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Methods for reviewing large bodies of evidence

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Ariennir gan Lywodraeth Cymru
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Overview of workshop

- Introduce some of the methods that can be used for reviewing large bodies of evidence
- Methods used for conducting a recent review of prognostic factor for lung cancer survival (presented as an example)
- Group work – think about how you would approach reviewing a large body of evidence using a series of scenarios (examples of review questions)
- Discussion/feedback session

(A bibliography, including list of references, is provided as a handout)

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Systematic review (SR) – gold standard

- Systematic reviews provide a **comprehensive, rigorous, and transparent** synthesis of the evidence to inform clinical practice.
- Use standardised and empirically tested methods to minimise systematic error (bias) and random error (chance).
- Primarily used to assess the effectiveness of interventions ('what works?')
- Methods have also been adapted to address a range of questions, e.g.
  - What is the cost-effectiveness?
  - What is the extent of the problem?
  - What affects take-up and adherence?
  - What are the risk factors?

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Essential elements of a SR of 'what works?'

- Clearly framed research question
- Detailed protocol
- Exhaustive search using explicit search criteria and multiple databases
- Pre-defined eligibility criteria
- Explicit and reproducible methodology
- Systematic presentation of the characteristics of included studies
- Assessment for the validity of the findings of the included studies
- Formal synthesis of study findings using pre-defined and explicit methods
    - Narrative synthesis +/- meta-analysis

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Systematic review methods

Stage 1: *Defining the scope and research question* (eligibility criteria for PICOs) and developing protocol

Stage 2: *Searching* the literature

Stage 3: *Identifying* eligible studies
- screening titles and abstracts
- retrieval of full papers
- screening full papers

Stage 4: *Extracting data* for key characterises and results of included study

Stage 5: *Assessing quality* of included studies (risk of bias)

Stage 6: *Analysing and synthesising* the data (structured tables, meta-analysis)

Stage 7: Interpreting the findings

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Limitations of systematic reviews

- Time consuming and resource intensive
- Limited in scope - aim to answer a specific question
- What if the decision problem that needs an answer relates to:
  - large volume of research
  - broad topic area
  - diverse and complicated body of evidence
  - multiple relevant questions
  - complex intervention (variation - frequency, duration, degree, engagement, fidelity of delivery)
- Requires robust methods to provide confidence in the findings

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Approaches used to review large bodes of evidence

- Narrow the scope of a review
  - Could be missing key areas of importance in the broader evidence base.
  - Difficult to develop a focused question for messy data, or a complex evidence base
- Overview of existing reviews
- Mapping review
- Scoping review
- Systematic mapping or scoping review can help to identify, or prioritise, a focused review question
- Should not be used as an alternative to investing the time and effort required to develop a specific review for a SR

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Overview of reviews

- Also called: review of reviews, umbrella reviews
- Systematic review of existing reviews, evidence synthesis, or meta-analysis
- Various approaches for using/integrating existing reviews within a SR
- Different levels for which data from existing reviews are used (Robinson, 2014):

i. list of included studies (scanning references - quality check)
ii. existing searches (identify body of evidence)
iii. existing data abstraction, study-level risk of bias assessments and/or synthesis
iv. complete review including conclusions

Time / resources required decreases, but so does the depth of analysis

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Mapping reviews

- Also called systematic mapping review, evidence map, evidence gap maps etc.
- A mapping review is a classification and description of the available evidence (experimental, observational, economic, qualitative etc.) relating to a topic or question of interest
- Used to identify what evidence there is; not what the evidence says
- No agreed definition or standard methods

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Mapping reviews – method development

- EPPI-Centre (systematic map)
  - First mapping review published in 1996 (Peersman)
- SCIE (systematic map)
  - *Social Care Institute for Excellence;* use same approach as EPPI (2006)
- 3ie (evidence gap map)
  - *International Initiative for Impact Evaluation* (first map - Gaarder, 2010)
- CEE (systematic map)
  - *Collaboration for Environmental Evidence Based;* use SCIE approach (James, 2016 – description of method)
- Campbell Collaboration (evidence and gap maps, EGMs)
  - Recent review of methods (Saran & White, 2018) to inform their guidance

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Mapping reviews – recent definitions

- 'An *evidence map* is a systematic search of a broad field to identify gaps in knowledge and/or future research needs that presents results in a user-friendly format, often a visual figure or graph, or a searchable database' (Miake-Lye, 2016)
- 'An evidence and gap map is a systematic [visual] presentation of the availability of relevant evidence [of effects] for a particular policy domain. The evidence is identified by a search following a pre-specified, published search protocol.' (Saran & White, 2018, included a review of definitions)
- Intended users also key (demand rather than supply-driven)

Miake-Lye, I.M., Hempel, S., Shanman, R. et al. What is an evidence map? A systematic review of published evidence maps and their definitions, methods, and products. Syst Rev 5, 28 (2016)

Saran A, White H. Evidence and gap maps: a comparison of different approaches. Methods research paper. 2018 https://doi.org/10.4073/cmdp.2018

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Systematic map method

Stage 1: Defining the *scope and question*, engaging with stakeholders, and developing protocol [broader than SR]

Stage 2: *Searching* for evidence (exhaustive search using explicit criteria) [same as SR]

Stage 3: *Screening* – assessing eligibility (pre-specified criteria, multiple independent reviewers) [same as SR]

Stage 4: *Extracting data* using coding / 'keywording' (developing a searchable database) [simpler, less detail]

Stage 5: *Critical appraisal* [optional]

Stage 6: *Describing and visualising* the findings [analysis simpler]
(No synthesis of study results)

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Mapping review - indications

- Inform research priorities and funding
- Describe nature, characteristics and volume of research in a particular area
- Inform systematic review planning or conduct of a synthesis
- Identify research gaps
- Inform policy and practice

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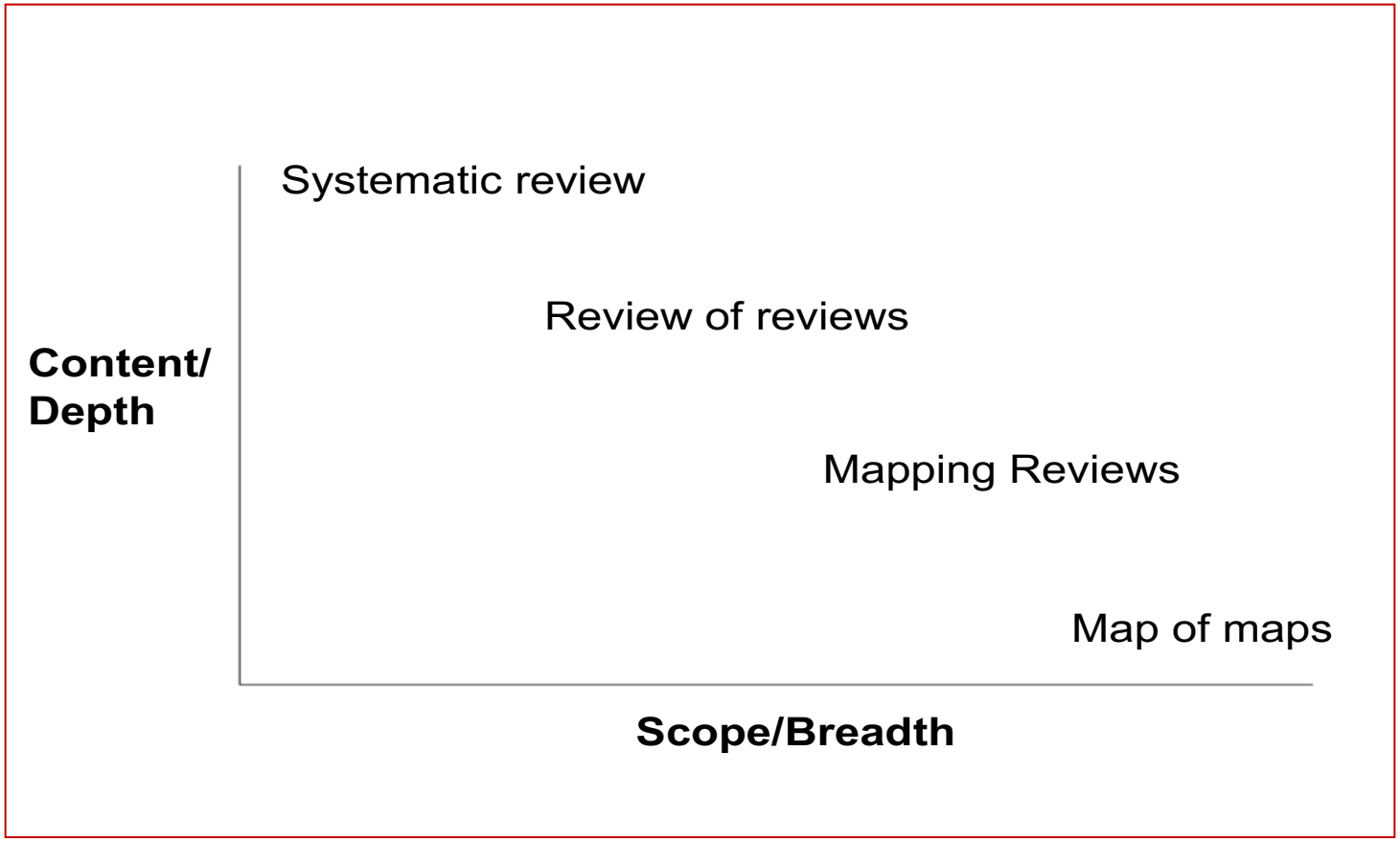
Scope and content of different reviewing approaches



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Scoping review – method development

- First developed by Arksey and O'Malley (2005)
  - 5 Staged methodological framework
- Framework adapted by Levac et al (2010)
  - 6th stage – consultation with stakeholders
- Further enhanced by Daudt et al (2013)
- Further enhanced by Peters et al (2016)
  - to develop the approach used by Joanna Briggs Institute (JBI)
- Reporting guidance developed by Tricco et al (2018) (PRISMA-ScR)
  - Informed by scoping review of scoping reviews (Tricco, 2016)

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Scoping review definitions

- Defined as a systematic approach to map evidence on a topic and identify main concepts, theories, sources, and knowledge gaps (Arksey and O'Malley, 2005)
- Recently described as 'A form of knowledge synthesis that addresses an exploratory research question aimed at mapping key concepts, types of evidence, and gaps in research related to a de-fined area or field by systematically searching, selecting, and synthesizing existing knowledge' (Colquhoun, 2014)
- 'Scoping review' also used to describe a pilot exercise to cost or gauge the potential size of a future systematic review

Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19–32

Colquhoun HL, Levac D, O'Brien KK, et al. Scoping reviews: time for clarity in definition, methods, and reporting. J Clin Epidemiol. 2014;67(12):1291–4.

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Scoping review - indications

Conducted to meet various objectives:

- To identify the types of available evidence in a given field
- To clarify key concepts/ definitions in the literature
- To identify key characteristics or factors related to a concept
- To examine how research is conducted on a certain topic or field
- As a precursor to a systematic review
- To identify and analyse knowledge gaps

Identified by Munn Z, Peters M, Stern C, et al. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMC Medical Research Methodology. 2018 18(1):43

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Scoping review method

Stage 1: *Identifying research question* by clarifying and linking question with purpose

Stage 2: *Identifying relevant studies* by balancing feasibility with breadth and comprehensiveness

Stage 3: *Selecting studies* using an iterative approach

Stage 4: *Extracting data* incorporating numerical summary and qualitative thematic analysis

Stage 5: *Summarising and reporting* results including the implications for policy, practice or research

Stage 6: *Consultation exercise* (optional step)

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EXAMPLE:

Systematic mapping review and overview of systematic reviews of prognostic factors for lung cancer survival

Aim:

To identify prognostic factors consistently shown to be associated with lung cancer survival in published literature, and determine which factors may be modifiable and could be targeted to improve outcomes

Lewis R, Hendry M, Din N, et al. Pragmatic methods for reviewing exceptionally large bodies of evidence: systematic mapping review and overview of systematic reviews using lung cancer survival as an exemplar. Syst Rev. 2019 Jul 16;8(1):171.

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Background

Purpose:

- To inform the development of multivariate modelling of Welsh data proposed by the Welsh Cancer Intelligence & Surveillance Unit (WCISU).

Funding:

- Public Health Wales (PHW)
- 2 consecutive 9 month periods

Stakeholders:

- Director of WCISU (Consultant in Public health)
- Consultant Respiratory Physician

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What is a prognostic factor?

- Any measure that is associated with the risk of future health outcomes in those with existing disease
  - socio-demographic factors, patient characteristics, health seeking behaviours, health service factors, and clinical characteristics
- potential value dependent on availability of consistent evidence of its prognostic ability across multiple studies

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Prognostic research

- Four types of prognosis studies can be identified
- Summarised as four inter-related research themes in the PROGRESS partnership series:
  - Theme 1: overall prognosis
  - Theme 2: prognostic factors (independent effect of PFs)
  - Theme 3: prognostic models (combined effect of multiple factors)
  - Theme 4: predictors of treatment effect (also called predictive factors, or treatment selection factors)

PROGnosis RESearch Strategy (PROGRESS) partnership (http://progress-partnership.org/)

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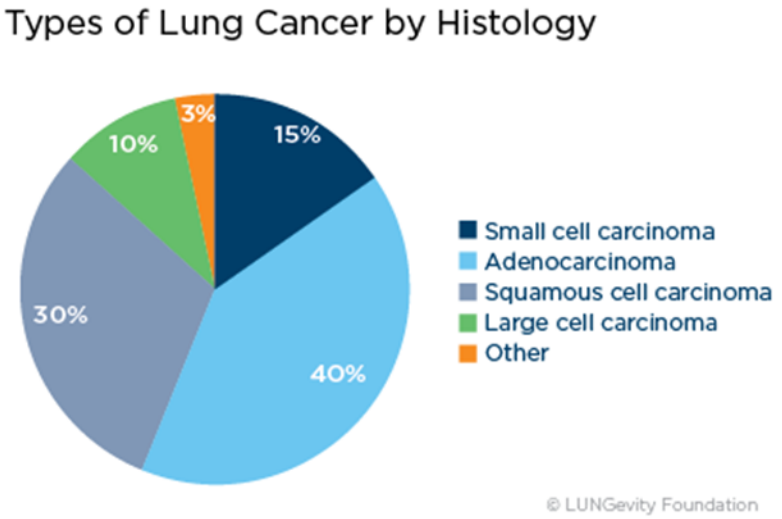
Main challenges for the review

- Large, diverse and complicated body of evidence
- Covering all prognostic research – studies with broad range of aims and objectives
- Large volume of LC prognostic research – hundreds of prognostic factors identified (increasing exponentially)
- Multiple existing SRs and MA
- Lung cancer – different histology types



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Choosing a reviewing approach

We needed a reviewing approach that enabled:

- Identify all relevant PFs and develop a summary of the evidence underpinning them in an efficient and timely manner
  - identify significant factors consistently found to be associated with LC survival
  - potentially modifiable factors
- Based on a review existing reviews
  - new systematic review not required or feasible
- To maintain stakeholder input throughout the project
  - obtain ongoing feedback on relevancy of PFs
- To provide WCISU with preliminary findings during the project

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Staged reviewing approach

STAGE 1 — **Mapping review** of prognostic research (based on titles and abstracts only)

STAGE 2 — **Overview of reviews** of prognostic factor research (full text)

STAGE 3 — A more in-depth evaluation of **modifiable factors**

Supported my monthly meetings with the stakeholders; progress report submitted at end of each stage

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Systematic literature search

- MEDLINE, EMBASE, Cochrane Library, and Web of Science
- Search strategy: published strategy for prognostic factors plus search filter for systematic reviews and meta-analyses
- 1990 onwards
- No limits on publication type or language

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Stage 1: Mapping review

Aim: to develop a descriptive map of the prognostic research and a comprehensive list of prognostic factors investigated

Inclusion criteria for the mapping review:

- Any prognostic factor for lung cancer survival
- Any prognostic research (PROGRESS theme 1-4)
- Any lung cancer type
- Published as an abstract or full paper
- Any language
- Review or meta-analysis

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Stage 1: Mapping review

Coding and data extraction:

- Classification/coding of key features:
  - PROGRESS research themes 1-4
  - lung cancer type
  - publication type (full/abstract)
  - Review method (SR/MA)
- Number and type of prognostic factors investigated

No quality appraisal

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Mapping review output

- Descriptive map – report to stakeholders
- Database for identifying relevant studies for overview of reviews (stage 2-3)
  - Maintain transparency
- List of prognostic factors used to:
  - develop a prognostic factor coding scheme for stage 2
  - identify potentially modifiable factors for stage 3 (by 2 independent stakeholders)

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Stage 2-3: Overview of reviews

Aim: to identify important factors and develop a summary of the evidence underpinning them

Inclusion criteria:

- Any prognostic factor for lung cancer survival
- Prognostic factor research (PROGRESS Theme 2)
- Published in full
- Published in English
- Systematic review (4 essential criteria for SRs)
- Reported separate data for LC subtypes

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Stage 2: Overview of prognostic factor research

Data extraction:

- Existing coding checked (full paper)
- Summary of key data and additional coding
  - Search dates, aims, descriptor of prognostic factors, type of analysis etc.
- Findings for individual PFs:
  - Statistical significance
  - Direction of association

Quality appraisal:

- Using 8 essential criteria of a SR

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Stage 3: Data extraction and quality appraisal

Data extraction:

- More in-depth evaluation of the results
  - Summary of the magnitude of the effect (effect size)
  - Confidence intervals

Quality appraisal:

- AMSTAR checklist

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Overall findings

- Large volume of published SRs & MA, but few focused on modifiable factors
  - 398 reviews or meta-analysis of prognostic research
  - 207 SRs investigating the independent effect of PF on lung cancer survival.
  - 20 reviews investigating modifiable factors
- Most frequently evaluated factors were novel biomarkers
  - 86 biomarkers in 138 reviews
- 15 modifiable factors identified

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Challenge of conducting an overview of reviews

- Large number of existing reviews
- Variation in reviewing methods
  - Including searching, data extraction, quality appraisal and synthesising the evidence
- Large variability among prognosis studies within reviews (primary studies)
  - e.g. number and type of PFs investigated, selected populations, definition of predictors and outcomes, methods used to measure PFs, type and no. of variables adjusted for in the analyses.
- Multiple reviews likely to include same primary studies
- Missing prognostic factors not evaluated by existing reviews

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Advantages of the overall approach

- Novel approach for reviewing an extensive and complicated body of research evidence
- Enabled us to address a broad research question and focus on a specific area of priority
- Staged approach ensured the review remained relevant to the stakeholders throughout, whilst maintaining the use of objective and transparent methods
- Provided important information on the needs of future research
- Can be extended – 4th stage: SR of primary studies

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Disadvantages of the overall approach

- Required extensive planning, management, and ongoing reviewer training
- Needs experienced reviewers
- Difficult to accurately code studies based on titles and abstracts in stage 1 (mapping review)
- Lacked in-depth evaluation of primary studies in stage 2
- Not able to account (or measure) the overlap between reviews (same studies in multiple reviews)

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Conclusions

- There is no one method that fits all, and the right method depends on your review question, data type, and why and for whom you're doing the review
- All evidence synthesis should use the most efficient approach, whilst maintaining a comprehensive, rigorous, and reliable approach
- Transparency is also essential, and the limitations of the review need to be clearly reported, particularly in terms of the potential bias or shortcomings of the conclusions

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GROUP EXERCISE: