SOURCES OF DRUG INFORMATION
UMKC MEDICINE 9385

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GOAL & OBJECTIVES

The primary goal for this document is to familiarize the student with the usefulness and limitations of various sources and types of drug information, as well as develop skills in information retrieval. This goal coincides with those Life-Long Learning objectives listed in the Experienced Based Curriculum. Students may utilize the skills gained from this section throughout the medical school curriculum (i.e. MED 408) and can apply them to other topics in addition to besides pharmacology.

Objectives:

- Define primary literature, secondary literature and tertiary literature.
- Give one or two examples of primary literature, secondary literature and tertiary literature.
- Demonstrate the ability to appropriately comprehend and utilize the primary, secondary or tertiary literature to answer a variety of drug information questions.
- Demonstrate the ability to access Internet applications for drug information purposes.
- Given a drug related question, give an effective search strategy to find the appropriate drug information necessary to answer the question: tablet identification, usual dose, available dosage strengths, dose adjustment for renal impairment, drug safety in pregnancy or lactation, drug interactions, and accessing drug information in specific journal articles.
- State five limitations of using and recommending Internet resources for drug information.
- Define the benefits and limitations of using sources of drug information from experts, pharmacists, hospital based treatment plans, and pharmaceutical companies.

“Knowledge is power.” - Sir Francis Bacon

The overall amount of medical information is growing at an alarming rate; the body of knowledge covering drug information alone can seem endless. There are vast amounts of data on drugs approved by the Food and Drug Administration (FDA), and on agents undergoing clinical investigation. There are many sources of information available that can help answer drug-related questions. Deciding which one is best for a specific situation is the key. This outline will discuss drug information sources and explain how to effectively utilize them. Exercises posted on the web, and the self-paced news group will assist you in developing the skills to efficiently utilize these resources to better manage your patients' drug related problems.

SECTION I: THREE TYPES OF DRUG INFORMATION LITERATURE

Primary Literature - Definition:

Primary literature forms the foundation of the literature hierarchy. It is the source of information for the development of secondary and tertiary literature resources. Primary literature is comprised of original research that is written in the author(s) own words. It consists of research studies, case reports, editorials, and letters to the editor. Most primary literature contains a detailed description of the study design, methodology, and scientific results. The reader is able to critique and analyze the study in order to develop a conclusion.
Advantages of primary literature:
1. Information from primary literature is current, original, and "cutting-edge." Core Clinical Journals contain information about patient-oriented, evidence-based medicine that may change or affect patient care. The mnemonic POEMS (Patient Oriented Evidence that Matters) is often utilized to define this information and the journals in which it is contained.
2. Many articles undergo review by the author's peers before an article is accepted for publication, thereby incorporating unbiased views and suggestions to improve the quality of the report. This is known as the "peer-review process."

Disadvantages of primary literature:
1. With any research report, flaws in study methodology may lead to inaccurate conclusions. For example, utilizing inappropriate statistical analysis may lead one to reach an inappropriate conclusion of the results of a study.
2. In assessing the primary literature, knowledge of scientific methods and statistics is necessary to properly interpret the information.
3. Since the information presented in the primary literature is so new, it may take time before wide acceptance occurs throughout the medical community.

Using the primary literature:
Be cautious, careful, and conservative when utilizing new information from a primary literature source.

Is the article from a peer-reviewed journal? Articles published in peer-reviewed journals are generally better in quality and objectivity than non-peer reviewed work.

In utilizing data from primary sources be sure that all aspects of the primary source are understood (i.e. patient inclusion or exclusion criteria, study methods and interventions, primary outcome being assessed, statistical and clinical relevance of the reported findings), before applying that information to your patient.

To extrapolate primary literature data to a single patient encounter, make sure the patient population mentioned or utilized in the primary work corresponds to your practice population.

Remember that case reports relate only to one or a few patients, not a whole patient population. Be watchful for potential for bias and avoid relying solely on anecdotes.

Example Primary Literature Sources
Examples include research articles and studies published in the New England Journal of Medicine, Journal of the American Medical Association, Archives of Internal Medicine, Annals of Internal Medicine, Lancet, and British Medical Journal. These publications are among about 100 others designated as Core Clinical Journals by the National Library of Medicine. They are important journals because they contain information that is significant to medical practice.

Secondary Literature - Definition:
Indexing and abstracting services compile secondary literature that can be used to systematically locate various types of published literature. The indexing system usually provides bibliographic information
indexed by topic and will allow the user to view a brief description of the information within most citations.

Examples of secondary literature databases are PubMed (Medline), Embase, National Library of Medicine Gateway, International Pharmacy Abstracts, Scopus, and Toxline. There are many secondary literature databases and each has its own scope, look, feel, and features to make it easy for the user to search the database.

Advantages of secondary literature:
1. Provides quick access to the primary literature.
2. Provides a broad scope and/or concise information on specific topics. The information is usually current, but it depends on the abstracting service and the specific type of information for which one is looking.
3. Generally, the journal sources are peer reviewed and of a high standard.
4. Most resources provide the option to subscribe to periodic emails with updated information (weekly or monthly).

Disadvantages of secondary literature:
1. The period between publication and inclusion (lag time) into secondary sources can vary for each database, from days to weeks.
2. The number of journals indexed by each system depends upon the scope of the database. You must evaluate if these are journals you consider important and regularly review them.
3. Because a secondary source can encompass such a large amount of information, you must be proficient at sifting through the sources listed on a particular subject to find the exact information you are looking for.
4. To obtain useful information, you must utilize specific search terms and be proficient with a particular database's search techniques. Medical databases organize the literature using Medical Subject Headings (MeSH). The way MeSH works is this: if you search for “heart attack” in a medical database, the system will look for “Myocardial Infarction,” which is the MeSH heading. Your use of terms will influence what you find. If you search for "the use of aspirin" in a particular medical database, hundreds of articles would be reported. However, if you specify “aspirin use in myocardial infarction, secondary prophylaxis,” use of the more exact term will yield more focused results. Think of MeSH like a hashtag for similar topics in the literature.

Using secondary literature:
Each database has its own focus, or scope, and collects primary literature in a certain field about a disease, drug-information, or literature related to patient care. Medline focuses on the biomedical sciences, Toxline focuses on toxicology, CINAHL focuses on the nursing and allied health literature.

The databases links you to citations that show you the author, title of the work, location and date of the publication and generally, an abstract of the manuscript. Sometimes the full text of the article will be available, but other times you need to get access to the article itself through a subscription. That's where the library comes into the picture. The UMKC Health Sciences Library makes the article available online through its subscriptions to journals. Click on the Full Text button to see whether the article is available electronically or in print through the library. If the article is not available, you can order it for
free from another library using the UMKC Libraries’ service called “inter-library loan” or “ILL.” For information on how to use ILL, go to: https://ill.library.umkc.edu/illiad/ill-test-web/

The Clinical Medical Librarians (CMLs) have expert search skills and understand how to find the secondary literature. They can show you how to search using keywords and medical subject headings (MeSH) to find just what you need. The medical librarians are extremely helpful. You can also get online live help via chat or text message. Just look for the chat button on the library webpages. For information on how to get help from a librarian, go to: http://library.umkc.edu/ask-a-librarian

Example Secondary Literature Sources

OVID: The Ovid database is used by many health professionals to search large collections of scientific, medical, and technical databases (currently over 80). For the most part it is extremely easy to work with and use. The UMKC Health Sciences Library uses OVID technology which is available online. The CMLs can demonstrate how to use it. For a discussion of the company that created OVID, see the OVID website at http://www.ovid.com.

MEDLINE: Abstracting service produced by the National Library of Medicine; indexes articles from over 5,000 journals of international biomedical literature including allied health fields; available on-line through UMKC Health Sciences Library (via the OVID or PubMed interface).

PubMed: PubMed comprises more than 28 million citations for biomedical literature from MEDLINE, life science journals, and online books. Citations may include links to full-text content from PubMed Central and publisher web sites. When you use PubMed to search MEDLINE, access it from the left-hand side of the Library’s homepage at http://library.umkc.edu/hsl. By going through the Library you will see the “Full Text” link in the abstract view of your articles. Click on “Full Text” to get the article online or borrow it for free from another library. PubMed and Medline are free databases created by the United States National Library of Medicine (NLM) and National Center for Biotechnology Information (NCBI). Some free, full-text articles and books are always available for free, but not all.

International Pharmaceutical Abstracts: Offers an extensive list of indexed information, including information pertaining to international pharmacy and pharmaceutical sciences; index includes all pharmacy periodicals. IPA is available as an online database from the Health Sciences Library website in the OVID databases.

The Cochrane Library (Collaboration): Cochrane analyzes and summarizes the literature on health care and health policy through protocol-driven, rigorous systematic reviews. Cochrane Systematic Reviews are available in the Ovid databases Evidence Based Medicine Reviews (EBM Reviews). Ovid EBM Reviews also includes the Cochrane Central Register of Controlled Trials, the Cochrane Methodology Register, NHS Economic Evaluation Database (EED), Database of Abstracts of Reviews of Effects (DARE), Health Technology Assessment database (HTA), and ACP Journal Club.

Review Articles: Review articles are summaries that are usually written by experts in the field; however, they may have the same inherent limitations as texts. The reader needs to be aware of the timeliness of a review, and the author’s credentials.
Comparing Primary and Secondary Literature

Cynthia Lewis and Jessica Owens from Ashford University Library, created a great online tutorial (click the picture below), which provides you with an interactive session on differentiating primary and secondary information resources.

Credit: Cynthia Lewis & Jessica Owens

Tertiary Literature - Definition:

The information presented in tertiary literature is core knowledge established via primary literature or accepted as standard of practice within the medical community. Drug information contained in the tertiary literature is generally well-established information that is approved and accepted by the FDA (i.e. a FDA labeled indication) or well founded in the primary care literature (i.e. an unlabeled but well-documented use for an FDA approved drug).

Tertiary references may be of textbooks on various drug or disease topics (e.g. Pharmacotherapy), compendia (a vast array of information about many drugs such as the Physician's Desk Reference) or online, full-text databases. As with any tertiary reference, the information should be evaluated for bias.

Advantages of tertiary literature:

1. Tertiary references are convenient and accessible, especially in light of their full text availability on the Internet. These days, most of the tertiary references that UMKC Libraries offer are available online as an electronic books.
2. Drug information references may be divided into specific subjects to make them easier to use. For instance, one text may be devoted only to drug interactions, while another might discuss principles of pharmacotherapy or use of drugs in pregnancy. This way, if a specific subject needs to be queried, a corresponding reference can be reviewed.
3. Usually the information contained in tertiary literature is well accepted in medical practice. This is because most forms of tertiary literature are referenced with primary literature sources and often undergo a stringent review process to ensure that the information presented is generally well regarded in the medical community.
Disadvantages of tertiary literature:
1. Because of the lag time between when a text was written and the actual publication date, whether in print or electronically, time passes before the information is available, and updated information may not be available in a database.
2. Space limitations within a text may prevent extensive discussion of a drug or topic.
3. Authors may emphasize limited information about a topic or drug.
4. Authors may present information that is based on a less than thorough review of the primary care literature.
5. The tertiary literature may not be referenced appropriately, thus preventing a proper check of the primary care literature.
6. If the information presented in the tertiary literature is based on flawed primary care literature, (i.e. poorly designed research studies are referenced) then the tertiary information may not be the most accurate and reliable.

Using tertiary literature
✓ The reader should assess the text for timeliness. In the case of print resources, ask yourself when the last edition was published. If available to you, know what your institution or affiliation has available online and make sure you arrange to have access to the online information. Many online journals and publications have RSS feeds which notify you via email when new information is added.
✓ The reader should assess consistency by comparing information presented in one text to the same information presented in another text.
✓ The reader should evaluate the credentials of the authors/contributors.
✓ Check each resource’s references for currency.

Example Tertiary Literature Sources
This is not intended to be a comprehensive list, but the following categories contain sources of drug information that are examples of tertiary literature resources. Many of these resources are available online to UMKC students, faculty, and staff through the UMKC Health Sciences Library.

Use the UMKC Libraries’ catalog to look up the tertiary resources that are available to you. MERLIN is the library catalog for all of the libraries in the University of Missouri system. It tells you what items the libraries own. If you need help understanding how to use the catalog, this guide will assist you: https://libguides.library.umkc.edu/catalogguide or contact the library.

The examples of tertiary literature sources are numerous. Many examples are listed below, and you will become familiar with them as you continue your career. The best examples include textbooks, encyclopedia articles, guidebooks, and handbooks. Other examples include sources that DO NOT include references or that are NOT published in peer-reviewed sources.

Other Aggregated Content
• Access Medicine is a subscription-based resource available from the UMKC libraries that features leading medical content, multimedia, self-assessment, algorithms, case studies, and more. It also contains resources for drug information, clerkships and creating differential
diagnosis. Access Medicine aggregates the information from many of the tertiary textbooks mentioned above and those below into one database.

- UpToDate is aggregated expert opinion used for point of care decision making to check treatment, procedural, or drug information. The app is available to UMKC users via St. Luke's license and therefore is not managed by the UMKC libraries. Users must sign up using the School of Medicine’s wifi (www.uptodate.com/login) or using the UpToDate icon found on library computers. Renewal is required every three months onsite.

**Evidence Based-Medicine (EBM) & Drug Literature**

You will hear the term “evidence based medicine” (or EBM) used quite a bit in the years to come. In fact, many employers and agencies may judge your career based on how well you practice EBM. As you can imagine “not all literature is created equally.” Different types of articles published in the medical literature have more credence than other types of articles; the stronger the article type, the better (or stronger) the evidence. You will learn more about these publication types and levels of evidence in future courses. For now, just remember that some articles provide much more evidence on a particular topic than other types of articles.

**Evidence-Based Medicine (EBM) Resources**

In 2000 (Sackett, et al.) updated the definition of evidence-based medicine as:

“...a systematic approach to clinical problem solving which allows the integration of the best available research evidence with clinical expertise and patient values.”

Essentially, EBM utilizes the most up-to-date medical information to help you care for each of your patients. This information may come from many of the source types we listed in this handout. Developing the skills to review the correct and current information, assess information as it pertains to your individual patient population, and finally, consistently utilizing and reevaluating this information over the lifespan of a patient’s care will ensure you are correctly caring for your patients. Constructing
your medical practice based on evidence based medicine skills is the key. You will learn how to utilize EBM throughout your time at UMKC. See the following table for more EBM tutorials and overviews.

<table>
<thead>
<tr>
<th>Evidence-Based Medicine Resources</th>
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<tbody>
<tr>
<td>Dartmouth Biomedical Libraries</td>
</tr>
<tr>
<td>Florida State University College of Medicine</td>
</tr>
<tr>
<td>Himmelfarb Health Sciences Library</td>
</tr>
<tr>
<td>Johns Hopkins Medicine Center for Evidence-Based Practice Third Edition: Models and Guidelines</td>
</tr>
<tr>
<td>Students 4 Best Evidence</td>
</tr>
</tbody>
</table>

### The Information Ladder

Credit: Wooten, James. D, PharmD.

**SECTION II. DRUG INFORMATION RESOURCES AVAILABLE FROM UMKC HSL**

**IBM Micromedex®**

IBM Micromedex® is an online pharmacology database with immense value. It contains a vast array of information dealing with pharmacology, therapeutics, poison information, etc. Micromedex contains the RED BOOK Online®. It is available online via the Health Sciences Library website. You have access to three separate mobile app downloads with the subscription:

- Micromedex® Drug Information
- Micromedex® Drug Interactions
Micromedex® IV Compatibility
Apps are available for iPhone®/iPad®, Android™, and Windows 8; you will need a password. Please call the Health Sciences Library (816-235-1880) or email umkc-hslref@umkc.edu to obtain current Micromedex passwords.

Pharmacology and Drug Information Resources

**American Drug Index** Listing of products available in the US and cross-referenced by trade, generic, and chemical names; various pharmacy type information (2016). Updated editions published annually.

**Basic & Clinical Pharmacology** is a complete and comprehensive general pharmacology text which is utilized nationally as primary reference for many pharmacology courses.

**Basic Concepts in Pharmacology: What You Need to Know for Each Drug Class** provides a basic overview of drug classes and reinforces key concepts & definitions.

**Clinical Pharmacology** is an online pharmacology database that consists of extensive, peer-reviewed, current, accurate drug information for health care providers. Contains full-text information on generic, brand, herbal or investigational drugs. UMKC students, faculty and staff can access this database either on or off-campus. Contains drug identification information online via tablet or capsule markings, shapes and color(s).

**Red Book Online** provides National Drug Codes (NDC numbers); average wholesale prices (AWP) of legend (prescription) and OTC (over-the-counter) drugs; manufacturer's phone numbers; "do not crush or chew" list; updated editions published annually with monthly updates. The Database Micromedex contains the RED BOOK Online®.

**Goodman & Gilman’s: The Pharmacological Basis of Therapeutics** is considered the “Gold Standard” Pharmacology Text; very well referenced (general references and reviews separated). Contains general principles of action, absorption, distribution, & metabolism.

**Katzung & Trevor’s Pharmacology: Examination & Board Review** includes a set of objectives providing students with a checklist against which they can assess their progress. Each chapter provides a review of the core subject matter. Important drug names are provided in each chapter dealing with specific drug groups, and practice questions and answers are included at the end of each chapter. Appendices include 17 case histories with questions and answers, and test strategies. Available online in the Access Medicine eBook collection.

**Poisoning & Drug Overdose** gives practical advice for the diagnosis and management of poisoning and drug overdose, as well as concise information about common industrial chemicals. Available online in the Access Medicine eBook collection.

**Drug Interaction Resources**

**Adverse Drug Interactions: A Handbook for Prescribers, Second Edition** assists clinicians by providing key information on potential adverse effects that can result from prescribing two or more drugs for simultaneous use (2016).
**Antiepileptic Drug Interactions [electronic resource] A Clinical Guide** is a description of both pharmacokinetic and pharmacodynamic antiepileptic drug (AED) interactions, including details of the magnitude and mechanism of interactions, and also of drug combinations that are not associated with interactions and therefore can be co-prescribed without undue concern. Presented in alphabetical order and by drug class, drug interactions that occur between AEDs and also between AEDs and non-AEDs are described in three sections: Drug interactions between AEDs; Drug interactions between AEDs and non-AED Drugs: Interactions affecting AEDs; Drug interactions between AEDs and non-AED Drugs: Interactions affected by AEDs (2016).

**Case Approach to Perioperative Drug-Drug Interactions** addresses the complex realm of pharmacokinetic drug interactions in an easy-to-read volume that functions as both a comprehensive clinical reference and a casebook. This book presents a summary of the core concepts of drug interactions; an organized, annotated presentation of the drug interactions most relevant to the perioperative clinician; and approximately 200 case scenarios that highlight specific drug interactions (2015).

**Clinical Pharmacokinetic and Pharmacodynamic Drug Interactions Associated with Antimalarials** provides a systematic, unbiased analysis, critique and summary of the available literature and generates novel clinical decision-making algorithms which can aid clinicians and scientists in practice management and research development. Potential mechanisms for the identified drug interactions are deduced from available preclinical and in vitro data which are interpreted in the context of the in vivo findings (2015).

**Pharmacokinetic and Pharmacodynamic Drug Interactions Associated with Antiretroviral Drugs** Discusses the clinical pharmacokinetics and pharmacodynamics of drug interactions involving antiretroviral drugs recommended by the World Health Organization (2016).


**Medical & Other Pharmacology Resources**

**Goldman’s Cecil medicine** by Schafer, Andrew I; Goldman, Lee (Physician); Schafer, Andrew I et al. "Since 1927, Goldman's Cecil Medicine has been the world’s most influential internal medicine reference”. Three electronic copies available for viewing volumes I & II from the UMKC libraries.

**Pharmacotherapeutics for Advanced Practice: A Practical Approach** offers guidelines on prescribing drugs for over 50 common diseases and disorders. The book is organized by disorder rather than drug class and includes algorithms and case studies that illustrate critical thinking aspects of prescribing, such as drug selection, lifespan considerations, therapeutic drug monitoring, adverse reactions, unexpected outcomes, and when to change therapy (2017).

**Pocket Guide to Critical Care Pharmacotherapy** serves as a bedside medical reference, providing the unique element of supplying a step-by-step design that will guide clinicians in giving their patient optimal, evidence-based care (2014).
Side Effects Information

*Meyler’s Side Effects of Drugs (also called Side Effects of Drugs Annual)* lists and discusses side effects associated with drug therapy; comprehensive index referenced by drug and adverse drug reaction; updated editions published approximately every four years with yearly updates (2016).

Special Patient Populations

*CURRENT Diagnosis & Treatment Pediatrics, 23e* is an up-to-date, well-referenced guide to the diagnosis and treatment of the medical problems of children – from birth to adolescence (2016).

*Drugs in Pregnancy and Lactation* is a reference guide to fetal and neonatal risk: listing of nearly 1,200 commonly prescribed drugs taken during pregnancy and lactation, each detailed, in-depth drug monograph offers a summary of known or possible effects on mother, embryo, fetus and nursing infant. This topic is extensively reviewed in the year five Self-Paced Learning Module [Medicine 575R]) (2015).

*Drug Therapy for the Elderly* provides the practitioner with background information on the elderly population regarding their needs for particular drugs (with an eye to frailty, co-morbidity patterns, and special sensitivities regarding drug metabolism and excretion); Practical advice about drug treatment surveillance parameters in the elderly; In-depth discussion of drugs in relation to the elderly with specific diagnoses (2014).

*Fundamentals of Geriatric Pharmacotherapy* gives practitioners the information they need to improve outcomes and personalize care for elderly patients. Useful features throughout the book guide practitioners in navigating the maze of information required when caring for the older patient including: Summarized treatment guidelines, Reviews of the evidence, Special focus on recommendations for the frail elderly, Full case studies in each chapter, Clinical Pearls Key Points and Key Terms (with definitions) in each chapter (2015).

*Fundamentals of Pediatric Drug Dosing* focuses on pediatric physiology, pharmacology, pharmacokinetics and pharmacodynamics. This book illustrates the differences between the pediatric population and adults; knowledge of extreme importance not only during pediatric drug development but also in clinical practice. (2016).

*Hazzard’s Geriatric Medicine and Gerontology, 7e* is a mainstay of the rapidly developing field of geriatric medicine. Provides basic treatment information for a variety of geriatric syndromes as well as targeted information about palliative care treatments (2017).

*The MD Anderson Manual of Medical Oncology, 3e* details the personalized multidisciplinary approach to cancer management and treatment of common and rare cancers pioneered by The University of Texas MD Anderson Cancer Center. Its pragmatic presentation can provide valuable insights at any stage of your career (2016).

*Micromedex* *see Micromedex entry above

*Natural Medicines (formerly Natural Standard)* is an evidence-based database that is available from the UMKC libraries online in full text. It contains information on alternative, complementary and integrative medicine, arranged in topic monographs. It is continually updated and international in scope.
**Skeel’s Handbook of Cancer Chemotherapy** is an online reference relevant to the pharmacology and use of chemotherapeutic agents (2016).

**SECTION III: EVALUATING DRUG INFORMATION ONLINE**

This section has two sub-sections. First, it offers some reliable Internet tutorials for evaluation information and sources, and second, it addresses five questions you can use to evaluate information from the Internet. The Internet is inextricably woven into our culture as a tool for finding information, and it can provide quick access to numerous sources on medicine and drugs. As when using any information resource, the important factor in using the Internet for drug and medical information is for you to analyze whether the information source is authoritative, reliable, up-to-date, and unbiased.

Below find a couple of online tutorials for evaluating information and sources.


University of California Berkeley. *Evaluating resources*. [Online Research Guide]. Updated February 20, 2018. Retrieved from [https://guides.lib.berkeley.edu/evaluating-resources](https://guides.lib.berkeley.edu/evaluating-resources). This work is licensed under a Creative Commons Attribution-Noncommercial 4.0 License.

**When is it most appropriate to use the Internet?**

- Accessing the Internet depends on your time and need. Is it a necessity to get online to find information when opening up a particular reference book would be faster and easier?
- Do you have the computer comprehension needed to use the Internet efficiently? Will you save time looking for the information you need on the Internet?

**What technology and technology skills do you need to use the Internet?**

- Reliable broadband connections are available in urban areas of developed countries like ours, but if you are located in another setting, you may not have access to the Internet.
- Organizations, facilities and institutions can be concerned about privacy and security, and may have policies and procedures to restrict use of technology and applications.
- A person’s skill and comfort with the Internet, computer equipment, and applications takes time, training, and motivation for learning.

**In what ways is the Internet useful for finding drug and medical information?**

- If a reference to the Internet is found in an advertisement or a citation, you may already have the Internet address you need to quickly access the information described.
- When company specific information is necessary, such as information on pharmaceutical companies, Internet information is usually readily available.
- Items in the news and current event topics are rapidly available through the Internet.
- Content offered by United States government sites such as the Food and Drug Administration or the Centers for Disease Control is widely and freely available on the Internet.
• Some information, such as rare diseases, alternative medicine, vector borne diseases, or tropical diseases may be unique to the Internet, and unavailable in any print information.

What problems might be experienced in using the Internet for drug and medical information?
• Sometimes, accessing and navigating the Internet can be time consuming and restraining.
• Not all content distributed over the Internet is useful. Some of the information is advertising from pharmaceutical companies, some contains discussions of people in support groups. You must be willing to take the time to critically and judiciously review all the information that is presented.
• Many useful sites may charge a fee, or require a subscription to get the information.
• Some sites require you to register before you may use the content. You need to determine the reliability of the site, and which personal information you want to give.
• The sheer amount of information that is available on the Internet can be daunting. It may be time consuming and challenging to sort through all of the clutter to get to what you need.
• Some Internet drug information sites give incorrect information since many of the articles, reviews, and citations are not referenced. The accuracy of this information should always be questioned.
• Many patients will utilize the Internet as their primary information source. Effective communication with patients can ensure that patients understand their medical conditions and therapies. You may be in a position where you need to teach your patient about how to evaluate medical information presented on the Internet, and to explain why some can potentially be misleading, or not related to a particular patient’s condition. You can use the Internet to teach a patient about a condition, and how to stay well informed and educated.

How do you evaluate drug and medical information from the Internet?
The Internet can be an effective tool to access drug information quickly and efficiently, but you should remember that the best counterfeit looks the most like the real thing. Here are some questions you can ask to help you evaluate web sites on the Internet.

Author
✓ Is the name of the author/creator on the page?
✓ Are the author’s credentials, such as years of experience, position or education given?
✓ Is there contact information, such as an email address, somewhere on the page?
✓ What does the domain name/URL reveal about the source of the information, if anything?
✓ If the owner is not identified, what can you tell about the origin of the site from the address?

Purpose
✓ For what underlying reason did someone create the web site?
✓ Who is the intended audience? Scholarly audience or experts? General public or novices?
✓ Is the purpose of the site to inform, teach, persuade, or sell a product?

Objectivity
✓ Is the content on the web site fact, opinion, or propaganda?
Does the author’s affiliation with an institution or organization appear to bias the information?

Accuracy
- Are the factual information resources clearly listed so that the information can be verified?
- Has the information been reviewed or refereed?
- Is the information free of grammatical, spelling, or typographical errors?

Reliability and Credibility
- Why should anyone believe information from this site?
- Does the information appear to be valid, well-researched, and supported by strong scientific evidence?
- Is there a non-Web equivalent of this material that would provide a way of verifying it is legitimate?

Currency
- If timeliness of the information is important, is it kept up-to-date?
- Is there an indication of when the site was last updated?

Links
- Are links related to the topic and useful to the purpose of the site?
- Are links still current, or have they become broken?
- Are the links evaluated or annotated in any way?

Conclusion
Are you sure the Internet is where you want to be? It may take more time to find the answer to a question on the Internet than it would take to find if you used a print resource. Effectively assessing medical and drug information will enable you to provide proper care for your patients. You will develop these skills throughout your medical education at UMKC.

SECTION IV: FREELY AVAILABLE DRUG INFORMATION
Refer to the above questions in Section III when evaluating freely available drug and medical information online. The following table lists just a handful of freely available, reputable sources of drug and medical information available in app and/or Website format.

<table>
<thead>
<tr>
<th>Free Drug &amp; Medicine Mobile Apps and Websites</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>BestBETs</td>
<td><a href="http://bestbets.org/home/bets-introduction.php">http://bestbets.org/home/bets-introduction.php</a></td>
</tr>
<tr>
<td>Calculate by QxMD</td>
<td><a href="https://www.qxmd.com/apps/calculate-by-qxmd">https://www.qxmd.com/apps/calculate-by-qxmd</a></td>
</tr>
<tr>
<td>Facts and Comparisons</td>
<td><a href="http://online.factsandcomparisons.com/">http://online.factsandcomparisons.com/</a></td>
</tr>
<tr>
<td>iMedicalApps.com</td>
<td><a href="http://www.imedicalapps.com/">http://www.imedicalapps.com/</a></td>
</tr>
<tr>
<td>Merck Medicus</td>
<td><a href="http://www.merckmedicus.com/">http://www.merckmedicus.com/</a></td>
</tr>
</tbody>
</table>
SECTION V: ADDITIONAL SOURCES

Your association with colleagues, associates, and experts whom you encounter will enable you to build a network of people who have information to share with you. As with any information resource, it is your responsibility to analyze the risks and benefits of using this information, and to ascertain whether it is accurate, reliable, up-to-date, and relatively free from bias. Here are highlights of things to remember when using information from experts and other sources.

Drug Information and Poison Control Centers

- **UMKC Drug Information (DI) Center** (ph# 816-235-5490): staffed primarily by pharmacy students and instructors from the UMKC School of Pharmacy; turn-around time for response to questions is not always rapid; may want to speak with a pharmacist and not a student (must know the credentials of the person); DI center only open for a limited time period each day.

- **Missouri Poison Center at Cardinal Glennon Children's Hospital**
  Phone 1-800-222-1222. Used by the TMC Emergency Medicine Department for FAX-back information on poisonings and overdose; consultation provided by trained center staff. They provide statewide service 24 hours a day, 7 days a week.

- **University of Kansas Poison Control Center**
  Phone: 1-800-222-1222. One of the 61 poison control centers in the United States and the only one in Kansas. It is certified by the American Association of Poison Control Centers.

Expert Opinion

**Benefits**
- The expert may have great wisdom gained through many years of experience.
- Important clinical "pearls" can be obtained.

**Detriments**
- The information may be out of date.
- The expert may be biased.
• Experience may be favored over good scientific evidence.

General considerations
• Make sure the expert advice makes good medical sense and if possible can be supported by current best evidence or research data. If seeking expert advice, give the expert the full case history.
• Make sure that the expert's experience parallels your patient population.

Other Sources
Review articles from non-peer reviewed journals, referred to as "throw-aways.” These may offer good information but this information needs to be reviewed very carefully for author or organizational bias, especially those from drug company sponsored journals.

Hospital based treatment plans or clinical pathways
Although some people consider this to be "cook-book" medicine, these plans (if done well) can ensure that patients with certain problems are treated correctly and uniformly. The drug information they contain may be very specific and may be based on cost. Only use them if they conform to what is currently recommended in the medical literature.

Pharmacists
Pharmacy professionals are an excellent drug information source, especially if you develop a good working relationship with one. Make sure you know this person's background and skill level. When utilizing pharmacists for information, make sure that only a licensed pharmacist responds to your request, not a technician or student. It is also advisable to inquire which resources the pharmacist utilized to answer your request. Always know the resource from which the information was taken, and whether it is current.

Pharmaceutical companies and sales representatives.
Generally, pharmaceutical companies and their representatives mean well. However, in the business of promoting their product the information that they provide to you may be very biased. Never base a drug treatment plan solely on what is provided to you by a pharmaceutical company. Always ask that it be backed up by sound scientific evidence based on research.

SECTION VI: CLINICAL MEDICAL LIBRARIANS (CMLs)
The Health Sciences Library serves the discovery and learning needs of students, faculty, and staff in the Schools of Medicine, Nursing, and Pharmacy. UMKC Clinical Medical Librarians attend in-patient rounds as members of the docent team during the Internal Medicine Rotation. CMLs teach information literacy skills – information skills that support the curriculum competencies of the School of Medicine for students in Years 4-6, and Resident Physicians. They help the team frame clinical questions to explore in the literature. Additionally, they help the team acquire, and appraise literature, and to utilize information resources that support clinical skills, professionalism, the art of medical practice, and educational success. The opportunity to have CMLs as part of a team reinforces professional medical education views of optimal patient care as inter-professional.
SECTION VII: CONCLUSION
Remember the points below – important for you to learn, reflect upon, and practice.

1. Understand what drug information you need.
2. Go to the most accessible and convenient source first (generally a textbook or tertiary reference).
3. If more information is necessary, seek other sources (e.g., the secondary or primary literature).
4. If you still cannot answer your question, seek help from a qualified pharmacist or a medical librarian.
5. Continue to ask many drug information questions as this can only enhance your experience, expand your knowledge and most importantly, benefit your patients.
6. Never settle for poor or inadequate answers.
REFERENCES


