NMDA321
Nutritional Physiology Research

Session 2
Nutritional Medicine Department

Asking answerable clinical questions
Session 2

- Formulating PICO questions (ASK)
- Therapy, Aetiology, Diagnosis, Prognostic questions
- Extracting searchable key terms
- Choosing and searching the databases (ACQUIRE)
- Using flow charts to report the search process
Formulating PICO questions
Formulating PICO questions

- The 5 Step EBP Process:
  - **ASK** an answerable clinical question
  - **ACQUIRE** the best evidence to answer the question
  - **APPRAISE** the evidence for quality and external validity
  - **APPLY** the results with clinical expertise and patient values/circumstances
  - **ANALYSE** or **ASSESS** the effectiveness of the process

(Hoffman et al., 2013)
Formulating PICO questions

- As clinicians, we all have needs for both background and foreground knowledge, in proportions that vary over time and that depend primarily on our experience with the particular condition at hand.

- The less we know of a condition the more we will ask background questions, perhaps related to mechanisms, clinical presentation, or pathophysiology.

- As we grow in clinical experience we will have increasing need to ask foreground questions but we are never too experienced to outlive the need for background questions.
Formulating PICO questions

- **Background Questions**
  - Ask general information about a condition or thing
  - Have two essential components:
    1. A question root (who, what, where, when, how, why) and a verb
    2. A disorder, test, treatment, or other aspect of health care
       (Fineout-Overholt & Johnston, 2005)
  - e.g. What are the complications of type 2 diabetes?

- Answers to background questions can be found in secondary or tertiary sources, such as narrative reviews, textbooks and official websites such as [Diabetes Australia](https://www.diabetesaustralia.com.au).
Formulating PICO questions

- **Foreground Questions**
  - Ask for specific knowledge to inform clinical decisions or actions
  - Generally arise from 6 aspects of clinical work:
    - Clinical evidence: how to gather clinical findings and interpret them
    - Diagnosis: how to select and interpret diagnostic tests
    - Prognosis: how to anticipate the client’s progression
    - Therapy: how to select treatments that do more good than harm
    - Prevention: how to screen and reduce risk of disease
    - Education: how to teach yourself and the patient what is needed

  (Richardson et al., 1995)

- Require systematic searching of the evidence from appropriate primary sources (research articles) to answer
Formulating PICO questions

- Foreground Questions

- Have 4 components (sometimes 5) for use in clinical decision-making, which is the PICO(T) question:
  1. **Patient/population and/or problem** – describes those relevant to your practice and clinical question (*among _____*)
  2. **Intervention** (or exposure) – therapies, environmental factors, patient education, lifestyle factors or diagnostic tests (*does ____*)
  3. **Comparison** – may be standard therapy, placebo, alternative treatment, exposure or diagnostic test (*versus ____*)
  4. **Outcomes** – disease diagnosis, improvement, remission….the outcome is important clinically and to your patient (*affect _____*)
  5. **Time** - sometimes it is important to determine a specific timeframe for the clinical question to be relevant (*how long____*)
Formulating PICO questions

- **Example:**
  
  In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?

  1. **Patient/population and/or problem** – patients with type 2 diabetes
  2. **Intervention (or exposure)** – inositol
  3. **Comparison** – metformin
  4. **Outcomes** – decrease HbA1c
  5. **Time** – one year

- **PICO(T) questions** are formulated to be answerable by searching the research literature *systematically*. 

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Formulating PICO questions

- Deciding which question to ask:
  - What is most important to your patient?
  - Which question is most feasible to answer in the available time?
  - Which question has the potential to inform the treatment plan?
  - Which question are you likely to encounter often in your practice?
  - Which question is most interesting to you?
  - Have a think about the cases you have seen in clinic…….
Therapy, Aetiology, Diagnosis, Prognostic questions
Therapy, Aetiology, Diagnosis, Prognostic questions

- Most PICO questions will fall into 4 basic categories:
  1. **Aetiology/harm** *(what is the cause or correlation with an intervention or exposure)*
  2. **Diagnosis or screening** *(what is the best method to identify disease or risk)*
  3. **Therapy** *(what intervention or treatment is most effective to achieve a specific outcome)*
  4. **Prognosis or prevention** *(what is the likelihood of disease occurrence or progression)*

- We might also want to ask a question about patient experience which demands qualitative research but this will not be covered in NMDA321

(Sackett & Wennberg, 1997)
Therapy, Aetiology, Diagnosis, Prognostic questions

Examples:

1. **Aetiology/harm**: Do adults who binge drink compared to those who don’t have higher mortality rates?

2. **Diagnosis or screening**: For deep vein thrombosis is D-dimer testing or ultrasound more accurate for diagnosis?

3. **Therapy**: In patients with osteoarthritis of the knee is hydrotherapy more effective than physiotherapy in relieving pain?

4. **Prognosis or prevention**: In obese children does the use of community recreation activities compared to educational programs on lifestyle change reduce the risk of type 2 diabetes?

(University of Canberra, 2018)
Therapy, Aetiology, Diagnosis, Prognostic questions

- There are appropriate study designs to answer each type of clinical question.

Start with the highest level of evidence that can answer your question and if none exists, move to a lower level.

(Georgetown University, 2019)
Therapy, Aetiology, Diagnosis, Prognostic questions

<table>
<thead>
<tr>
<th>Type of Question</th>
<th>Type of Study/Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapy/Treatment</td>
<td>Double-Blinded RCT, Quasi-experimental (non-randomised controlled trial)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>RCT, Controlled Trial, Cross-sectional</td>
</tr>
<tr>
<td>Aetiology/harm</td>
<td>Cohort Studies, Case Control</td>
</tr>
<tr>
<td>Prognosis</td>
<td>Cohort Studies, Case Control, Case Series</td>
</tr>
<tr>
<td>Prevention</td>
<td>RCT, Cohort Studies</td>
</tr>
</tbody>
</table>

(Adapted from Sackett et al., 2000)
Extracting searchable key terms
Extracting searchable key terms

**Example:** *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?*

- Write down the keywords from your PICO(T) question and some common synonyms next to each:

<table>
<thead>
<tr>
<th>PICO</th>
<th>Keyword</th>
<th>Synonyms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient/Problem</td>
<td>Type 2 diabetes</td>
<td>T2DM, diabetes, diabetes mellitus</td>
</tr>
<tr>
<td>Intervention</td>
<td>inositol</td>
<td>myo-inositol, d-chiro-inositol</td>
</tr>
<tr>
<td>Comparison</td>
<td>metformin</td>
<td>metformin</td>
</tr>
<tr>
<td>Outcome</td>
<td>HbA1c</td>
<td>glycated hemoglobin, glycated haemoglobin</td>
</tr>
<tr>
<td>Time</td>
<td>1 year</td>
<td>12 months</td>
</tr>
</tbody>
</table>
Extracting searchable key terms

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?

- Next identify what type of clinical question you are asking – our example is a therapy question
- You may be able to eliminate some parts of the PICO(T) question if they are not relevant to the question or if this will narrow your search results too much
  - Prognosis (usually) and prevalence (always) questions do not have a comparison
  - Time may not be relevant or searchable (may be more important for screening and diagnosis questions)
  - Often the outcome is not important to search as it narrows your results although it is still important in your appraisal of the studies
Choosing and searching the databases
Choosing and searching the databases

○ The 5 Step EBP Process:
  • **ASK** an answerable clinical question
  • **ACQUIRE** the best evidence to answer the question
  • **APPRaise** the evidence for quality and external validity
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(Hoffman et al., 2013)
Choosing the databases

**Example:** *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?*

- The next step is to choose the appropriate databases to search
  - MEDLINE – US National Library of Medicine database of indexed citations and abstracts to medical, nursing, dental, veterinary, health care, and preclinical science peer-reviewed journal articles
  - CINAHL – Cumulative Index to Nursing and Allied Health Literature
  - AMED – Allied and Complementary Medicine Database
  - PsychINFO – American Psychological Association’s database of peer-reviewed literature in behavioural and mental health
Choosing the databases

- More databases……..

  - ScienceDirect – database of peer-reviewed journals, articles, book chapters and open access content covering physical sciences and engineering, life sciences, health sciences, social sciences and humanities
  - There are many more subject-specific databases (not all are free)
  - Don’t forget to ask the librarians if you are unsure which to choose

- We will be using PubMed in this session:
  - Provides free access to MEDLINE plus related medical literature
  - Most used search engine in medical and health sciences
  - All content is peer-reviewed
  - The best and most current database for nutrition-related content
  - You will be expected to use PubMed plus one other database to search the evidence for your assessments in NMDA321
Searching the databases

**Example:** *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?*

- Use the table you have constructed with your search terms to conduct a **systematic search** of the literature
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?

Click 'clear history' if this box appears
Searching the databases

Example: *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c after 1 year?*

- In some medical databases you can search for **MeSH terms** (Medical Subject Headings) which are commonly indexed terms in medical and health science literature
- We will be using MeSH terms along with ‘free’ terms in PubMed to capture all relevant literature
- We will be using the **clinical queries** function to focus the search results to appropriate study designs
- We will be eliminating the Time term from the search
- It is important to search *systematically* through the PICO terms, starting with **P** to capture all relevant literature
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

1. Select ‘MeSH Database’ from drop-down menu

2. Type the P term in the search box and click ‘Search’
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

Select the most appropriate MeSH term

Click ‘Add to search builder’ and ‘Search PubMed’
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

There are 120,407 hits. Click “Advanced” to view your search history.
Searching the databases

**Example:** In patients with *type 2 diabetes*, is inositol versus metformin more effective in decreasing HbA1c?

Select ‘Clinical Queries’ from the drop-down box

Note the Search history #
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

- You only need to use the clinical queries function once in your search
- Always use it after entering the MeSH term
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

Select the correct Clinical Study Category from the drop-down box. Keep the Scope 'Broad'.

Click ‘See all’
Searching the databases

**Example:** In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

Click 'Advanced' to see your search history.

Now click 'PubMed Home' to enter the 'free term'.

Here is your search history.
Searching the databases

Example: In patients with **type 2 diabetes**, is inositol versus metformin more effective in decreasing HbA1c?

There are 162,282 hits. Click on ‘Advanced’ to add it to your search history.
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

Click 'Search'

Now we can combine all the P terms with OR. Select #2 + 'OR in builder' and #4 + 'OR in builder' and #5 + 'OR in builder'.
Searching the databases

**Example:** In patients with *type 2 diabetes*, is inositol versus metformin more effective in decreasing HbA1c?

Click 'Advanced'

Here is the combined result of the P search terms – 162,460 hits
Searching the databases

Example: *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?*

- Now we search for the **I** term in ‘MeSH Database’ under ‘More Resources’ and repeat the process as above
- Combine the MeSH term and the free terms with **OR**
- Do this *systematically* for each applicable PICO term
- No need to repeat the Clinical Queries step after **P**
- Do this now for **I** (inositol), **C** (metformin), and **O** (HbA1c)
- Do NOT combine any terms with **AND** until you have searched all the PICO terms you need
Searching the databases

Example: *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?*

- If you make a mistake and need to delete a step, click the search # and ‘Delete from history’
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?

- Combine the OR terms with ‘AND in builder’ at the last step
- For our search this is #6 AND #12 AND #16 AND #20 AND
- Click ‘Search’ to see the combined results
Searching the databases

Example: In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?
Searching the databases

**Example:** In patients with **type 2 diabetes**, is **inositol** versus **metformin** more effective in decreasing **HbA1c**?

- We only have 6 results which may suggest the search parameters are too narrow (we used too many PICO terms), or there may not be a substantial body of clinical research on the topic – common for holistic therapies.

- Click on the number under ‘Items found’ to see the papers
Searching the databases

Example: *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?*

- If the parameters are too narrow to capture your topic of interest, try eliminating one PICO term
- Combine just (**P AND I AND C**) or just (**P AND I AND O**)
- You will always need **P** (Patient, Population, Problem) and **I** (Intervention or Exposure) in your search
- Aim for around 50-100 final search results
- In this search, the inclusion of metformin brought many irrelevant results for our topic of interest so we will exclude the **C** (Comparator)
Searching the databases

**Example:** *In patients with type 2 diabetes, is inositol versus metformin more effective in decreasing HbA1c?*

<table>
<thead>
<tr>
<th>Search</th>
<th>Add to builder</th>
<th>Query</th>
<th>Items found</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>#22</td>
<td>Add</td>
<td>Search (((&quot;Diabetes Mellitus, Type 2&quot;[Mesh]) OR ((Therapy/Broad[filter]) AND (diabetes mellitus type 2)) OR type 2 diabetes)) AND (((&quot;Inositol&quot;[Mesh]) OR inositol) OR myo-inositol) OR d-chiro-inositol) AND (((&quot;Glycated Hemoglobin A&quot;[Mesh]) OR HbA1c) AND Search (((&quot;Diabetes Mellitus, Type 2&quot;[Mesh]) OR ((Therapy/Broad[filter]) AND (diabetes mellitus type 2)) OR type 2 diabetes)) AND (((&quot;Inositol&quot;[Mesh]) OR inositol) OR myo-inositol) OR d-chiro-inositol) AND (((&quot;Metformin&quot;[Mesh]) OR metformin)) AND (((&quot;Glycated Hemoglobin A&quot;[Mesh]) OR HbA1c)</td>
<td>65</td>
<td>03:10:15</td>
</tr>
</tbody>
</table>

- Now we have 65 results
- We have already focused our search to articles about treatment (Therapy Clinical Queries) but we may need to apply further filters
Searching the databases

- On the left column of the results page are filters
- Select relevant filters one at a time and check the number of results
- Always tick ‘Humans’ for clinical questions (untick ‘Other Animals’)
- Check the results after applying each filter
- Here we have further narrowed the results to 58 after filtering to humans
- You can filter the year of publication and check the article types also
Searching the databases

- When you have the final number of papers you want to review for relevance to your PICO question:
  - Take a screen shot of the final search 'syntax' and save it to a word document (see slide 42) so you can easily repeat the process.
  - You will need to submit your final search syntax from each database searched with your assessments for NMDA321.
  - Import your results to Mendeley software.
  - Only one page of results will be imported at a time (20 items by default) so remember to go back to the results and scroll to the next page until you have imported all the results from your search.
  - Here is a demonstration of how to import results from PubMed to Mendeley: [https://www.youtube.com/watch?v=YsvlYnzm3RU](https://www.youtube.com/watch?v=YsvlYnzm3RU)
Using flowcharts to report the search process
Reporting the search process

- For your assessment in NMDA321 you are required to search PubMed plus one other database.
- In this session you will receive a library tutorial demonstrating the search process on another database.
- Here are some useful demonstrations for searching databases:
  - ScienceDirect advanced search tutorial: https://service.elsevier.com/app/answers/detail/a_id/25959/supporthub/sciencedirect/~/performing-an-advanced-search-tutorial/
  - EBSCO Discovery training: https://www.youtube.com/watch?v=YjZp-2d2-nY&feature=youtu.be
  - N.B. Not all databases use MeSH terms or restrict to peer-reviewed literature only – choose carefully.
Reporting the search process

- Import the results from each database search into a folder in Mendeley dedicated to your task (NMDA321 assignment)
- Once you have saved the results to Mendeley you can remove any duplicated records:

  ![Removing Duplicates](https://researchguides.library.tufts.edu/mendeley)

  To check for duplicate references in your Mendeley library, select All Documents in the left-hand panel. Then, select Tools > Check for Duplicates from the menu bar.

  A list of duplicate references will be displayed. Review the references and choose the details that you would like to keep from each reference by selecting the check box next to each field. Once you have reviewed all the field, click the Merge Documents button.

- Keep a record of how many results are eliminated after removing duplicates
Reporting the search process

- Now you can start reading the titles and abstracts to exclude papers that are not relevant to your PICO question.
- When you find a systematic review (SR) or meta-analysis (MA) relevant to your topic (or a narrative review but this is lower quality evidence), read the full text to understand what is already known and what gaps remain in the research evidence – this will help you to write the background rationale (Assessment 1).
- Save the SR/MA but exclude them from your final papers.
- If there are original research papers included in the SR/MA that do not appear in your search results, search for them and add them to the results in Mendeley.
Reporting the search process

- Keep a record of how many articles are *excluded with reasons* and how many are *added* from searching other sources (e.g. SR/MA, reference lists, grey literature such as theses).

- It is accepted practice to report the search process in a **flow diagram** when you write up your results.

- There is a template for this purpose available from **PRISMA** (Preferred Reporting of Systematic Reviews and Meta-Analyses).

- Download it from here:  

- We will look at SR, MA and PRISMA in session 5.
Reporting the search process

- Here is a flowchart of our search so far:

  - Add the other database search results here
  - Papers left after screening titles and abstracts
  - These are the final papers you will appraise
  - Add additional papers from reference lists etc. here
  - Final number of records after removing duplicates
  - SR/MA, wrong study design, irrelevant papers etc.

- Note you will only be performing a *qualitative* synthesis of the evidence – a *quantitative* synthesis is an original data analysis performed in meta-analyses (more in session 5)
Reporting the search process

- Now you have learned how to formulate a PICO question, extract the search terms, search the databases systematically for relevant evidence and report the search process in a PRISMA flowchart

- Once you have located previous reviews on your topic, use them to write the background rationale for the literature review: *what is known & what is not yet known*

- This is your task for **Assessment 1: Research Question and Rationale**

- It seems laborious at first but it gets easier with practice

- Time to practice!

- Next session: **APPRAISE** the evidence
References


5 steps of EBP


References


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