

FOUNDATION MODULE: RESOURCES



When answering an enquiry, you will often start with tertiary resources. When interpreting tertiary resources, be aware that the evaluation process can introduce bias, and that important details may have been missed in summarising research.

For the purposes of the module, resources have been divided into the following categories:

- General pharmacy references
- Bibliographical databases
- Drug information databases
- Internet resources.

General pharmacy resources

Almost all general references are available in electronic format, with a few still available in hardcopy.

Australian product information

Product information is a collection of information about a medicine that is required to be provided by the manufacturer or sponsor of the product for registration in Australia. It is intended to provide assistance with prescribing, dispensing and administration of medicines.

The Australian product information is available on the Therapeutic Goods Administration (TGA) website, or in a range of electronic product packages provided by MIMS or AusDI. The TGA usually has the most recent version of the product information. MIMS is available in several formats; eMIMS is updated monthly and there is an annual printed edition. MIMS and AusDI product packages may include a range of extra functions such as:

- Drug interaction checkers
- Disease management guides
- Tablet identification tools
- Consumer medicine information leaflets
- Calculators
- Search functions (e.g. gluten-free medicines, suitability of drugs in sport)
- Optional add on resources such as Don't Rush to Crush and IM Gateway.

Australian Medicines Handbook (AMH)

Published annually in hard copy and electronic format (the eAMH is updated in July each year), the AMH is a concise source of independent medicines information. It is based on best available evidence, expert opinion and consensus. Each chapter provides therapeutic information, drug class information and individual drug monographs. In addition to medicines that are registered and marketed in Australia it includes some unregistered medicines.

Therapeutic Guidelines

Therapeutic Guidelines are a collection of independent, evidence-based, consensus treatment guidelines intended to assist Australian prescribers. The guidelines include practical advice, specific treatment and management instructions and may include off-label use of medicines and unregistered medicines. The guidelines are now produced in electronic format only with the exception of the Antibiotic guidelines.

Australian Pharmaceutical Formulary and Handbook

Originally a small formulary, the APF has evolved into a reference relevant to broad aspects of pharmacy practice and academia. The formulary is still used for preparing extemporaneous products and for dispensing and advice to consumers (i.e. Cautionary and Advisory Labels). It contains limited clinical and therapeutic information, counselling guides, health information, physicochemical data and standards and guidelines. The APF is published every 3 years and available in hard copy and electronic formats, with the electronic version updated more frequently.

Martindale: The Complete Drug Reference

Published in the UK, Martindale aims to be an evaluated source of drug information for practitioners working throughout the world. It includes drug monographs, brief drug treatment and disease reviews and a useful section to help you identify overseas products. It is a good place to start if you are looking for information about unregistered drugs or 'off-label' use of drugs. It is available by online subscription through Medicines Complete or Micromedex. The electronic version is regularly updated and the hard copy is published approximately every three years.

American Hospital Formulary Service (AHFS) Drug Information

A collection of detailed monographs about most drugs available in the US, the AHFS is particularly helpful for drugs that are used more frequently in the US than in the UK or Australia. It is published annually by the American Society of Health-System Pharmacists and it is available online as AHFS Clinical Drug Information. The online version includes more drugs than the book and is updated regularly. Remember to look up drugs under their American names.

Merck Manual

This is a small encyclopedia of medicine which is useful for refreshing your memory about common disease states, or finding out about the management of more unusual conditions. It is available free online at: www.msdmanuals.com

British National Formulary (BNF & BNF-C)

The BNF is designed to be a concise, first-line reference for the prescribing, dispensing and administration of drugs for UK health professionals. May be helpful for new drugs, off-label uses and paediatrics. The BNF is published in hard copy twice a year. The BNF-C has a paediatric focus and is published annually in hard copy. Both are available via online subscription.

The Women's Pregnancy and Breastfeeding Medicines Guide

Compiled by medicines information pharmacists at The Royal Women's Hospital in Victoria, this is an Australian, independent, evidence-based practical guide to treatment options during pregnancy and breastfeeding. It is available in electronic format and includes concise patient information factsheets.

Neonatal Formulary

This is a handbook on drug use in the neonatal period. Each monograph lists the main indications and the doses for both term and pre-term babies. Helpful neonatal pharmacokinetic parameters are included where they are known.

Practical advice is given on how to administer the very small volumes that are sometimes required. Available in hard copy or ebook: <https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118819494.ch15>

Bibliographical databases

Medline and Embase are the two most comprehensive databases of medical literature. They both include the major medical journals but they have different content, so ideally they should both be searched. Access outside the public hospital or university setting may be limited. If Medline and Embase are not available, then use PubMed and TRIP. SHPA members can access Medline through the EBSCOhost interface on the SHPA website.

PubMed and TRIP are very easy to search, PubMed contains the same information as Medline. It uses keyword searches but no subheadings so it is harder to narrow down the results than with a well-constructed Medline search. TRIP contains a subset of PubMed and includes a selection of tools to assist with searching.

Taking the time to learn to search Medline and Embase effectively is well worth the investment. It will save you time and improve the quality of the information obtained.

This section cannot replace hands-on experience – experiment with as many different databases as you have available.

General tips on searching bibliographical databases

When starting a new search, don't use too many search terms. If you retrieve too many hits, you can always narrow your search.

Many databases operate using a concept called 'Boolean logic'. If you want to combine two terms in a search, you can use the Boolean operators AND, OR and NOT. For example:

- cats AND dogs will produce articles that mention both cats and dogs in the same article. This is the most commonly used Boolean term.
- cats OR dogs will produce some articles that mention cats and some articles that mention dogs and some that mention both cats and dogs.
- cats NOT dogs will produce articles that only mention cats. Articles that mention cats and dogs will not be included.

Many databases use a thesaurus which can help make your search more effective. Each article is read by an indexer, who decides what the key concepts are and assigns keywords to

the article from the thesaurus. When you search the database using your chosen keyword from the thesaurus, you will retrieve all the articles with your keyword assigned.

You may need to use US drug names and spellings if you are using an American system. For example, paediatric (pediatric), salbutamol (albuterol) Some databases will automatically convert US and UK spellings and names.

MEDLINE®

Established in 1966, Medline (Medical Literature, Analysis, and Retrieval System Online) is the US National Library of Medicine's (NLM) bibliographic database. It contains over 23 million references to journal articles in clinical sciences and biomedical research and covers over 5600 journals.

There are several different ways to access Medline. Many hospitals have access via OVID Medline.

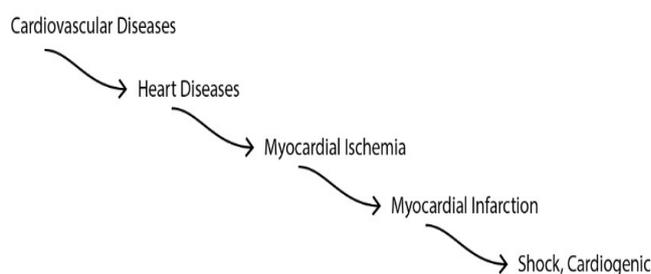
Medline does not provide the full text of a journal article; in most cases an abstract is provided. If the journal can be accessed electronically there may be a hyperlink to the relevant website; some of these may be free or may be available via your organisation's subscription. There is usually a lag-time between articles being published and being indexed in Medline.

There is no right or wrong way to search Medline. It can be searched using the thesaurus, an author's name, a journal title, or a word in the text or title of the article abstract. If you are not looking for a single specific article, use the thesaurus for the best results.

Using the Thesaurus

Using the thesaurus is essentially searching for a subject. The Medline thesaurus is called 'MeSH' which stands for Medline Subject Headings. MeSH terms are arranged into 'trees', where very broad search terms are the 'trunk' of the tree and more narrow terms are the branches and twigs.

In the example shown below 'Cardiovascular Diseases' is the broadest term and 'Shock, Cardiogenic' is the narrowest term.



Exploding Terms

If you explode a MeSH term you will include all the terms listed under your selected term in the thesaurus tree.

Using the example tree above about cardiovascular diseases; if you just want very broad articles about cardiovascular diseases, that may not mention myocardial infarction specifically, then do not explode the term. However, if you want to search for articles about

cardiovascular diseases (including those that definitely mention myocardial infarction), then you need to explode the term cardiovascular diseases. The explode facility will therefore include all the specific terms 'beneath' it in the tree hierarchy.

When the term that you select is further down the branch of a tree it will narrow your searching.

OVID Medline does not automatically explode terms for you. To explode a term using OVID you will need to tick the 'Explode' box.

If you use the PubMed version of Medline it will automatically explode your chosen term.

If you are in any doubt, always explode; you've nothing to lose because you can always limit your search later on if too many results are obtained.

Using subheadings

If your search is producing too many hits, consider using a subheading, also called a 'qualifier'. Subheadings are terms that you can add onto your MeSH term to make your search more specific (e.g. drug therapy, adverse effects, metabolism, pathology). For example you might want to add 'drug therapy' into your search about myocardial infarction to only search for articles about the drug treatment of myocardial infarction. For most versions of Medline there is a screen where you can choose to add subheadings.

Using limits

In addition to MeSH terms and subheadings, each article is tagged with a variety of terms such as the age group of the population studied, the nature of the participants (e.g. human vs. animal) and the type of article (e.g. review). If, despite adding a subheading to your search, you still have too many results, consider adding one of these 'tags' or 'limits'. If your search about the drug therapy of myocardial infarction has produced too many hits then consider adding a 'human' limit or the limit for review articles.

Focussing terms

Most Medline records have between six and fifteen MeSH terms assigned to them. Two or three of these are marked as the article's major MeSH terms, which describe the main topics of the paper. In the Medline record these terms will be marked with an asterisk. On some versions of Medline you can choose to find papers that consider your search term as one of the major topics. This process is called 'focussing'.

Supplementary concepts

There is a lag-time between the development of new drugs and their entry into the thesaurus. During this time some versions of Medline (e.g. PubMed) refer to them as 'supplementary concepts'. If the thesaurus indicates that your term is a supplementary concept, it will normally give you a 'registry number' to use instead. Alternatively you can just use your new term anyway, turn the thesaurus off and Medline will search the title or text of an article abstract for it. This is also known as a text word or keyword text search.

Combining Terms

The use of Boolean logic applies to Medline searches and you can combine MeSH headings and supplementary concepts using AND, OR and NOT.

Read the following examples and then try the exercise.

Example 1

Your oncology pharmacist asks you for help in finding recent evidence to support the use of lenalidomide in patients with multiple myeloma.

- Start by thinking about the MeSH headings you want to check in the thesaurus.
- Go to the NLM thesaurus at <http://www.ncbi.nlm.nih.gov/mesh> and enter lenalidomide. The thesaurus indicates that lenalidomide is a MeSH heading and gives a small description of the term ('scope'). By selecting the lenalidomide hyperlink it also gives a list of all the subheadings (qualifiers) that you can choose from. If you scroll further down the page you can see where lenalidomide fits into its trees.
- Now go back to the search page and enter the term for multiple myeloma. The thesaurus indicates that multiple myeloma is a MeSH heading, gives the scope and subheadings and shows where multiple myeloma fits into its tree structure.
- The subheadings for multiple myeloma include 'drug therapy'. You may want to consider adding this to narrow down your search.

So far you have two MeSH headings – lenalidomide and multiple myeloma. You also have one subheading for multiple myeloma – drug therapy.

- Now consider whether you are able to use any limits to narrow your search further. You may want to select only human studies, for example.

You have now constructed your Medline search. These will be the terms you will enter into the version of Medline that you have available to you.

Example 2

A pharmacist asks you to perform 'a quick Medline search' about the clinical trial evidence for benralizumab for uncontrolled, severe eosinophilic asthma for a committee meeting in half an hour.

As in example 1, first take time to think about your terms.

- Go to the thesaurus at <http://www.ncbi.nlm.nih.gov/mesh> and enter benralizumab. At the time of writing the thesaurus indicated that benralizumab was still a supplementary concept and not yet a MeSH heading. It gives you an entry term that you can use instead of a MeSH term. Or you can simply enter benralizumab and run a keyword or text word search.
- Now think about the disease. If you search for eosinophilic asthma you will see that there is a MeSH heading for asthma, but there is no suitable subheading. Eosinophilia is also a MeSH heading.

You can try searching for asthma/drug therapy, eosinophilia/drug therapy. Depending on how many results you get you might combine the terms. Or for a narrower search you might combine eosinophilia/drug therapy AND benralizumab.

For newly marketed drugs you may not want to add limits to your search. In this example if you get too many hits with your first search, consider adding limits for clinical trials.

Medline Exercise

Now it's your turn. Read the following enquiry and try to find the terms in the thesaurus that will enable you to perform a Medline search.

Your neurology pharmacist calls into your office to find out if peripheral neuropathy has been associated with simvastatin.

- What MeSH headings will you use?
- What subheadings, if any, will you use?
- Do you need to add limits?
- What extra information would be helpful to this search?
- What terms did you use for your search?

[Answers are available if you complete this exercise online.]

Embase®

Although less well known than Medline, in many ways Embase is better for medicines information enquiries. It includes references to over 32 million articles in 2900 indexed journals. The basic structure is similar to Medline, although search terms may differ between the two databases. The main advantages of Embase over Medline are:

- it covers a larger number of biomedical journals. In particular, it is more comprehensive for pharmaceutical, European and drug-related journals.
- the subheading and limit functions are more comprehensive; for example, you can limit searching to a specific route of drug administration.
- the thesaurus includes more drug names.

CINAHL Complete

CINAHL is the Cumulative Index of Nursing and Allied Health Literature. It provides indexing for over 5000 nursing and allied health journals. The CINAHL subject headings follow the MeSH structure, as used in Medline. The database provides abstracts or full text papers for selected journals. It is helpful for enquiries with a nursing theme, e.g. nurse prescribing, nurse-led admission clinics etc. SHPA members can access Medline through the EBSCOhost interface on the SHPA website.

PsycINFO®

PsycINFO is a bibliographic database that provides systematic coverage of the professional and academic literature in psychology and related disciplines, including medicine, psychiatry, nursing, sociology, education, pharmacology, physiology, and linguistics. PsycINFO contains coverage of articles and books.

Cochrane Library

The Cochrane Collaboration is an international organisation that aims to promote evidence-based medicine. The Cochrane Library, the Collaboration's database, is comprised of five sections, the most helpful being The Cochrane Database of Systematic Reviews and The Database of Abstracts of Reviews of Effectiveness (DARE). The Database of Systematic Reviews contains protocols and reviews prepared by the Cochrane Collaboration. DARE is composed by the NHS Centre for Reviews and Dissemination at the University of York and contains good quality systematic reviews performed by groups other than Cochrane. In Australia, access to the Cochrane Library is funded by the Federal Government.

In-house archiving databases

Many Medicines Information Services have an in-house database to archive the details of past enquiries. As enquiries are entered into the database they are usually given an individual identifying code and can be keyworded. Examples of software databases used in Australia include MiDatabank and ANDIN.

Drug information databases

Often described as point-of-care solutions or clinical decision support solutions, there are several database that provide a combination of drug and disease information databases through a single interface. Healthcare organisations usually subscribe to one or more of these products. It is important to know where the information is sourced. Most are referenced and reviewed regularly.

Micromedex®

Micromedex is an American integrated electronic suite of databases that, depending on the subscription, may include DRUGDEX, DISEASEDEX, POISINDEX, REPRORISK, Alternative Medicine, IV Compatibility and Martindale. The databases can be searched individually or all together.

DRUGDEX is a collection of comprehensive drug monographs called 'drug evaluations'. The evaluations include full text information on doses, unlicensed indications, adverse effects and drug interactions. They are structured similarly to a monograph in Martindale with references given at the end of each monograph.

Alternative Medicine is a similar format to DRUGDEX for complementary medicines.

Micromedex is focussed on drug therapy and easy to use. However it is an American product and information about indications and doses may not reflect Australian practice. Drug names and formulations may be different to what is used and available in Australia.

UpToDate®

UpToDate is an American online resource that provides evidence-based and peer-reviewed information about a wide range of medical conditions. It is popular amongst medical staff for the breadth and depth of content. Therapeutic recommendations may be different to Australian practice. It is useful for conditions not covered by the Therapeutic Guidelines.

Lexicomp Online

Lexicomp is an American integrated electronic suite of databases that, depending on the subscription, may include Lexi-Drugs Multinational, Lexi-Interact, AHFS Drug Information, Briggs Drugs in Pregnancy and Lactation, Facts & Comparisons, Martindale and Trissel's IV Compatibility. Lexicomp drug information is included in UpToDate.

DynaMed

Dynamed is similar to UpToDate in that it provides information about a range of medical conditions. DynaMed is available for free through EBSOhost to SHPA members.

Internet resources

Wikipedia, Google and other internet searches can help you find useful information, however, an internet search is not a reliable means of finding medicines information. Internet searches may be useful for:

- background information
- understanding what the public might be reading
- information about street drugs and use patterns
- availability of branded and/or foreign products
- identification of drugs and herbal products
- information or news about obscure or new treatments
- details of clinical practice in other countries.

Google Scholar is less precise than Medline and Embase and search results can be inconsistent, although it is sometimes useful for accessing full-text articles and conference abstracts.

Most search engines include an “advanced search” function that will help target your search.

Assessing quality

Although many internet sites are reliable sources of information (e.g. NPS Medicinewise), some websites containing healthcare information are poorly evaluated, inaccurate and biased. To help you assess the quality of information, always consider the following points:

- **Who are the authors?**
If the author is named, enter the name into Medline to see if they have published any work in a peer-reviewed journal.
- **Are there any references?**
Check if the information is referenced. Consider whether the information is based on fact or is an opinion.
- **Is the information current?**
Check if the information is up to date. Most webpages include the date of the last update.
- **Who owns or sponsors the site?**
Most websites include an ‘about us’ or similar tab, or at least a link to contacts. Is the site a not-for-profit (.org) or government (.gov) site and is it Australian (.au)? Is the owner or sponsor looking to make money or gain advantage from the information provided?
- **Who is the target audience?**
This should be made clear. Websites providing healthcare information to members of the public should direct them to healthcare professionals as appropriate.
- **Try to cross check the answer in another resource**
This applies to using any information resource but is particularly important with information on the internet, when you may be unsure of the quality.

Useful websites

Exercise: from each of the categories below, choose one website. Try to navigate your way around the site and make a note of the type of information included on the site.

Complementary and alternative medicine

- About herbs, botanicals and other products

Evidence-based medicine

- Cochrane Library
- NICE: National Institute for Health and Care Excellence
- Scottish Intercollegiate Guidelines Network

Government and regulatory bodies

- Therapeutic Goods Administration
- Australian Government Department of Health
- DailyMed (for US Prescribing Information)
- Electronic Medicines Compendium (for UK Summaries of Product Characteristics)
- European Medicines Agency

Other resources

There will be times when you may need to contact other information providers to help you answer an enquiry:

Poisons Information Centre (PH: 13 11 26)

This is an emergency telephone service available 24 hours a day, 7 days a week that provides advice about exposure to poisons, medicines, plants, bites and stings.

University or hospital libraries

Most hospitals have a library that is a first point of call for information. Depending on your place of work, it may be possible to access a university library.

Pharmaceutical companies

Medical information departments are most helpful for enquiries about drug storage conditions, drug supply, excipients and some administration enquiries. They can be helpful for enquiries about very new drugs when there may not be a great deal of information in the medical literature. Before you contact a medical information department, always ensure that you've checked all your resources first, especially the current Australian product information.

Colleagues

Clinical pharmacists, specialist departments and other medicines information pharmacists are a valuable resource. Specialty Practice networks such as those facilitated by SHPA are a great way to access peer knowledge and advice. Contacts at universities may also be helpful for specialised areas and research.

SEARCH STRATEGIES

A search strategy is the order in which you search information resources. It helps make sure that you use the most appropriate resources to answer the enquiry. Very simple enquiries may only require you to consult one or two resources (e.g. what is the dose of pantoprazole for a gastric ulcer?) whereas more complex enquiries may require the use of many resources (e.g. what is the dose of intrapleural gentamicin for empyema?).

Experience will help you learn which resources are most helpful for each type of enquiry. If you are working in MI, your in-house database is always a good place to start. If the enquiry has been answered recently it could save you a lot of time and energy.

It is usually appropriate to start with general resources, such as the product information, AMH, Therapeutic Guidelines, Martindale and Micromedex first.

You may not need to use Medline or Embase for relatively easy enquiries and doing so may be an unnecessary use of your time.

Search strategies can vary between individuals and workplaces depending on personal preferences and resources available.

Here is an example of a search strategy for an enquiry about enteral administration from a MI centre in an Australian hospital:

1. Product information
2. Don't Rush to Crush
3. Micromedex
4. Medline/Embase
5. Compounding pharmacist
6. APF

Knowing when to stop searching is an important skill to learn. Finish when you are absolutely certain that you haven't missed anything that would change your response, i.e. you're confident that your search has been exhaustive within the limits of the time, skills and access to resources available to you.

There is a comprehensive list of search strategies in Section 5.3 of the Medicines Information Procedure Manual.

Read the following examples and then try the exercise.

Example 1

A junior doctor calls you to ask: "Can sodium-glucose co-transporter 2 inhibitors cause hyperkalaemia?"

Firstly check:

- Australian product information
- AMH
- Specialist adverse drug reaction textbooks/databases (e.g. Meyler's Side Effects of Drugs)

If you don't find the information to answer your enquiry consider:

- Martindale
- AHFS
- DRUGDEX (in Micromedex®)

If you still haven't found enough information try:

- Medline
- Embase
- Reactions Weekly (a specialist ADR rapid-alert journal).

Recognised adverse effects for established drugs usually only require that you check first-line resources, especially if the enquirer only wants a yes or no answer. If the adverse effect is unusual, the drug is relatively new or if you need more in-depth information (such as incidence or information about management), then you may need to proceed further through your strategy.

Example 2

A paediatric oncology pharmacist calls into your office to ask you about the interaction between posaconazole and ciclosporin. There is a child on the bone marrow transplant unit who is currently on both drugs but has suffered an adverse reaction to the ciclosporin and needs to discontinue it. How will this affect the posaconazole levels, if at all?

Firstly check:

- Australian product information
- AMH
- MIMS or AusDI drug interactions

If you don't find the information to answer your enquiry consider:

- Stockley's Drug Interactions
- Top 100 drug interactions (Hansten & Horn)
- Micromedex® Drug interactions

If you still haven't found enough information try:

- Medline
- Embase.

Exercise

A gastroenterologist telephones you to ask about the safety of infliximab in pregnancy. A patient with Crohn's disease has received several doses of infliximab over the last month and has just found out she is 10 weeks pregnant.

What resources would you check first?

If you didn't find an answer, where would you look next?

And if you still needed more information?

[Answers are available if you complete this exercise online.]