# Trend in Drug Information Resources (DIR) on Using Online Medical Databases or Hardcopy References Among Ministry of Health Prescribers and Pharmacists: A Single District Study

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**Abstract**

**Introduction**: As access to drug information resources (DIR) expands for prescribers, concerns have grown regarding the reliability of information used to support safe and appropriate treatment decisions in patient care.

**Objective**: To evaluate the utilisation patterns, preferences, and factors influencing the use of DIR, including online and hardcopy references, among Ministry of Health (MOH) prescribers and pharmacists.

**Methods**: A cross-sectional study using a validated questionnaire was conducted among MOH prescribers and pharmacists in Tangkak District in April 2023. Data were analysed using SPSS version 22, with descriptive statistics presented as frequencies and percentages.

**Results**: Of the 114 respondents, the highest proportions were male (56.1%) and medical officers (36.8%). A substantial proportion (35.1%) had five or fewer years of work experience. Across all respondents, mobile applications and online medical databases were the most preferred sources of DIR due to their accessibility (82.5%), immediacy (68.4%), and cost-free nature (57.0%), followed by pharmacist consultation (among prescribers) and hardcopy references. The most commonly used digital resources were My Blue Book (53.5%), National Antibiotic Guidelines (NAG) (47.4%), and Medscape (34.2%). Among hardcopy references, the most frequently used were Clinical Practice Guidelines (CPGs) (44.7%), Frank Shann Drug Doses (31.6%), and MIMS Drug Reference (18.4%). Regarding willingness to pay for drug references, a higher proportion of respondents were willing to pay for hardcopy references (79.8%) compared with softcopy (64.9%).

**Conclusion**: This study revealed a shift towards digital DIR, while highlighting the continued value of hardcopy references for in-depth learning and clinical practice. Findings also emphasised the need for accessible, up-to-date, and freely available resources. Further research across diverse districts and healthcare levels is warranted to validate these findings and inform national strategies for digital resource provision.

**Keywords:** Drug information resources, prescribers, pharmacist, online medical database, hardcopy references

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## Introduction

In view of the rapid expansion of pharmaceutical markets, coupled with increasing therapeutic complexity and a growing emphasis on evidence-based patient care, access to accurate, current, and reliable drug information is essential for healthcare professionals to support safe, effective, and rational use of medicines (1-4). Prescribers and pharmacists frequently require drug information to make clinical decisions, including those related to drug selection, dosing, contraindications, drug interactions,

adverse drug reactions, and appropriate use in specific patient populations (2-3). The availability and accessibility of reliable drug information resources therefore play an important role, particularly when errors such as incorrect dosage, route or frequency, and polypharmacy can result in adverse drug events such as drug toxicity, drug–drug interactions, hospitalisation, morbidity, and mortality (4-5).

Traditionally, drug information has been obtained from hardcopy references such as pharmacopoeias, drug formularies, textbooks, treatment guidelines, and drug information manuals. Although these resources remain important, advances in information technology have substantially changed the way healthcare professionals access and retrieve drug-related information. The proliferation of health-related mobile applications illustrates the scale of this expansion, with more than 318,000 applications reported to be available as of March 2020 and approximately 200 new applications being introduced daily (6). Online medical databases and electronic resources now provide rapid access to a large volume of information and can offer advantages such as ease of searching, frequent updating, portability, and access to multiple sources through a single platform. Consequently, electronic resources have increasingly become integrated into clinical practice and may influence healthcare professionals' preferences and patterns of drug information-seeking behaviour.

Nevertheless, the choice of drug information resource (DIR) may vary according to professional role, clinical needs, familiarity with available resources, accessibility, and confidence in the reliability of the information obtained. While online resources may provide greater convenience and speed, hardcopy references continue to have a role in healthcare settings, particularly where established institutional references and printed guidelines are routinely used. Understanding how healthcare professionals use and perceive these different resources is therefore important for ensuring that appropriate and reliable drug information is readily available to support clinical decision-making.

Within Ministry of Health (MOH) healthcare facilities, prescribers and pharmacists are key users of drug information in the provision of patient care. However, there is limited local evidence on the utilisation patterns and preferences for different DIR among these healthcare professionals, particularly at the district level. Understanding the factors that influence the selection and use of different DIR, as well as their utilisation patterns, may provide insights into evolving drug information-seeking practices and identify potential gaps in access, training, or institutional support. Therefore, this study aimed to evaluate the utilisation patterns, preferences, and factors influencing the use of DIR, including online and hardcopy references, among MOH prescribers and pharmacists.

## Method

*Study design*

A cross-sectional study was conducted from early- to mid-April 2023 using a validated questionnaire. The facilities involved were Hospital Tangkak, Payamas Health Clinic, Sagil Health Clinic, Sungai Mati Health Clinic, Bukit Gambir Health Clinic, Bukit Serampang Health Clinic and Gersik Health Clinic. Ethical approval was obtained from the National Medical Research and Ethics Committee (MREC) via the National Medical Research Registry (NMRR ID-22-02304-YLX (IIR)) before the commencement of research.

*Study population*

The sample size was calculated using a single-proportion sample size formula with finite population correction (7). During the study development phase, the total population size was identified as 156, encompassing all pharmacists, medical officers and medical assistants stationed across the Tangkak District Health Office and Hospital Tangkak. Assuming a 95% confidence level (Z=1.96), a 5% margin of error (d=0.05), a finite population of 156, and an estimated proportion of 74%, the minimum required sample size was calculated to be 93 participants. The estimated proportion of 74% was based on a published study reporting that online sources of drug information were preferred by 74% of physicians (8).

This study utilised convenience sampling which involved all MOH prescribers, medical assistants, and pharmacists who were involved in prescribing medications at the time of data collection in Tangkak District. Medical assistants were included and categorised as prescribers in this study to

provide a comprehensive view of drug information–seeking practices in the Tangkak district. Medical assistants are authorised to prescribe a restricted range of medications, primarily Group C poisons under the Poisons Act 1952 and existing MOH clinical administrative circulars (9). This authorisation supports healthcare delivery by alleviating physicians' prescribing burden, improving patient flow, and reducing delays in care, particularly in health clinics and understaffed facilities. Healthcare personnel who refused to take part in this survey were excluded from the start.

*Study instrument*

The questionnaire was adapted from a previously validated survey developed by Pui et al., with permission obtained from the original author (10). Several study-specific modifications were made to ensure its relevance to the local context. Specifically, pharmacists were added as a professional category in the demographic section and as a consultation option for prescribers in the resource preference section. In addition, the multiple-choice options for commonly used reference sources in Sections 3 and 4 were revised to reflect resources commonly used in local district healthcare settings. These included My Blue Book, the National Antibiotic Guidelines (NAG), and Frank Shann Drug Doses.

The adapted questionnaire was subsequently revalidated for content and face validity by a panel of fifteen experts working in MOH facilities, comprising three medical officers, five medical assistants, and seven pharmacists. Internal consistency reliability testing was not conducted, as the survey primarily comprised categorical and multiple-choice items designed to identify specific resource preferences rather than Likert-scale items intended for psychometric construct measurement. A pilot study was conducted and no modifications to the study protocol or data collection instrument were deemed necessary. Therefore, data collected during the pilot study were included in the final analysis.

Generally, the questionnaire was divided into four sections. Section 1 collected the demographic information of respondents, while Section 2 explored their preferences and the factors influencing their choice of DIR. Sections 3 and 4 assessed the frequency of use and subscription status of online medical databases/mobile applications and hardcopy references, respectively. The latter two sections also examined the willingness to pay for subscriptions among the respondents and their preferences for institutional subscriptions (online DIR only). Sections 1 and 2 consisted of multiple-choice questions, while open-ended questions were included in sections 3 and 4 according to the data requirements. Since all subjects involved were healthcare professionals, the questionnaire was designed in the English language only.

*Data collection and analysis*

The final questionnaire was printed in hardcopy and distributed to participating facilities by the respective investigators, who visited each site and provided it directly to eligible healthcare professionals. Upon providing consent, respondents completed and immediately returned the questionnaire, which took approximately 10–15 minutes.

All data were entered into a password-protected computer for further analysis, with access restricted to the research investigators only. The raw data was retained for two years before being securely disposed of in accordance with relevant guidelines. No personal information was disclosed during communication between the relevant departments.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 22. Descriptive analysis was used to present the results of this study. Numerical data were presented in mean (standard deviation, SD) or median (interquartile range, IQR). Categorical data were presented as frequency and percentage.

## Results

Of the 154 eligible healthcare personnel approached, 114 agreed to participate and completed the questionnaire, resulting in a response rate of 74.0%. Among the 114 respondents, the highest proportions were male (n=64, 56.1%), while medical officers constituted the largest professional group (n=42, 36.8%), with an average age of 34.0 years (SD ± 6.0). The distribution of work experience was skewed toward early-career practitioners. Although no single group constituted a majority, those with

ten years or less of experience comprised the largest proportion (68.4%), including 35.1% with five years or less of experience (Table 1). Accessibility (n=94; 82.5%) was the most influential factor in respondents' preferences for DIR, followed by urgency (n=78; 68.4%) and free access (n=65; 57.0%), as shown in Table 2. The three most preferred resources were consistent across all types of drug-related information. Online medical databases and mobile applications (apps) ranked highest, followed by pharmacist consultation (among prescribers) and hardcopy references, as shown in Table 3.

Table 1: Demographic characteristics of respondents (n=114)

| Characteristics | n (%) |
|---|---|
| Gender | |
| Male | 64 (56.1) |
| Female | 50 (43.9) |
| Age group (year) | |
| 18-30 | 42 (36.8) |
| 31-45 | 67 (58.8) |
| 46-60 | 5 (4.4) |
| Profession | |
| Specialist / Medical officer | 42 (36.8) |
| Medical assistant | 41 (36.0) |
| Pharmacist | 31 (27.2) |
| Working Experience | |
| 0-5 | 40 (35.1) |
| 6-10 | 38 (33.3) |
| 11-20 | 31 (27.2) |
| >21 | 5 (4.4) |

Table 2: Factors affecting choices for drug information used (n=114)

| Factors [a] | n (%) |
|---|---|
| Accessibility | 94 (82.5) |
| Urgency | 78 (68.4) |
| Free subscription | 65 (57.0) |
| Comprehensiveness | 56 (49.1) |
| Type of drug-related information | 49 (43.0) |
| Type of pharmacotherapy | 27 (23.7) |

[a]Multiple responses were allowed

Table 3: DIR used by prescribers and pharmacists by type of drug-related information

| Types of drug-related information | Types of DIR used[a] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Online medical databases/mobile apps | Hardcopy references | Pharmacist consultation[b] | Consult colleague/senior | Product information leaflet | Journal | Non-medical website |
| Dose regime | **104 (91.2)** | 75 (65.8) | 67 (80.7) | 43 (37.7) | 46 (40.4) | 5 (4.4) | **2 (1.8)** |
| Renal/Hepatic adjustment | **95 (83.3)** | 75 (65.8) | 67 (80.7) | 44 (38.6) | 44 (38.6) | 10 (8.8) | **7 (6.1)** |
| Pregnancy/Lactation | **97 (85.1)** | 69 (60.5) | 65 (78.3) | 47 (41.2) | 50 (43.9) | **6 (5.3)** | 7 (6.1) |
| Drug interactions | **98 (86.0)** | 70 (61.4) | 63 (75.9) | 42 (36.8) | 50 (43.9) | 10 (8.8) | **8 (7.0)** |
| Drug availability | **95 (83.3)** | 71 (62.3) | 69 (83.1) | 61 (53.5) | 32 (28.1) | **1 (0.9)** | 8 (7.0) |
| Therapeutic drug monitoring | **97 (85.1)** | 69 (60.5) | 69 (83.1) | 56 (49.1) | 40 (35.1) | 7 (6.1) | **6 (5.3)** |
| Side effects & Contraindications | **102 (89.5)** | 66 (57.9) | 59 (71.1) | 41 (36.0) | 54 (47.4) | **8 (7.0)** | 13 (11.4) |
| Drug administration | **96 (84.2)** | 68 (59.6) | 65 (78.3) | 50 (43.9) | 52 (45.6) | 7 (6.1) | **4 (3.5)** |
| Compatibility | **104 (91.2)** | 57 (50.0) | 67 (80.7) | 46 (40.4) | 47 (41.2) | 12 (10.5) | **10 (8.8)** |
| Pharmacotherapy choices | **104 (91.2)** | 71 (62.3) | 67 (80.7) | 49 (43.0) | 34 (29.8) | 13 (11.4) | **7 (6.1)** |

[a] Multiple responses were allowed with a maximum of three options. Percentages were calculated based on the total number of eligible respondents for each category (n=114 for all resources, except n=83 for pharmacist consultation).
[b] For prescribers only (Denominator: n=83).
Abbreviation: DIR = Drug information resources; apps = applications

The most frequently used online medical databases and mobile apps were My Blue Book (n=61; 53.5%), National Antibiotic Guidelines (NAG) (n=54; 47.4%) and Medscape (n=39; 34.2%) (Table 4). Only eleven respondents (9.7%) reported subscribing to paid online or mobile resources, all of whom were subscribed to UpToDate. A total of 79 respondents (69.3%) expressed a desire for their hospital or MOH to provide institutional subscriptions to online databases to improve accessibility. Among these, UpToDate was the most requested resource (n=39; 49.4%), cited for its comprehensiveness and frequent updates. Other requested platforms included MIMS Malaysia (n=26; 32.9%), My Blue Book (n=4; 5.1%), Lexicomp (n=3; 3.8%), and Medscape (n=2; 2.5%). Single requests (n=1; 1.3% each) were also made for PubMed, NAG, and the MySejahtera application.

For hardcopy references, Clinical Practice Guidelines (CPGs) (n=51; 44.7%), Frank Shann Drug Doses (n=36; 31.6%) and MIMS Drug Reference (n=21; 18.4%) were the most frequently used (Table 4). Fifteen respondents (13.2%) reported personally purchasing hardcopy materials, with Frank Shann Drug Doses being the most commonly acquired across all three professions (n=8; 53.3%). The remaining respondents purchased a range of less commonly used clinical texts, with the Sarawak Handbook of Medical Emergencies and the Oxford Handbook of Clinical Medicine accounting for two each, while the British National Formulary (BNF), John Murtagh's General Practice, and 200 Single Best Answer Questions in Family Medicine (SBAQ) accounted for one each. Generally, more respondents (n= 91; 79.8%) were willing to pay for hardcopy references compared to softcopy references (n=74; 64.9%) as shown in Table 5.

Table 4: Frequency of use for online and hardcopy DIR (n=114)

| Types of DIR | Frequency of use | | | |
|---|---|---|---|---|
| | Never | Rarely | Sometimes | Always |
| *Online medical databases/mobile apps* | | | | |
| My Blue Book | 14 (12.3) | 18 (15.8) | 21 (18.4) | 61 (53.5) |
| NAG | 30 (26.3) | 13 (11.4) | 17 (14.9) | 54 (47.4) |
| Medscape | 17 (14.9) | 27 (23.7) | 31 (27.2) | 39 (34.2) |
| MIMS Malaysia | 10 (8.8) | 26 (22.8) | 40 (35.1) | 38 (33.3) |
| UpToDate | 36 (31.6) | 25 (21.9) | 30 (26.3) | 23 (20.2) |
| Micromedex | 63 (55.3) | 22 (19.3) | 15 (13.2) | 14 (12.3) |
| Lexicomp | 69 (60.5) | 26 (22.8) | 11 (9.6) | 8 (7.0) |
| Sanford Guide to Antimicrobial Therapy | 71 (62.3) | 23 (20.2) | 15 (13.2) | 5 (4.4) |
| *Hardcopy references* | | | | |
| CPGs | 5 (4.4) | 15 (13.2) | 43 (37.7) | 51 (44.7) |
| Frank Shann Drug Doses | 19 (16.7) | 18 (15.8) | 41 (36.0) | 36 (31.6) |
| MIMS Drug Reference | 23 (20.2) | 28 (24.6) | 42 (36.8) | 21 (18.4) |
| Oxford Handbook of Clinical Medicine | 51 (44.7) | 29 (25.4) | 28 (24.6) | 6 (5.3) |
| BNF | 57 (50.0) | 33 (28.9) | 20 (17.5) | 4 (3.5) |
| CURRENT Medical Diagnosis and Treatment | 57 (50.0) | 26 (22.8) | 28 (24.6) | 3 (2.6) |

Abbreviation: DIR = Drug information resources; apps = applications; NAG = National Antibiotic Guidelines; CPGs = Clinical Practice Guidelines; BNF = British National Formulary

Table 5: Willingness to pay for DIR among respondents (n=114)

| Responses | Number of respondents, n (%) | | | Total, n (%) |
|---|---|---|---|---|
| | Medical officer | Medical assistant | Pharmacist | |
| Online references | | | | |
| Yes | 28 (66.7) | 20 (48.8) | 26 (83.9) | 74 (64.9) |
| No | 14 (33.3) | 21 (51.2) | 5 (16.1) | 40 (35.1) |
| Hardcopy references | | | | |
| Yes | 34 (81.0) | 31 (75.6) | 26 (83.9) | 91 (79.8) |
| No | 8 (19.0) | 10 (24.4) | 5 (16.1) | 23 (20.2) |

## Discussion

This study found a clear preference for online medical databases and mobile apps among prescribers and pharmacists in the Tangkak district across all types of drug-related inquiries. By including both prescribers and pharmacists, the present study demonstrates that this shift towards digital resources extends across multiple professional groups. Resources such as My Blue Book (53.5%), NAG (47.4%), and Medscape (34.2%) were the most frequently used digital tools. This shift towards digital platforms for their comprehensiveness and efficiency is a central theme in modern medical practice and reflects the trends observed in both local and international literature. A study conducted in Sabah involving only prescribers in a tertiary care setting similarly identified Medscape and MIMS as among the most commonly used DIR (9). Internationally, a multicentre study in the United Arab Emirates (UAE) also highlighted a similar transition from traditional textbooks to online platforms, reflecting a universal demand for point-of-care tools that enable rapid access to comprehensive medical information to support decision-making in high-pressure clinical settings (11). Notably, when accounting for eligible respondents, pharmacist consultation emerged as a highly preferred resource among prescribers (ranging from 71.1% to 83.1% across various drug inquiries), underscoring the vital collaborative role of pharmacists in clinical decision-making at the district level.

Reliable drug information is essential for appropriate medication use and the prevention of medication errors that may lead to adverse drug events. In the context of a district healthcare setting, where practitioners often face heavy workloads, limited specialist support, and resource constraints, the ability to make quick and informed clinical decisions is paramount. The strong preference for digital resources reflects this need, as such platforms enable rapid and convenient access to up-to-date information. This is further supported by the key factors influencing the choice of DIR, where accessibility (82.5%) and urgency (68.4%) ranked highest, followed by the availability of free access (57.0%).

In Malaysia, locally-adapted guidelines (online and hardcopy) are more often used than international references. The study by Hisham et al. reported that rural doctors in Pahang relied primarily on CPGs as a source of information for patient management as they perceived these recommendations to be grounded in rigorously appraised evidence by MOH and therefore should be adhered to (12). Similarly, My Blue Book facilitates medicine prescribing by ensuring adherence to MOH formulary restrictions, while the NAG provides a clear framework for the rational use of antimicrobials to strengthen national antibiotic stewardship (13-14). This pattern of DIR utilisation differs from that reported internationally such as the UAE cohort that demonstrated a high reliance on international databases. Overall, these findings suggest that DIR utilisation in Malaysia is strongly shaped by the availability and relevance of locally developed, MOH-endorsed resources to ensure clinical relevance within the national healthcare framework.

However, an increased reliance on digital platforms also introduces potential risks such as information inconsistency, information overload, and concerns regarding the quality and reliability of these platforms (15). In fact, many physicians now face challenges in the process of searching information online due to the overwhelming volume of available data, the time required to scan large amounts of information, and the lack of specificity in the results provided (16). These concerns are closely linked to the study's next key finding, which has clear institutional implications. A substantial proportion of respondents (69.3%) expressed a desire for MOH or their institutions to provide free subscriptions to premium online databases, particularly UpToDate. This preference is likely driven by its provision of synthesised, physician-authored, and graded evidence-based recommendations that are specifically optimised for rapid clinical decision-making at the point of care (17). This breadth of information within a single platform is particularly valuable to prescribers when multiple aspects of drug therapy must be considered simultaneously.

Institutional subscriptions to vetted, evidence-based DIR, including clinical decision support tools and peer-reviewed databases, are essential for ensuring consistent access to reliable, up-to-date clinical knowledge. However, cost remains a significant barrier, particularly for smaller or rural healthcare facilities potentially contributing to disparities in database access between well-resourced urban centres and lower-resourced settings (17). Therefore, institutional licensing is a critical strategy to ensure equitable access to high-quality resources across all facilities, thereby narrowing the "digital divide" (18). In addition, centralising access through institutionally licensed, vendor-regulated platforms with rigorous editorial oversight can reduce reliance on unverified sources, promotes standardised

clinical practice, and may help mitigate information overload by directing healthcare professionals toward designated trusted resources. Collectively, these findings support the development of a national guidance framework to curate and provide standardised, evidence-based DIR to all healthcare practitioners. Such a digital health strategy could improve equitable access to reliable information, reduce the risks associated with unverified sources, and should be complemented by training programmes that strengthen digital literacy and critical appraisal skills for evaluating online health information (19-20).

Despite the strong demand for institutional support, our findings also reveal gaps in the awareness of existing resources among practitioners. For example, although MIMS Malaysia was the second most requested subscription (32.9%), it is already centrally provided by MOH and accessible to government healthcare staffs (21). Similarly, subscription to NAG and My Blue Book were still requested, despite them being provided as free-access resources without additional institutional funding. These findings suggest that perceived accessibility issues may stem from limited awareness or inadequate dissemination rather than actual lack of provision. The inclusion of MySejahtera (1.3%) as a desired drug information resource further indicates possible misunderstanding of its primary role as a public health management tool rather than a clinical reference. These discrepancies highlight the need for improved communication and structured digital literacy initiatives to ensure healthcare professionals are aware of and able to effectively utilise the full range of existing resources available to them.

A unique and paradoxical finding of this study was the expressed willingness of respondents to pay for access to DIR. Despite a clear preference for free softcopy resources in daily practice, a significantly higher percentage of respondents were willing to pay for hardcopy references (79.8%) compared to softcopy subscriptions (64.9%). This trend aligns with previous studies suggesting that while digital tools are favoured for rapid screening, physical books are still highly valued for more in-depth learning (22-23). In clinical settings, printed references are often perceived as more dependable, quick-access tools as they are not constrained to device availability, internet connectivity, or subscription validity - factors that can compromise confidence in digital platforms during critical decision-making. Beyond mere reliability, hardcopy reading is often credited with superior knowledge retention and a more thorough, focused educational experience (23-24). Notably, Frank Shann's Drug Doses emerged as the most frequently purchased hardcopy reference across all three professions. This preference likely highlights its specialised utility in paediatric dosing, where precision is paramount, as well as its pocket-sized convenience, enabling practitioners to maintain a portable, "gold-standard" resource for bedside use without technological limitations (25).

This study has a few limitations that must be acknowledged. The primary limitation of this research lies in its limited scope, as it was conducted in a single district and restricted to non-specialist government healthcare facilities. Consequently, the findings may not be generalised to large tertiary centres or other regions in Malaysia. Future studies involving additional districts such as Mersing and Pontian are recommended to validate these trends and offer a broader, more representative understanding of DIR utilisation, thereby informing national healthcare policy.

## Conclusion

This study demonstrated a clear shift towards digital DIR, while also revealing a continued appreciation for traditional hardcopy references. Although softcopy resources were preferred for daily use, the greater willingness to purchase hardcopy materials highlights their enduring role in supporting in-depth learning and clinical practice. The findings also emphasised the importance of accessible, up-to-date, and freely available information, alongside a strong demand for institutionally funded subscriptions to comprehensive databases such as UpToDate to ensure equitable access to high-quality resources. Future research should be conducted across multiple districts and levels of healthcare to validate these findings and inform national strategies for digital resource provision.

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**Conflict of Interest**

The authors declare that they have no conflicts of interest and they did not receive any financial support or funding that is relevant to this study.

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