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# ISSUES ON SOURCE, ACCESS, EXTENT, AND QUALITY OF INFORMATION AVAILABLE AMONG PHARMACISTS AND PHARMACY PERSONNEL TO PRACTICE EFFECTIVELY

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## INTRODUCTION

Providing information about medicines to the prescribers and to other healthcare providers was the earliest task undertaken by pharmacists while making the dramatic transformation in the pharmacy profession by shifting the orientation of practice from focusing mainly on the medicine itself to focusing on the patient who uses medicine and later on focusing also on the community. Such huge change ended by establishing clinical pharmacy practice during the period of 1960s and 1970s and led later on to founding pharmaceutical care (Elenbaas & Worthen, 2009). The new trend of practice, which was started early in the United States and transferred to other countries, represents a way of practice dominating worldwide. Since then, pharmacists became the main source of information on medicines and gained the appreciation and respect of the healthcare team members everywhere in the world. Information on medicines is provided by individual pharmacists during medical rounds and scientific meetings such as conferences, workshops, and seminars or within official bodies such as medicines information centers and hospital committees. Trust and appreciation extended to the general public because of pharmacists' contribution to the awareness campaigns, patients counseling, pharmacists-run clinics, and participation in wellness programs.

Our world today witnesses huge advancements in the information-related technologies and in the amount of medicines information available and accessible by all healthcare providers as well as the public. This represents great challenge for pharmacists and puts more responsibility on them as medicines information specialists. To remain in the front line as information providers and as information experts, pharmacists need to provide specific, objective, up-to-date, and unbiased information and be very efficient, competent, and skillful while searching for and providing the information.

This chapter describes various medicines information sources and their availability, accessibility, and quality based on research conducted worldwide with a more focus on the studies performed in developing countries. When describing the characteristics of a particular medicines information source and the potentialities for improvement in a certain area, we may rely on some researches conducted in developed countries due to scarcity of evidence from developing countries and because evidences can be generalized to other countries given that the basic requirements for establishing a particular initiative exist. Information on novel initiatives from developed countries can be used as valued lessons and learning experiences that can be replicated elsewhere.

It is important to make a note here that using the descriptions “medicines information centers” and “medicines information services” is chosen throughout the chapter consistently with the terminology used in the whole book. However, some resources cited here were using the descriptions “drug information centers” and “drug information services.” We tried to be consistent in using the description “medicines information” whenever possible unless the term was linked in the original resource to a name of a particular service or center; in such cases we used the word “drug” to illustrate such descriptions.

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## SOURCES OF MEDICINES INFORMATION AVAILABLE TO PHARMACISTS IN DEVELOPING COUNTRIES

Pharmacists should identify and be able to use credible, up-to-date, and high-quality information resources while practicing. The information will be used to build pharmacists' own competencies to practice efficiently and ethically and to provide high-quality services. The information will be needed

to effectively manage drug supply, monitor and assess medication use, evaluate medications, counsel patients, promote rational use of medicines, and perform administrative works besides other activities. However, acting as a primary source of medicines information for healthcare providers and the public is the job most done by all pharmacists working in different settings of practice in a formal or in an informal manner. This is why this chapter is focusing mainly on the issues related to the source, access, extent, and quality of medicines information available among pharmacists and pharmacy personnel. Nevertheless, any other type of information ahead from medicines information is also applicable to what is described in the chapter.

## SCIENTIFIC JOURNALS

Scientific biomedical journals represent the core source of our knowledge about medicines. Published research papers are called primary literature because they are the primary source of newly discovered and recently revealed information that is established from research and investigations before such information becomes well known and later on all other sources of information are built based on them. Previously, all journals are published as printed material. Nowadays, journals are published as print and as online digital copies, and some journals are online-only. This has increased accessibility of the journal materials to the readers. In terms of accessibility, journals are either subscription based (i.e., users' payments) or freely accessed (i.e., publication fees are paid by the individual researchers or their institutions). When we describe the availability of biomedical journals in a particular institution, we mean their availability within the library databases of that institution, which requires the subscription of such institution with the database that includes the required journals. If a journal is available free to the readers, then there is no problem with accessibility to its content and the content can be downloaded and easily used by anyone. However, with subscription-only journals' content, there may be a problem in the accessibility to such information among pharmacists in the poorest developing countries (i.e., low-to middle-income countries).

## TEXTBOOKS, BOOKS, AND HANDBOOKS

For a user who needs to establish basic information about certain topic, textbooks and books represent the cornerstone, particularly when the topic is very broad and the information user has little or no background about the topic. However, a major limitation of textbooks and books is that some included details must be updated from other resources depending on the nature of the information and on how progressive the research in the particular scientific field is. This is like statistics on the epidemiology of a fast-spreading disease. On average, for a book to be written and published, it requires a period ranges from 3 to 5 years. If some references included in a book at the book preparation time were 5 years back, then such information will be about 10 years backdated when the book becomes firstly available in the market. In our rapidly changing world today, 10 years-back information might be totally obsolete. A study conducted by Novo Nordisk Inc. to assess the accuracy of information about Novo Nordisk products in 37 common drug and medical references identified some errors in such references including outdated product information (Lum & Ahn, 2012).

However, textbooks, books, and handbooks still remain important sources of medicines information. A survey conducted in Nigeria among practicing pharmacists revealed that text books such as *Index of Essential Medicines (Emdex)*, first published in 1991 as Nigeria's Essential Drugs (NED)

Guide), *British National Formulary*, and others are among most used sources of medicine information (Udezi, Oparah, & Enyi, 2007). In Jordan, a study conducted by Wazaify, Maani, and Ball (2009) reported that all private community pharmacies had at least one reference book, but most were outdated. In Singapore, reference texts are still trusted by pharmacists (Wong, Ko, & Sklar, 2009). Even in the United States, a survey performed among Alabama pharmacy facilities indicated a high use of textbooks as medicine information resources such as *Drug Facts and Comparisons* and *Physician's Desk Reference* (Schrimsher, Freeman, & Kendrach, 2006). Clauson, Fass, and Seamon (2008a) explored the legal requirements for maintaining medicines information resources in pharmacies across the 50 states in the United States and found that two states, Minnesota and South Dakota (3.8% of states), required print references. The availability of digital copies of textbooks, books, and monographs has increased the availability and the wide usage of such resources since they are portable and they are convenient while used (Hughes, Kendrach, Schrimsher, Wensel, & Freeman, 2011).

### THE INTERNET (THE WORLD WIDE WEB)

The emergence of the Internet, which had begun on small scale in the mid-1960s as part of the US Department of Defense's projects and propagated outside the United States as a worldwide service in the early 1990s by establishing the World Wide Web, had changed life of the people and the communities all around the globe and played huge roles in science advancement and sharing (Abate, 2001, pp. 1–27). Today, the Internet is the most commonly used source of information for a variety of uses and topics. This is because it is fast in information retrieval and is convenient and enjoyable in its use. Moreover, it is a good medium for information storage and exchange and almost all known types of medicines information resources have been transformed into Web-based products. However, a major limitation of some Internet-based resources is the uncertainty of quality, accuracy, and credibility of the information.

Digital versions of textbooks and books are easily uploaded to and downloaded from websites. Interactive versions of such resources provide more opportunity for information search, processing, and recovery. Surveys from both developed and developing countries indicated that online medicines information resources are widely utilized by pharmacists. In Malaysia for example, the majority of pharmacists preferred online medicines information resources (Khan, Emeka, & Khan, 2013).

### DATABASES (WEB BASED AND CD BASED)

Databases are large collections of data that are organized in a way that facilitates processing, searching, and retrieval of the required information. The use of databases, which are either CD based or Web based (the later format becomes more prominent), requires the availability of computers facilities, which are considered a basic requirement of any medicines information center (MIC). An online collection of thousands of journals' contents represents a database, such as MEDLINE, ScienceDirect, Scopus, Springer Link, and ProQuest. Cochrane Database for Systematic Reviews represents an example of evidence-based resources that is very useful for practitioners, academician, and researchers.

### MEDICINES INFORMATION CENTERS

The year 1962 witnessed the establishment of the first medicines information center in the world at the new University of Kentucky Medical Centre by Paul Parker (Elenbaas & Worthen, 2009). An MIC is a unit or a department having specific physical setting, supported with certain facilities (such as

computers and Internet, print and digital library, a telephone line and a fax) and dedicated staff specialized in the area of medicines information services provision. MICs are commonly localized or affiliated to hospitals, academic institutions, Ministries of Health, medicines manufacturers, health professional associations, and community pharmacies. In hospitals, which are the primary setting of MIC, if no center exists, there should be at least a medicines information service provided by pharmacy department, individual clinical pharmacists, or ordinary pharmacists. Sometimes, an MIC serves the poison information needs of its users and it may be referred to as a medicines and poisons information center. In some situations, there is a need for a regional MIC that covers with its services a large region or a state from a country. This is particularly needed in the poorest countries and it should be encouraged to overcome problems of shortage in infrastructures, facilities, funding, qualified personnel, and other resources.

The prescribers should be the primary target of the services provided by the MICs, and the utilization of such services by the prescribers is a good indicator of the success of a particular center.

The literature available in our hand indicates the presence of MICs in a variety of countries from the developing world. Such literature represented reporting of the activities undertaken by the centers, rates of medicines information inquiries, classification of requests made, classification of the information users, the satisfaction of the information users, and the impact of the information provided. It is important to notice that some reports presented here are 20 years back since very recent studies are scarce. Also, what is presented here only indicates the availability of the services and describes the pattern of the available reports and does not represent a conclusive listing of the actually available services as some services might be available but not reported.

1. A study was conducted in Saudi Arabia to evaluate electronic information resources for questions received by King Saud University College of Pharmacy Medicines Information Centre (Alnaim & Abuelsoud, 2007). The evaluation included time spent to get an answer, ease of use, comprehensiveness, and availability of information in *Drugdex*, *Lexi-Drugs*, and the Internet search engine *AltaVista*. Investigators concluded that *Drugdex* and *Lexi-Drugs* are faster, more efficient medicines information databases and all of the three databases were comparable regarding comprehensiveness and availability of information. Using the Internet through the search engine *AltaVista*, in addition to print drug information resources, appears to be a suitable substitute to *Drugdex* and *Lexi-Drugs* when they are not available.
2. A study assessed the utilization of MICs located in four public hospitals of Addis Ababa, Ethiopia, found that most of the queries made came from the public hospitals (69%) and likely from healthcare professionals (94.9%) (Samuel, Dawit, & Ashenef, 2014). Physicians were ranked first in making queries (49.7%) followed by pharmacists (32.8%). The highest number of questions was categorized under therapeutic use followed by general product information and product availability.
3. A telephone interviews were conducted using a semistructured questionnaire to assess the user satisfaction with the services provided by an MIC affiliated with Ministry of Health Khartoum State, Sudan (Fathelrahman, Awang, Bashir, Taha, & Ibrahim, 2008). Most of calls came from within Khartoum State (89.6%). Pharmacists were ranked first in making calls (36.1%), followed by physicians (29.5%) and the public (22.3%). Almost one-fifth, one-half, and one-third of users had made inquiries more than five times, two to five times, and once, respectively. Overall, users reported very high satisfaction with the services received and with the way how the medicines information pharmacists treated them.

4. Another study from Zimbabwe assessed the utilization of the national drugs and poisons information center in Harare, the capital city (Ball, Tagwireyi, & Maponga, 2007). Most of the requests came from within Harare (67%). Pharmacists were ranked first in making medicines information calls (40%), whereas physicians were ranked first in making toxicology-related calls (49%). Among medicines information inquiries, systemic antiinfective (24%) and nervous system agents (20.4%) predominated. Among toxicological inquiries, pesticides (28%) and pharmaceuticals (21%) predominated.
5. A review on records of medicines information inquiries received by the Hospital Universiti Sains Malaysia Drug Information Unit was performed (Ab Rahman and Abu Samah, 1998). Among main findings were the quantity and type of questions received and the categories of users remained relatively constant during a period of 6 years. Most of the requests were directly related to patient care and they came within the university hospital. The use of textbooks as sources for answering questions was the most common practice during the first years of the unit start and it became less common during the subsequent years. This was associated with a gradually increased use of *MICROMEDEX* drug database, which became the most consulted source of information at the end of the studied period.
6. A study was performed to identify the characteristics of the medicines information provided by an MIC of a university hospital in Brazil (Silva et al., 2011 available only as an abstract). There was a variation in the rate and nature of the received inquiries and in the categories of requesters during a period of only 2 years.
7. An assessment of medicines information services provided by pharmacy practice department in Kasturba Hospital, Manipal, a South Indian teaching hospital, was made (George & Rao, 2005). Evaluation included the nature of queries and the quality of the provided services. The majority of the service users were physicians (82%) and medical postgraduate students (16%). Feedback from users indicated their regular use and their high satisfaction with the services provided.
8. After promoting the services of the MIC of Karnataka State Pharmacy Council, India, to health-care professionals and patients, a dramatic increase in the number of queries received by the center was eminent (Lakshmi, Rao, Gore, & Bhaskaran, 2003). Pediatricians, general physicians, dermatologists, and gynecologists constituted the bulk of the doctors using the center services. Queries received from doctors represented 41.3% after the promotion of the service, while they represented only 13.2% at the beginning. Other requests were from patients, pharmacists, and drug regulatory authorities (Table 22.1).

## MANUFACTURERS-BASED INFORMATION SOURCES

Manufacturers of medicines usually represent an important source of information on medicines specifically about the labeled and off-label indications, potential toxicities, and adverse reactions of the medications newly introduced to the market and on other pharmacoepidemiologic information. However, the major limitation of the manufacturers-based information is the potentiality of bias involved in such information. Bias here simply means declaring the information that is considered positive from the provider point of view and hiding the information that is seemed to be negative.

The *MIMS* (i.e., Monthly Index of Medical Specialties) is an inevitable source of information needed by prescribers and pharmacists about products marketed in a particular country or region (Management Sciences for Health, 2012). It is a pocket-size book reference that represents a compilation of technical information prepared originally by the medicines manufacturers at the registration

**Table 22.1 Examples of a Variety of Medicines Information Centers-Related Studies and Reports Published From Developing Countries During a Period of 20 Years**

Region	The Study	Country	Reported Information
Africa	Samuel et al. (2014)	Ethiopia	Assessment of the utilization of medicines information centers located in four public hospitals of Addis Ababa.
	Ball et al. (2007)	Zimbabwe	Assessment of the utilization of the national drug and poisons information center in Harare, the capital city.
	Fathelrahman et al. (2008)	Sudan	Evaluating user satisfaction with services provided by medicines information center affiliated with Ministry of Health.
Middle East	Alnaim and Abuelsoud (2007)	Saudi Arabia	Evaluation of electronic information resources for question received by a college of pharmacy medicines information center.
Southeastern Asia	Ab Rahman and Abu Samah (1998)	Malaysia	Reviewing records of medicines information inquiries received by the Hospital Universiti Sains Malaysia Drug Information Unit located in Kota Bharu, Kelantan, Malaysia.
Southern Asia	George and Rao (2005)	India	An assessment of medicines information services provided by pharmacy practice department in Kasturba Hospital, Manipal. Evaluation included the nature of queries and the quality of the provided services.
	Lakshmi et al., 2003	India	The utilization of the medicines information center of Karnataka State Pharmacy Council, India.
	Shankar et al. (2007) <sup>a</sup>	Nepal	Describing the scope of the activities and the achievements of drug information center at Manipal Teaching Hospital, Pokhara, Nepal. <sup>a</sup>
Latin America	Silva et al. (2011)	Brazil	Identifying the characteristics of the medicines information provided by a medicines information center of a university hospital in Brazil.
	Hall et al. (2006) <sup>a</sup>	Costa Rica	Describing the operations, activities, and resources of seven medicines information centers and services affiliated with public institutions in Costa Rica <sup>a</sup>

<sup>a</sup>Such studies are described under the "Achievements" section.

stage of every medication and has been approved by the regulatory authority in the particular country. It provides basic information on medicines indications, contraindications, dosing, side effects, toxicity, price, etc. *MIMS* can be a country-specific or a regional edition such as *MIMS* Middle East, *MIMS* Asia–Pacific, *MIMS* Africa, and *MIMS* Caribbean and can be a specialty-specific edition such as *MIMS* cardiology, *MIMS* pediatric, and *MIMS* obstetrics and gynecology. A study conducted in community



pharmacies in Amman, Jordan, revealed that *MIMS* was the most commonly found medicines information resource (64.7%), whereas 19.2% of respondents declared getting medicines information directly from the pharmaceutical companies representatives (Wazaify et al. 2009).

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## MEDICINES INFORMATION SOURCES USED BY PRESCRIBERS AND OTHER HEALTHCARE PROVIDERS IN DEVELOPING COUNTRIES

Surveys conducted among prescribers to reveal their information seeking habits and usage patterns of information resources is useful for pharmacists while providing the medicines information services to them. Being aware of the information needs of the healthcare professionals is also helpful in tailoring the necessary assistance.

In Ethiopia, prescribers from different categories of hospitals (i.e., specialized referral, zonal, and district hospitals) are four to six times more likely to consult medicines information resources than the prescribers from healthcare centers (Hussien, Musa, Stergachis, Wabe, & Suleman, 2013). The prescribers complained from difficulty in accessing the required medicines information resources.

In Uganda, the sources of medicines information reported by physicians from district hospitals to be most available were colleagues, and those reported by the physicians from the regional and university hospitals were pharmaceutical companies literature and hard copies of research publications. However, the most commonly used sources in district and regional hospital at one hand and in university hospitals at the other hand, respectively, were National Standard Treatment Guideline and colleagues. Physicians reported difficulty in accessing medicines information from printed and digital research publication in medical journals, *MIMS*, and pharmacists (Tumwikirize et al., 2009).

In Estonia, main information sources used by healthcare professionals were the datasheet compendium *Pharmaca Estica*, specialty handbooks, medical journals, and medicines manufacturers' representatives (Raal, Fischer, & Irs, 2006). Healthcare professionals surveyed considered manufacturers-based medicines information sufficient according to their needs. However, substantial proportion of them declared that medicines information centers are necessary.

It is clear from the previous reports that the pharmaceutical manufacturers represent an influential source of medicines information among prescribers in various countries, especially when other resources are scarce or absent. Such influence is made via medical representatives' regular visits and communications with prescribers, promotional activities during conferences and medical gatherings. The Internet represents today an additional medium for communicating the manufacturers information. Some multinational companies established professional product information websites that are designed to provide clinicians with the same information that would otherwise be provided in response to a telephone call or a written inquiry (Kennedy, Baker, Riccio, & Song, 2001).

On the other hand, a survey was conducted among emergency medicine clinicians in an academic teaching center located in Brooklyn, New York City, the United States, to identify the medicines information references used for prescribing in pregnant patients (Jellinek, Cohen, Stansfield, Likourezos, & Sable, 2010). The study revealed the reliance of emergency medicine clinicians on general references rather than pregnancy-specific references to prescribe for pregnant patients. An important note to be made here is that such general references include *Micromedex*, *Tarascon Pocket Pharmacopeia*, and *Epocrates*. We know that *Micromedex* is a very useful and highly updated medicines information resource; however, it is still considered a general reference in a case of pregnancy and more specialized references should be used.

## MEDICINES INFORMATION SOURCES USED BY THE PUBLIC IN DEVELOPING COUNTRIES

Understanding the public needs and use of the medicines information and their views and perceptions about various information sources is essential for understanding consumers' behaviors regarding the use, misuse, and abuse of the medications. Due to scarcity in research studies from developing countries, we present here some studies conducted in a number of developed countries. Despite the possible variability between consumers from various countries due to cultural reasons, some attitudes and behaviors are expected to be common and similar.

Mass media, especially the newspapers, used to play great roles in the wide spread of the information and sometimes the perceptions about medicines, medicines use, and their effects among the public. This was true worldwide and it remains true in most of the developing countries in the world today. The Internet and its various applications have reduced such role in some countries. Nevertheless, electronic newspapers are making use of the Internet huge capacity to extend the roles played by traditional newspapers. This makes research studies conducted earlier in the area of journalism and newspapers still useful in understanding the influences and effects of such media on the general public knowledge and their information about medicines.

Moynihan et al. (2000) reviewed a sample of 180 newspaper articles and 27 television reports that appeared between 1994 and 1998 in the United States, covering information about three medications that are used for preventing major diseases, namely, pravastatin, alendronate, and aspirin. The researchers reported that news media stories about medications may include inadequate or incomplete information about the benefits, risks, and costs of the drugs. The researchers reported presence of financial ties between the study groups or experts cited in news media stories and pharmaceutical manufacturers. Another study from the Netherlands revealed that pharmaceutical industry represented the third most frequently cited source of information in the newspaper articles (van Trigt, Haaijer-Ruskamp, Willems, & Tromp, 1994).

Evidences revealed high popularity of online applications of drug information resources among the public. A survey from the United States for example showed Wikipedia and the National Library of Medicine rank highly in online drug searches (Law, Mintzes, & Morgan, 2011).

A study was conducted among consumers visiting community pharmacies in Brisbane, Australia, to assess their perspectives of medication information sources (Tio, LaCaze, & Cottrell, 2007). Written information was ranked first by the majority of them (90%) as a source of information followed by their doctors (83%) and the pharmacists (78%). The consumer perceived that doctors and pharmacists, as information sources, have good knowledge, are trained, and are trusted.

A study from South Africa evaluated the effect of patient information leaflets on acquisition and recall of information about medicines. Researchers compared a simple, shorter patient information leaflet that included descriptive pictograms with two types of text-only patient information leaflets varying in length and complexity. Findings revealed that patient information leaflet incorporating pictograms resulted in better knowledge gain and understanding of medicines information (Mansoor & Dowse, 2007). Another study from the United Kingdom assessed the effectiveness of the information leaflets as a source of information about medicines and addressed the need for additional verbal information. The investigators reported that a large minority of patients have poor reading skills but when the medicine information leaflet is designed to be easy to read, patients gain significant amounts of knowledge. Providing additional verbal clarifications tends to increase patients' knowledge about the medicines (Hill & Bird, 2003).

A survey conducted among adolescents in Uganda found that four-fifth of the adolescents reported that parents, teachers, and other adults represent important sources of their information about health. About half and more than one-third of the adolescents, respectively, reported that they tend to read a book/went to the library and use the computer and Internet to get needed information (Ybarra, Emenyonu, Nansera, Kiwanuka, & Bangsberg, 2008).

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## ACCESS TO VARIOUS MEDICINES INFORMATION SOURCES IN THE DEVELOPING COUNTRIES

The availability of a medicines information resource does not indicate the usage or the usefulness of such resource. The accessibility and the quality of information are having great effects on the use and the full utilization of such resource. An information user may not be aware of the availability of a particular resource close to him or her. This is why medicines information pharmacists have the responsibility of raising awareness among information users about available resources. This is especially important in the case of a newly established medicine information center or a service. Outreach activities and proactive approach are necessary for marketing a medicines information service. Outreach activities include organizing awareness programs, participating in media campaigns, and publishing locally prepared printed materials such as brochures, medicines information bulletins, and newsletters. This is called proactive approach contrasting the reactive approach, which means merely responding to the inquiries received from information requesters.

The accessibility of an information resource is affected by various factors such as whether such resource is a subscription based or freely available and whether the usage of the resource requires the availability of other facilities such as computers and Internet. In a developing country with limited funds available for healthcare systems, the access to medicine information databases is very difficult. This is further worsened if there is limited or no Internet and/or electricity. [Table 22.2](#) shows examples of some useful online resources for information on medicines and toxicology.

### HINARI

Hinari was developed in the framework of the Health InterNetwork, introduced by the UN Secretary General Kofi Annan at the UN Millennium Summit in the year 2000. Hinari was launched in January 2002, with some 1500 journals from six major publishers: Blackwell, Elsevier Science, the Harcourt Worldwide STM Group, Wolters Kluwer International Health & Science, Springer Verlag, and John Wiley, following the principles in a Statement of Intent signed in July 2001. Since that time, the numbers of participating publishers and of journals and other full-text resources have grown continuously. To date, 180 publisher partners and up to 400 publishers' content are offering more than 60,000 information resources in Hinari and many others are joining the program (information copied from Hinari website <http://www.who.int/hinari/en/>). Any institution from countries eligible for receiving its service (only low- to middle-income countries) can get access to Hinari after registering using an online registration form.

[Table 22.3](#) shows useful sources for providing access to free full-text articles besides Hinari.

**Table 22.2 Selected Useful Online Resources for a Variety of Health and Medical Information<sup>a</sup>**

Source and Website Address	Primary Users	Sponsored	Nature of Information
PubMed <a href="http://www.pubmed.gov">www.pubmed.gov</a>	Medical practitioners and researchers	The US National Library of Medicine	Bibliographic and abstracting information of biomedical literature. It is a secondary resource that contains abstracts of the research and review articles included in MEDLINE database in addition to numerous other resources.
Medline Plus <a href="http://www.medlineplus.gov">www.medlineplus.gov</a>	Consumers		General medical information for healthcare professionals and consumers and information about prescription and over-the-counter (OTC) medications, dietary supplements, and herbal medicines in language suitable for lay persons.
Clinical Trials.gov <a href="http://clinicaltrials.gov">http://clinicaltrials.gov</a>	Medical practitioners and researchers	The US National Library of Medicine in collaboration with FDA	An electronic registry of clinical trials conducted in the United States and other countries. The website provides abstracts of study protocols including information such as the study aims, participants' inclusion criteria, location of trial, investigator contact information, study design, and the condition and therapy being studied.
TOXNET: Toxicology Data Network <a href="http://toxnet.nlm.nih.gov">http://toxnet.nlm.nih.gov</a>	Practitioners and poison information specialists and toxicologists	The US National Library of Medicine	Toxic effect of drugs and chemicals including household products and information on general environmental health.
US Food and Drug Administration <a href="http://www.fda.gov">www.fda.gov</a>	Practitioners and regulators	US Food and Drug Administration	Information on approved drugs, recalls, safety warnings.
Cochrane Database of Systematic Reviews <a href="http://www.thecochranelibrary.com">www.thecochranelibrary.com</a>	Medical practitioners and researchers	The Cochrane Library, a production of Cochrane Collaboration	Contains over 5000 systematic reviews and metaanalyses answering clinical questions (only abstracts are freely available, but full-text access requires a subscription). Contents can be accessible in selected situations in low- to middle-income countries.
Google Scholar <a href="http://scholar.google.com">http://scholar.google.com</a> Medscape <a href="http://www.medscape.com">www.medscape.com</a>	Medical practitioners and researchers Healthcare professionals	WebMD	Secondary resource/scholarly literature on the Internet. Large database organized by medical specialty. General medical information accessed by registered users only (i.e., contents are freely accessible but require registration).

*Continued*

**Table 22.2 Selected Useful Online Resources for a Variety of Health and Medical Information<sup>a</sup>—cont'd**

Source and Website Address	Primary Users	Sponsored	Nature of Information
Mayo Clinic. Drugs and Supplements <a href="http://www.mayoclinic.com/health/drug-information/DrugHerbIndex">http://www.mayoclinic.com/health/drug-information/DrugHerbIndex</a>	Consumers and healthcare professionals	Mayo Clinic Foundation	Provides information on OTC and prescription drugs, herbs, supplements, and vitamins. Information on medicines is provided by Micromedex database for drug information.
The International Pharmaceutical Abstracts (IPA) database	Practicing pharmacists and researchers	Established by the American Society of Health-System Pharmacists (ASHP) in 1964, and later on its ownership was transferred to Thomson Scientific, a business of the Thomson Corporation	A comprehensive database provides indexing and abstracts for pharmaceutical and medical journals published worldwide.

<sup>a</sup>For more information, refer to *Grossman and Zerilli, (2013)* and *Lapidus and Dryankova-Bond (2014)*.

## QUALITY OF MEDICINES INFORMATION SOURCES IN THE DEVELOPING COUNTRIES

### ASSESSING THE QUALITY AND THE IMPACT OF A MEDICINES INFORMATION SERVICE

Providing high-quality medicines information services and having an access to high-quality medicines information sources should be ultimate goals of every pharmacist, especially those officially involved in the provision of medicines information. The quality of information provided can be measured in terms of satisfying certain standard criteria or in terms of satisfying the needs of the information user. The later varies widely according to the characteristics of the information user whether he or she is a consumer, a patient, or a healthcare provider. The standard criteria of good medicines information include being evidence-based, accurate, up-to-date, objective, unbiased, user-specific, and clinically relevant. Satisfying the needs of a medicines information user means providing the information in a timely manner and providing concise and complete information that is tailored to their actual needs.

Studies evaluating the quality of the information services or resources are focusing mainly on one out of three aspects: (1) the characteristics of the information provided including the accuracy, the appropriateness, and the validity of the information; (2) the users' satisfaction, or (3) the impact of the medicines information on patient care and on population health (*Bertsche, Hämmerlein, & Schulz, 2007; Hands, Stephens, & Brown, 2002; Spinewine & Dean, 2002*). The impact of a medicines information service is clinical, economic, or humanistic (i.e., patients' quality of life and satisfaction).

**Table 22.3 Useful Sources for Providing Access to Free Full-Text Articles (Primary Biomedical Literature)**

Source and Website Address	Sponsored	Nature of Information
WHO's Hinari <a href="http://www.who.int/hinari/en/">http://www.who.int/hinari/en/</a>	Hinari Programme set up by WHO together with major publishers	Hinari enables low- and middle-income countries to gain access to one of the world's largest collections of biomedical and health literature. Up to 15,000 journals (in 30 different languages), up to 47,000 e-books, up to 100 other information resources are now available to health institutions in more than 100 countries, areas, and territories benefiting many thousands of health workers and researchers, and in turn, contributing to improve world health.
Free Medical Journals <a href="http://www.freemedicaljournals.com">http://www.freemedicaljournals.com</a>		Up-to-date it covers 4832 journals. It provides free access to the full texts of contents that are made free by the original publisher immediately, after 1–6 months, after 7–12 months, or later. Some well-known subscription-only journals such as New England Journal of Medicine and British Medical Journal make certain contents available free after certain period.
Directory of Open Access Journals (DOAJ) <a href="https://doaj.org/">https://doaj.org/</a>		DOAJ is a community-curated online directory that indexes and provides access to high-quality, open-access, peer-reviewed journals. Up-to-date it includes 9400 journals and about 2.4 million articles from 128 countries.
BioMed Central journals (BMC journals) <a href="https://www.biomedcentral.com/journals">https://www.biomedcentral.com/journals</a>	BioMed Central is owned by Springer Nature	A publisher with a large portfolio of peer-reviewed open-access journals that cover all areas of biology, medicine, and health. The BMC series of journals is a collection of 65 online research journals published by BMC.
PubMed Central (PMC) <a href="https://www.ncbi.nlm.nih.gov/pmc/">https://www.ncbi.nlm.nih.gov/pmc/</a>	The US National Institutes of Health's National Library of Medicine (NIH/NLM)	PMC is a free full-text archive of biomedical and life sciences journal literature. Full text available can be freely accessed via links from PubMed. Up-to-date it includes 4.1 million articles.

## ASSESSING THE QUALITY OF PRIMARY LITERATURE

A basic skill for every medicines information provider should be an ability to assess the quality of the primary literature, which is the original research published in the peer-reviewed journal. Despite the filtering process of the peer review system undertaken by biomedical journals, still there are various limitations in the published literature. Accumulating evidence indicates that a significant proportion of the studies published in a variety of biomedical journals cannot be trusted regarding validity and accuracy, and there is a need for establishing some critical appraisal skills to differentiate between

high-quality and low-quality studies. Developing critical appraisal skills depends mainly on familiarity with research methodology, study designs, and statistics (the scope of the chapter does not allow for further elaboration on such point and an interested reader should consult a specialized reference).

## ASSESSING THE QUALITY OF THE INTERNET-BASED INFORMATION

The major limitations of the medicines information resources available in the Internet are the wide variability in the quality of the information and the uncertainty about its validity and accuracy. This requires that an Internet user be aware of such limitations and be skilled and knowledgeable about approaches that may be used to discern trustable high-quality information from untrusted low-quality information.

The first concern should be identifying the nature and the ownership of the website from which the information is derived, is it a government website (website address ends with .gov), an educational institution (website address ends with .edu), an organization (website address ends with .org), or a commercial website (website address ends with .com)? Grossman and Zerilli (2013) raised the attention of the Internet users to discern the purpose of the site and whether it provides objective information. Grossman and Zerilli ranked websites developed and/or sponsored by an educational institution (.edu), a nonprofit medical organization (.org), or a governmental agency (.gov) first in the likelihood of providing high-quality information compared with commercial websites (.com).

A second concern should be rating the quality of the contents of the website based on availability of the names of the authors/editors of the material, the good referencing, and citation, being regularly updated with dates of publication clearly indicated, having a controllable access policy that requires subscription or prior registration, and displaying the names of the sponsoring and funding bodies (Grossman & Zerilli, 2013). Clauson, Polen, Boulos, and Dzenowagis (2008b) evaluated the scope, completeness, and accuracy of drug information in Wikipedia compared with that of Medscape Drug Reference (MDR). Investigators concluded that Wikipedia has a more narrow scope, is less complete, and has more errors of omission than the comparator database. However, they also concluded it may be a useful point of engagement for consumers.

The American Medical Association (AMA) established guidelines that help in developing and posting contents of websites targeting professionals and consumers with certain standards that satisfy quality, ethical principle, and professionalism (Winker et al., 2000). The guidelines covered aspects such as site ownership; website policy toward site viewing, viewer access, payment, and privacy if applicable; funding and sponsorship of specific contents; quality of editorial content, linking to intrasite contents; intersite navigation; instructions regarding downloadable contents, and navigation of contents.

A medical or a health-related website certified by what is called Health on the Net Foundation (HON) will be trusted since it has been reviewed, approved, and regularly monitored by this noncommercial organization, which is based in Geneva, Switzerland. The HON has established Health on the Net Foundation Code of Conduct (HONcode) to assist with standardizing the reliability and credibility of medical and health information available on the World Wide Web (more information may be sought from the website <https://www.hon.ch/>). HONcode certification is voluntary, so some health-related websites with an excellent reputation might not be certified as they might not apply for certification (Grossman & Zerilli, 2013). Moreover, a certification does not indicate that all contents of a particular website are reliable, rather it indicate that such website, in general, fulfilled the minimum requirement of quality and ethical standards (Grossman & Zerilli, 2013).

## MEDICINES INFORMATION EDUCATION IN DEVELOPING COUNTRIES

Education on medicines information should be well established in the curricula of pharmacy colleges to prepare future pharmacists with the required knowledge and skills needed for good practicing. Basic level courses should be developed both at PharmD and bachelor programs, and advanced level courses can be made available for postgraduate students. Topics to be covered can include types and sources of medicines and medical literature, skills needed for effective searching and retrieval of information, critical appraisal of the literature for evaluating the quality of information, how to receive medicines information calls, how to deliver the information to the user, and how to prepare medicines information publications such as medicines information bulletins and newsletters.

For a college of pharmacy with a PharmD program, medicines information training should be a core component of an advanced pharmacy practice experience (APPE) training in addition to the education provided to the students as a didactic course during years of study. Residencies (postdoctoral programs) in medicines information can be made available as another opportunity for advanced training and specialization. Both opportunities for training (i.e., during APPE and as a residency) had become widely established in the western countries, in particular the United States. In the following we will try to highlight some of the research findings in this regard to assist in establishing similar trends in the developing countries and strengthening such sort of training if already available.

Sixty colleges of pharmacy in the United States were surveyed using an online survey to determine the contents of drug information education (Wang, Troutman, Seo, Peak, & Rosenberg, 2006). Study indicated that 70% of these colleges are having a didactic course on drug information and 85% of the colleges offer an APPE training in drug information.

Graduates of Samford University Mc Whorter School of Pharmacy residing in southeastern states were surveyed to determine whether types of questions received by the respondents during their drug information APPE training at Samford University Global Drug Information Centre are similar to those received while practicing in community settings. The study identified various differences in types of questions received, expected speed of response, and reference utilization. Accordingly, some changes were incorporated into the drug information APPE to solve discrepancies identified by the study (Lauderdale, Kendrach, & Kelly Freeman, 2007).

The University of Tennessee Health Science Centre, College of Pharmacy, in Memphis, Tennessee, developed an industry-based drug information rotation at a medical information company in affiliation with the college of pharmacy. The purposes were to offer pharmacy students during APPE an opportunity of exposure in medicines information training within a pharmaceutical industry setting and to secure additional practice sites for training to face problems associated with the growing number of pharmacy schools (Hurley & Miller, 2009).

In addition, the University of Tennessee Health Science Centre, College of Pharmacy, in Memphis, Tennessee, established a postdoctoral residency with collaborative training from the college of pharmacy, a pharmaceutical industry-based medical information firm and a children's research hospital. This is to offer the trainee an opportunity of exposure to the medicines information service provision in different settings of practice (Tadrous, Gharbawy, Hurley, Miller, & Suda, 2011).

A 2-year, post-PharmD drug information center-based fellowship in natural product research was developed and implemented in the University of Missouri-Kansas City School of Pharmacy Drug Information Centre to address an increased need for evidence-based information about consumer use of natural products (Bryant & McQueen, 2001).



The above reports do not represent a conclusive listing of the only APPE training programs or residencies available in the United States and they are not necessarily be the first colleges to introduce such programs, but rather they represent examples of the variety of options available in the United States.

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## ACHIEVEMENTS

Reporting about the important achievements of developing countries in the area of medicines information is not easy since it stems from evaluating overall performances across different countries and judging what is coming first and what is the next in terms of importance and impact. In the following we are providing snapshots of nice experiences from a variety of countries from the developing world. The purpose of this description is to offer others an opportunity to learn such experiences and replicating them in their own way.

1. On April 6, 1998, in recognition for its contribution and services in the field of drug and poison information, the National Poison Centre of Malaysia, which is based in Universiti Sains Malaysia, was designated as a WHO Collaborating Centre for Drug Information. The founding of the WHO Collaborating Centre for Drug Information was meant: (a) To establish, develop and facilitate a system of electronic information exchange among member states of Western Pacific Region (WPR) in particular, and WHO in general. (b) To develop, update and implement training modules on Drug Information in developing countries with emphasis on the needs of the Western Pacific Region. (c) To arrange and conduct fellowship training in drugs as well as poison information in support of the concept of rational drug use. (d) To collaborate with the Western Pacific Regional Office in developing computer applications relating to drug information and pharmacoinformatics. (e) To collaborate with the Western Pacific Regional Office in initiating a systematic data and information collection on activities related to the drug utilization, management and policies for identification of priorities and forecasting of needs. (f) To support countries and areas in the region to conceptualize, plan and set up Drug Information Services tailored to individual needs. (g) To undertake relevant drug utilization studies in support of promoting rational use of medicines, develop focused drug information intervention for providers and consumers to improve prescribing and drug use practices, and to undertake proper evaluation of the impact of drug information on rational use of medicines (Information copied from the website of the National Poison Centre of Malaysia [http://www.prn.usm.my/who\\_collaborating\\_centre.php](http://www.prn.usm.my/who_collaborating_centre.php) accessed December 28, 2016).
2. Going beyond medicines information: The drug information center at Manipal Teaching Hospital, Pokhara, Nepal, founded in November 2003 succeeded in providing activities besides the provision of medicines information services such as running a pharmacovigilance center and a medication counseling center (Shankar, Mishra, Subish, & Upadhyay, 2007). The center resources are used for teaching of the undergraduates and for continuing pharmacy education program of pharmacists. The center publishes a quarterly bulletin and support research activities.
3. Between 1983 and 2000, seven public medicines information units have been established in Costa Rica (Hall, Gomez, & Fernandez-Llimos, 2006). Of those, four are MICs and three are medicines information services. The seven MICs and services followed the guidelines established by Pan-American Health Organization (PAHO), and the seven units provide almost comparable wide scope types of activities including as examples answering inquiries from

user from inside as well as outside hospitals; preparation of technical reports for hospital committees; conducting research about drug use and adverse drug reactions; delivering lectures and seminars; participation in continuing education activities; conducting educational programs for patients and high-risk groups; publication of drug bulletins, papers, and booklets; supporting rotation programs for trained students; and preparation of guides on drug use for healthcare team.

4. Information sharing systems: A possible compensation for the lack and the scarcity of information is to establish an information sharing system by constructing a national or a regional medicines information database. The database may contain information needed by all stakeholders in the country or the region similar to the national information sharing system suggested by [Muangchoo and Kritchanhai \(2015\)](#) to serve the healthcare supply chain in Thailand.

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## CHALLENGES

1. Securing enough funding for establishing and running an MIC in the poorest countries represents a great challenge: A developing country with very limited financial resources will not be able to establish and then run an MIC easily. Even if establishment is achieved via donations or other sources, running the center will not be easily achieved without proper solutions. One of the strategies that should be followed is to build up one regional center instead of establishing a couple of centers that should grow weak and become unable to survive. Then the limited scarce resources can be saved to strengthen the center and ensure sustainability of its services. One of the possible solutions is to implement a fee-for-service policy. Several Western countries are having an experience in this regard. A survey sent to medicines information centers in Canada, the United Kingdom, and the United States revealed that 18% of the centers use a fee-for-service system ([Ansong, Moody, & Stachnik, 2003](#)). For a developing country, the payers can be the private sector and the industry, which will be willing to pay if their information needs are secured by the medicines information service provider
2. The full access to biomedical literature in the poorest countries: The full access to biomedical literature in the poorest countries where basic resources and infrastructures are lacking represents a challenge to the practicing pharmacists in general and to the medicines information specialists in particular. Pharmacists in such countries are advised to seek access to the required medicines information via registering with WHO's Hinari program.
3. Provision of medicines information about off-label use of medicines: "Off-label medicines use" refers to using a medication for an indication or in a dosage form or for a group of patients, which is not indicated when approved by the regulatory authority. It is very common practice worldwide and it may be unavoidable with a rate reaching 15% to 20% in western settings. It is most common among the groups of patients who are not normally included in the clinical trials that are conducted to evaluate the efficacy and safety of the medications. Those groups included pediatric patients, particularly neonates, adolescents, pregnant women, and psychiatric patients. There is a lack of evidence-based information on the efficacy and safety of a particular medication among the stated groups, and possible information available represents an extrapolation of the evidence generated from research conducted among other groups of patients. Manufacturers' sources of information can be useful in these situations, although such information should be used cautiously.

4. Provision of medicines and toxicological information during bioterrorism and biologic weapons attacks and other emergencies: An attack with a biologic weapon during a terrorism event or a biologic war is a special medical emergency that requires special readiness with poisoning and toxicology information. In such situation a medicines information pharmacist or an MIC is expected to provide the suitable support to the healthcare team and the attacked victims in a timely and an efficient manner.
5. Provision of medicines information during a pandemic: A pandemic is an epidemic of infectious diseases, such as H5N1 avian flu, Zika virus, Ebola virus disease, Rift Valley fever, and severe acute respiratory syndrome, which have spread through human populations across a large geographical areas including multiple continents or even worldwide. During such situations, a medicines information pharmacist or an MIC experiences a rush of high-frequency calls from healthcare providers asking for treatment information, especially at the beginning of an outbreak when healthcare providers are still not fully aware and may be lacking basic information about the disease.

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## RECOMMENDATIONS: THE WAY FORWARD

1. Poorest countries with limited resources should work on establishing national medicines information centers to cover the needs of the whole country.
2. Different institutions within the same country can work on establishing an information sharing system to facilitate information exchange and building up huge medicines information databases.
3. Collaboration among countries from the same region provides great opportunities to save resources and strengthening the capacities for attaining sustainable high-quality services. This can be achieved via sharing available experiences and resources and can be maximized by building collaborative regional MICs.
4. Institutions from developing countries with no or limited access to high-quality medicines information resources should seek assistance from supportive organizations such as the WHO, which can offer free access to the Hinari database. Other freely available resources should be also sought.
5. Medicines information education should be promoted among colleges of pharmacy at various levels including didactic courses during undergraduate studies, during APPE training of PharmD students and as postgraduate studies and training (i.e., residencies, fellowships, and masters programs).
6. Training for developing and strengthening the medicines information skills should be provided regularly to all practicing pharmacists as part of the continuing professional development (CPD) programs
7. Advanced training can be scheduled for pharmacists working on the provision of medicines information services as part of CPD activities to build their capacities and to raise their competencies.
8. Countries with limited experiences in the area of medicines information should work on to learn from countries having well-established systems of medicines information and try to copy successful innovations.
9. There is a need to monitor and evaluate various resources of medicines information available in the developing countries as well as evaluating the services provided by the medicines information centers. This is very useful for improvement and for the expansion and the sustainability of the services. Evaluations are done by conducting scientific research studies. Such researches should be published to allow others make use of the established evidence.

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## CONCLUSIONS

Pharmacists should identify and be able to use credible, up-to-date, and high-quality information resources while practicing. The information will be used to build pharmacists own competencies to practice efficiently and ethically and to provide high-quality services. The quality of information can be measured in terms of satisfying certain standard criteria and in terms of satisfying the needs of the information user. Being aware of the information needs of the healthcare professionals is helpful in offering the required assistance that is tailored to the users' needs. The availability of a medicine information resource does not indicate the usage or the usefulness of such resource. The accessibility and the quality of information are having great effects on the use and the full utilization of such resource. Securing enough funding for establishing and running an MIC in the poorest countries represents a great challenge. Education on medicines information should be well established in the curricula of pharmacy colleges to prepare future pharmacists with the required knowledge and skills needed for good practicing.

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## LESSONS LEARNED

- Collaboration between academia, hospitals, and industry provides great opportunity to achieve distinguished successes in research and for securing resources in the area of medicines information.
- Implementation of a fee-for-service system where the payer can be the private sector and the industry, which will be willing to pay if their information needs are secured by the medicines information service provider.
- Publications documenting the source, access, extent, and quality of information available among pharmacists and pharmacy personnel in developing countries are scarce, and this needs the attention of medicines information specialists, educators, researchers, and policy makers

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