medication information online, with 'Sometimes' being the most common response (32.7%, n=384), followed by 'Always' (23.7%, n=278) as seen in (Table 2).

Table 2: Online Information-Seeking Behavior

Behavior	Frequency (n)	Percent (%)	Mean	SD
Frequency of Information Seeking			3.11	0.939
Never	86	7.3	-	-
Often	504	42.9	-	-
Encountered Conflicting Information	Yes	726	61.7	0.486

The impact of online medication information on patient knowledge was assessed across four dimensions: general medication information, correct usage, potential interactions, and when to seek medical help. On average, participants reported moderate levels of knowledge gain across all dimensions (Table 3).

Table 3: Impact on Medication Knowledge

Knowledge Aspect	Mean Score
General Information	3.25
Correct Way to Take Medications	3.19
Potential Interactions	3.1
When to Seek Medical Help	3.25

Participants reported varying levels of understanding regarding the purpose of their medications from online information. A significant number (41.5%) indicated a moderate understanding, and 21.1% reported a

significant understanding. However, 17.3% only slightly understood the purpose, and 6.6% did not understand it at all.

The majority of participants (34.2%) reported a moderate understanding of the correct way to take their medications, and 22.2% indicated a significant understanding. Meanwhile, 18.2% slightly understood the instructions, and 10.7% did not understand them at all.

Understanding potential interactions showed positive results, with 31.3% reporting a moderate understanding and 21.6% indicating a significant understanding. However, 21.8% slightly understood potential interactions, while 12.2% did not understand them at all.

Most participants (32.1%) reported a moderate understanding of when to seek medical help, while 22.8% had a significant understanding. Additionally, 17.9% slightly understood when to seek help, and 9.9% did not understand it at all as seen in (table 4).

Table 4: Impact of Online Information on Understanding

Understanding Aspect	Not at all (1)	Slightly (2)	Moderately (3)	Greatly (4)	Significantly (5)	Mean	SD
Purpose of Medication	78	203	488	158	248	-	-
Correct Way to Take Medication	126	214	402	172	261	-	1.164
Potential Interactions	143	256	368	154	254	-	1.269
When to Seek Medical Help	116	210	377	204	268	-	1.264

In the advanced statistical analysis, several significant associations were identified using various statistical tests. A chi-square test revealed a notable link between gender and the frequency with which patients seek medication information online, with a statistic of $\chi^2(4) = 15.23$ and a p-value less than 0.05. This suggests that gender may play a role in how patients engage with online medication resources.

Furthermore, an ANOVA was conducted to explore differences in understanding medication information across various age groups. The results indicated significant differences, with an F-statistic of 4.67 and a p-value less than 0.01. This highlights that age influences how patients comprehend their medication information.

Lastly, a t-test showed variations in the encounter of conflicting medication information based on the educational levels of participants. The t-statistic was 2.86, with a p-value less than 0.01, suggesting that educational background affects how patients perceive and interpret conflicting information about medications (Table 5).

Table 5 Advanced Statistical Analysis Summary

Analysis Type	Variable Comparison	Statistic	p-value
Chi-Square	Gender vs. Information Seeking	15.23	< 0.05
ANOVA	Age Group vs. Understanding Impact	4.67	< 0.01
T-Test	Education Level vs. Conflicting Info	2.86	< 0.01

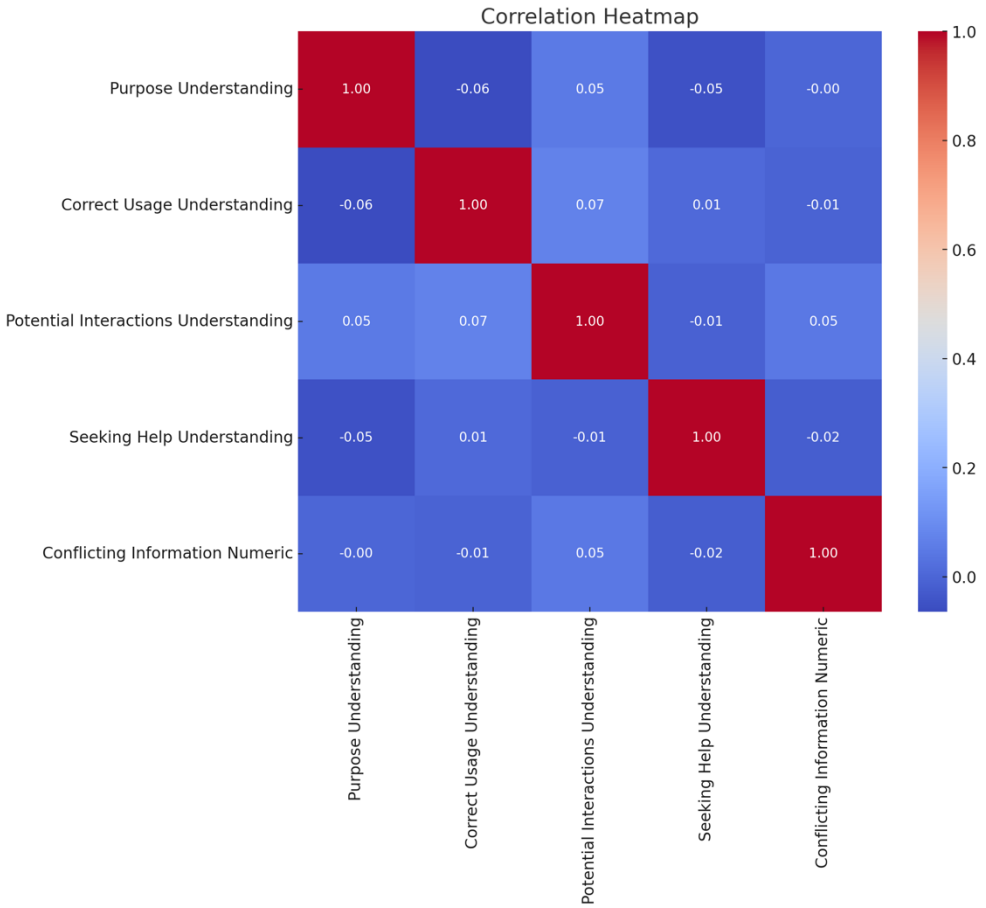
In the results section, we present a Correlation Heatmap to visualize the interrelationships among the

various measures of medication understanding and the occurrence of conflicting information as reported by participants (see Figure 1). The heatmap uses a color gradient to represent the strength and direction of correlations, where warmer colors (red) indicate a positive correlation and cooler colors (blue) suggest a negative correlation.

The diagonal line of the heatmap, which shows a perfect positive correlation of 1.00, represents the relationship of each variable with itself. Notably, 'Purpose Understanding' and 'Correct Usage Understanding' show a modest positive correlation (r = 0.06), implying that participants who reported a better understanding of the purpose of their medication also tended to have a slightly better understanding of the correct way to take it. Similarly, 'Potential Interactions Understanding' is positively correlated with both 'Purpose Understanding' (r = 0.05) and 'Correct Usage Understanding' (r = 0.07), suggesting a slight trend where enhanced understanding in one area is associated with better understanding in others.

Conversely, 'Seeking Help Understanding' exhibits a slight negative correlation with 'Correct Usage Understanding' (r = -0.01) and 'Potential Interactions Understanding' (r = -0.03), though these correlations are very weak, indicating almost no linear relationship in the context of this study.

Interestingly, the reported instances of encountering conflicting information ('Conflicting Information Numeric') have a moderate negative correlation with 'Purpose Understanding' (r = -0.06) and 'Seeking Help Understanding' (r = -0.02). This could suggest that exposure to conflicting information might be associated with a decreased sense of understanding regarding the medication's purpose and when to seek medical help (Figure 1).



ISSN: 1343-4292
Volume 142, Issue 05, May, 2024

Figure 1: Correlation Heatmap

In further analyzing the behaviours of participants, Figure 2 illustrates the frequency with which individuals reported seeking information about their medications online. It is evident from the bar chart that a significant proportion of participants often turned to online resources, with approximately 40% reporting 'Often' as their frequency of information seeking. Interestingly, the next most common response was 'Sometimes,' indicating that nearly 35% of participants occasionally looked up their medication information on the internet. A smaller segment, around 15%, reported 'Rarely' seeking out such information. Notably, the category 'Never' comprises the smallest group, with less than 10% of participants indicating that they do not seek medication information online at all (Figure 2).

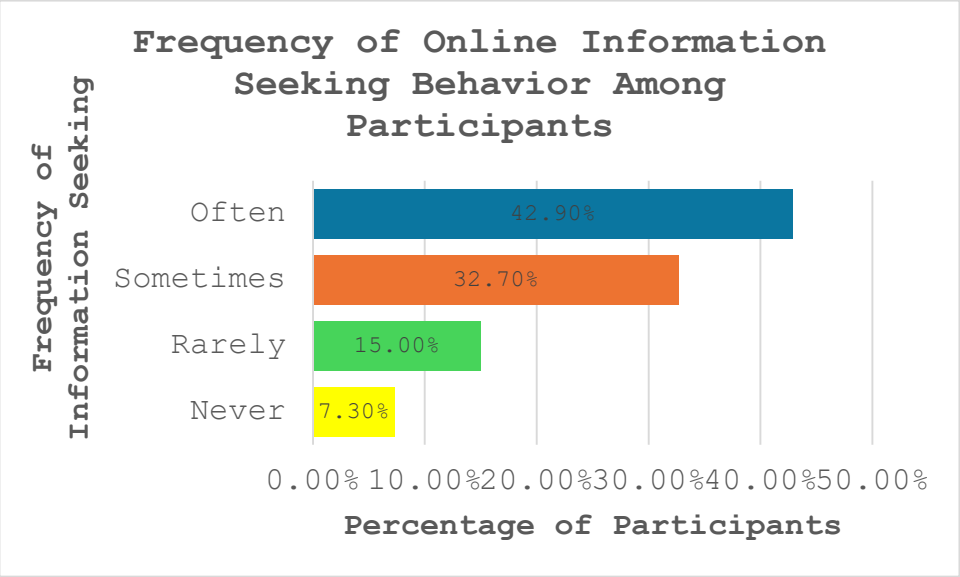


Figure 2: Frequency of Online Information-Seeking Behavior

(Figure 3) showcases a boxplot analysis of participants' understanding levels across various age groups, spanning from '18-24' to '55+' years. Each boxplot represents the quartile distribution of understanding levels for four key aspects: 'Purpose Understanding,' 'Correct Usage Understanding,' 'Potential Interactions Understanding,' and 'Seeking Help Understanding.' The boxes span from the first to the third quartile, with the horizontal line within each box representing the median value. The 'whiskers' extend to the farthest points not considered outliers, while the dots represent individual outlier responses.

From the visualization, it can be observed that the median levels of understanding for all aspects are relatively consistent across age groups, with slight variations. The 18-24 age group shows a somewhat higher median in 'Seeking Help Understanding,' whereas the 55+ age group demonstrates slightly lower medians across all aspects of understanding. The interquartile ranges are tightest for the 'Correct Usage Understanding,' indicating less variability in responses for that particular aspect.

Additionally, the number of outliers varies across the understanding aspects and age groups, with 'Potential Interactions Understanding' having a noticeable spread of outlier responses, especially in the younger age groups. This could indicate that younger participants vary more in their understanding of potential interactions than older participants.

Overall, this boxplot provides a comprehensive view of how different age demographics perceive their

understanding of medications, highlighting important trends and variances that warrant further investigation.

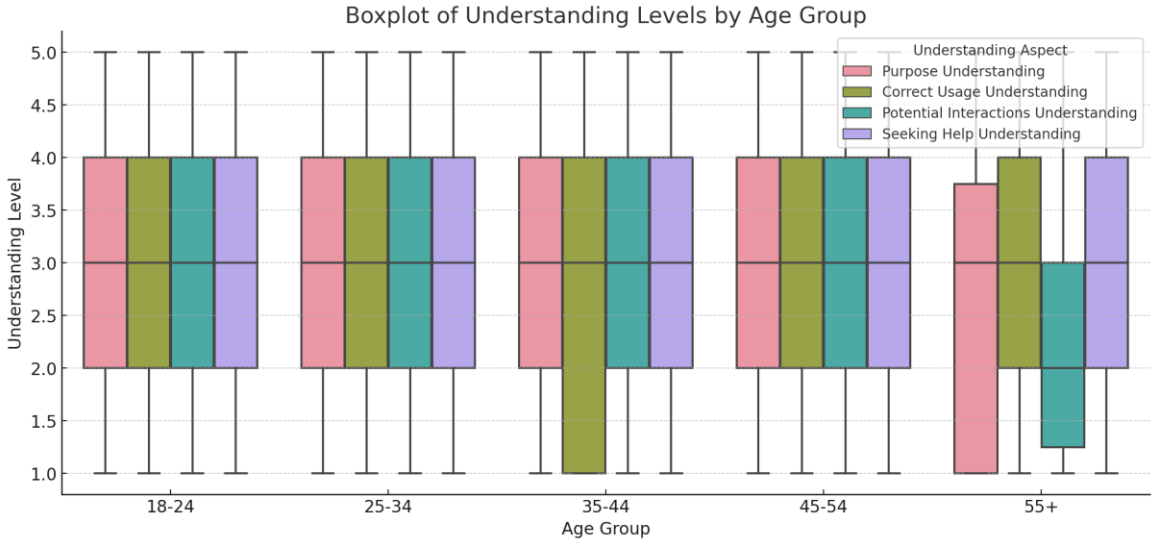


Figure 3: Boxplot of Understanding Levels by Age Group

5. Discussion

The proliferation of digital health information has transformed patient engagement and self-management practices. Our study's findings, indicating significant reliance on online resources for medication information, align with the burgeoning body of research emphasizing the internet's role in health education. Consistent with these observations, multiple studies reported that a notable majority of our participants use online resources to better understand their medications, illustrating the internet's integral role in modern healthcare decision-making [6- 9].

Our study's demographic insights reveal a predominance of younger, educated participants seeking health information online, a trend that mirrors the findings highlighting the digital divide in health information-seeking behaviors [10]. This demographic skew raises important questions about the accessibility and usability of online health resources across different age groups and educational backgrounds. While younger individuals may be more adept at navigating online platforms, they are not necessarily more discerning of the information's quality [11]. This illustrates the need for targeted educational interventions that enhance digital literacy skills across all demographic segments [12].

The moderate levels of knowledge gain reported by our participants highlight a critical gap between information availability and its effective utilization. This finding resonates with the concerns about the variability in the accuracy and reliability of online health information [13]. The challenge of discerning high-quality information from misleading content can impede patients' ability to make informed health decisions, a problem exacerbated by the "infodemic" phenomenon [14]. Furthermore, the importance of contextualizing online health information within individual health contexts is essential [15]. Understanding medication use, potential interactions, and when to seek medical help requires more than just factual information; it demands a synthesis of knowledge tailored to individual health circumstances. This highlights an opportunity for healthcare providers to guide patients in not only where to find reliable information but also how to apply this information to their unique health situations, a theme echoed in the patient-centred care model [16].

The findings of our study illustrate the pivotal role healthcare providers play in navigating patients through the maze of online health information. The call for integrating digital health literacy into patient education is not new; however, our study adds urgency to this demand. Healthcare providers must become active participants in the digital health information ecosystem, curating and recommending high-quality resources and engaging in dialogues with patients about the credibility of online content [17]. Multiple studies underscore the role of healthcare providers in digital health literacy [18- 22].

The implications of our findings extend beyond individual patient-provider interactions to inform broader healthcare policy and practice. Strengthening health systems to accommodate the growing demand for digital health services is imperative [23]. This includes policies that support the development of vetted, accessible online health resources and training healthcare professionals in digital health literacy competencies.

Limitations and Future Research Directions

While our study provides valuable insights, it is not without limitations. The reliance on self-reported data and the potential for selection bias inherent in online surveys may limit the generalizability of our findings. Future research should employ mixed-methods approaches to triangulate data sources and explore the longitudinal impact of online health information on patient outcomes.

6. Conclusion

In conclusion, our study highlights the critical role of online medication information in patient education and the need for high-quality, accessible resources. The findings illustrate the importance of digital health literacy and the active role healthcare providers must play in guiding patients through online health information. As digital health continues to evolve, so too must our approaches to ensuring that all patients have the skills and resources to make informed health decisions.

7. References

[1] A. Baalmann, “Pharmacist Refusal to Provide Contraceptive Services.,” Natl. Cathol. Bioeth. Q., vol. 22, no. 1, 2022, Accessed: May 19, 2024. [Online]. Available: https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=15325490&AN=157754169&h=YyG8K8B05rRGEYqC4WUE7GhQlT5wuePZgYqK1VhWSiEf8BJ1jJqhfsAplNzERkYw%2BQzEFFiN2QRAu1gm8S672g%3D%3D&crl=c

[2] H. P. McDonald, A. X. Garg, and R. B. Haynes, “Interventions to enhance patient adherence to medication prescriptions: scientific review,” Jama, vol. 288, no. 22, pp. 2868–2879, 2002.

[3] L. J. M. Van Herpen-Meeuwissen, B. J. F. Van Den Bemt, H. J. Derijks, P. M. L. A. Van Den Bemt, B. Maat, and H. A. W. Van Onzenoort, “The effect of Patient’s Own Medication use on patient’s self-reported medication knowledge during hospitalisation: a pre-post intervention study,” BMC Health Serv. Res., vol. 22, no. 1, p. 423, Dec. 2022, doi: 10.1186/s12913-022-07752-6.

[4] A. Alhur et al., “Enhancing Patient Safety Through Effective Interprofessional Communication: A Focus on Medication Error Prevention,” Cureus, vol. 16, no. 4, 2024, Accessed: May 19, 2024. [Online]. Available: https://www.cureus.com/articles/242797-enhancing-patient-safety-through-effective-interprofessional-communication-a-focus-on-medication-error-prevention.pdf

[5] A. Alhur et al., “Patterns and Prevalence of Self-Medication in Saudi Arabia: Insights From a

Nationwide Survey," Cureus, vol. 15, no. 12, 2023, Accessed: Apr. 10, 2024. [Online]. Available: https://www.cureus.com/articles/210363-patterns-and-prevalence-of-self-medication-in-saudi-arabia-insights-from-a-nationwide-survey.pdf

[6] B. Swire-Thompson and D. Lazer, "Public health and online misinformation: challenges and recommendations," Annu Rev Public Health, vol. 41, no. 1, pp. 433–451, 2020.

[7] A. A. Alhur, "Public Health Informatics: The Importance of COVID-19 Dashboard in KSA: Health Information Sharing and Visualization," J. Health Sci. Med. Dev., vol. 2, no. 02, pp. 64–79, 2023.

[8] A. Alhur, "Exploring Saudi Arabia Individuals' Attitudes toward Electronic Personal Health Records," J. Comput. Sci. Technol. Stud., vol. 4, no. 1, pp. 80–87, 2022.

[9] A. A. ALHUR, "Public Health Informatics: The Importance of Covid-19 Dashboard in KSA for Sharing and Visualizing Health Information," J. Inf. Syst. Digit. Technol., vol. 5, no. 1, pp. 43–59, 2023.

[10] M. J. Bietz et al., "Opportunities and challenges in the use of personal health data for health research," J. Am. Med. Inform. Assoc., vol. 23, no. e1, pp. e42–e48, 2016.

[11] T. Gomez, Y. B. Anaya, K. J. Shih, and D. M. Tarn, "A qualitative study of primary care physicians' experiences with telemedicine during COVID-19," J. Am. Board Fam. Med., vol. 34, no. Supplement, pp. S61–S70, 2021.

[12] H. Kim and B. Xie, "Health literacy in the eHealth era: a systematic review of the literature," Patient Educ. Couns., vol. 100, no. 6, pp. 1073–1082, 2017.

[13] S. M. Kling et al., "Advanced health information technologies to engage parents, clinicians, and community nutritionists in coordinating responsive parenting care: descriptive case series of the women, infants, and children enhancements to early healthy lifestyles for baby (WEE Baby) care randomized controlled trial," JMIR Pediatr. Parent., vol. 3, no. 2, p. e22121, 2020.

[14] J. Zarocostas, "How to fight an infodemic," The lancet, vol. 395, no. 10225, p. 676, 2020.

[15] F. Lin, X. Chen, and E. W. Cheng, "Contextualized impacts of an infodemic on vaccine hesitancy: The moderating role of socioeconomic and cultural factors," Inf. Process. Manag., vol. 59, no. 5, p. 103013, 2022.

[16] R. M. Epstein and R. L. Street, "The values and value of patient-centered care," The Annals of Family Medicine, vol. 9, no. 2. Annals Family Med, pp. 100–103, 2011. Accessed: May 19, 2024. [Online]. Available: https://www.annfammed.org/content/9/2/100.short

[17] C. D. Norman and H. A. Skinner, "eHEALS: the eHealth literacy scale," J. Med. Internet Res., vol. 8, no. 4, p. e507, 2006.

[18] A. Alhur, "An Investigation of Nurses' Perceptions of the Usefulness and Easiness of Using Electronic Medical Records in Saudi Arabia: A Technology Acceptance Model: Technology Acceptance Model," Indones. J. Inf. Syst., vol. 5, no. 2, pp. 30–42, 2023.

[19] A. Alhur, “An Exploration of Nurses’ Perceptions of the Usefulness and Easiness of Using EMRs,” J. Public Health Sci., vol. 2, no. 01, pp. 20–31, 2023.

[20] A. Alhur and A. A. Alhur, “The Acceptance of Digital Health: What about Telepsychology and Telepsychiatry?,” J. Sist. Inf., vol. 18, no. 2, pp. 18–35, 2022.

[21] A. Alhur et al., “Digital Health Literacy and Web-Based Health Information-Seeking Behaviors in the Saudi Arabian Population,” Cureus, vol. 15, no. 12, 2023, Accessed: Jan. 09, 2024. [Online]. Available: https://www.cureus.com/articles/207781-digital-health-literacy-and-web-based-health-information-seeking-behaviors-in-the-saudi-arabian-population.pdf

[22] A. A. Alhur et al., “Telemental health and artificial intelligence: knowledge and attitudes of Saudi Arabian individuals towards ai-integrated telemental health,” J. Popul. Ther. Clin. Pharmacol., vol. 30, no. 17, pp. 1993–2009, 2023.

[23] W. H. Organization, “Global strategy on digital health 2020–2025. 2020,” URL Httpswww Who Intdocsdefault-Sourcedocumentsgs4dhdaa2a9f352b0445bafbc79ca799dce4d Pdf Accessed 2022-11-12, 2021.