

Advanced Information Retrieval on the Edge Living Systematic Reviews

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AGENDA

- 8:40-9:00 PRESENTATION 1: Introduction to living systematic reviews (LSRs)
- 9:00-9:15 PRESENTATION 2: LSR searching
- 9:15-9:25 GROUP ACTIVITY 1: LSR planning exercise
- 9:25-9:40 PRESENTATION 3: LSR search: assessment and maintenance
- 9:40-10:00 GROUP ACTIVITY 2: Data analysis
- 10:00-10:30 BREAK
- 10:30-11:00 PRESENTATION 4: LSR enablers
- 11:00-11:30 GROUP ACTIVITY 3: Discussion and presentations





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Disclosures

- We are all members of the Living Systematic Review network
- We are all involved in either developing and/or evaluating the methods and tools to support LSR search methods
- James Thomas is responsible for the RCT Classifier
- Anna Noel-Storr is responsible for Cochrane Crowd















Presentation 1

Introduction to Living Systematic Reviews

Steve McDonald *Information Specialist, Cochrane Australia Monash University, Australia*



The review currency challenge

- Burgeoning volume of primary evidence
- Reviews take long time to produce (mean 20 months)
- Can be out of date on publication
- Updating a review not dissimilar from starting again
- Even with explicit updating commitment; difficult to maintain up-to-date review portfolio











Breaking the health evidence trade-off



• New updating model: to achieve greater currency and retain accuracy, with similar workload



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What is a living systematic review?

We define an LSR as a systematic review that is continually updated, incorporating relevant new evidence as it becomes available. In practice, this means <u>continual</u> <u>surveillance</u> for new research evidence through ongoing or frequent searches and the <u>inclusion of relevant new</u> information into the review in a <u>timely manner</u> so that the findings of the systematic review remain current.

Elliott et al. 2014 PLoS Med











When to consider an LSR

- The review question is a priority for decision making
- Certainty in the existing evidence is low or very low
- ✓ There is likely to be new research evidence
- For the LSR pilots: sufficient capacity and resources within the author and editorial teams to maintain an LSR











Features of Cochrane LSR approach

- Applies to any review type (e.g. RCTs, qualitative)
- Retains core systematic review methods
- LSR-specific methods pre-specified in protocol
- Explicit and a priori commitment to frequent search and updating
- Starts with a standard 'baseline' review
- Monthly Searches

() Cochrane

• Tell reader 'what's happening' monthly

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• Republish the review, informed by the evidence

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Process and LSR-specific methods



- Searching
 - Specify frequency of all sources (databases, trial registers, etc.)
- Screening
 - Should match search frequency; may use 'enablers' (Classifiers, Crowd)
- Data synthesis
 - Incorporate new evidence immediately OR use decision rules to delay
- Other
 - Methods and searches reviewed over time

LSR production model







Example Cochrane LSR

Interventions for increasing fruit and vegetable consumption in children aged five years and under (Review)

Hodder RK, Stacey FG, Wyse RJ, O'Brien KM, Clinton-McHarg T, Tzelepis F, Nathan NK, James EL, Bartlem KM, Sutherland R, Robson E, Yoong SL, Wolfenden L

What's new

() Cochrane

Cochrane Library

Cochrane Database of Systematic Reviews

• Baseline review Sep 2017: 50 trials

- 1st LSR published Jan 2018: 5 new
- 2nd LSR published May 2018: 8 new

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OXFORD

• 3rd LSR expected Jul 2018: 3 new

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Date	Event	Description
26 March 2018	Amended	This is a Living Systematic Review. Searches are run and screened monthly. Searches run up to 25 January 2018 identified 10 new studies and 4 ongoing studies. These studies are currently being incorporated in the review (expectation publication in May 2018). In addition, the team continues with monthly screening (last search date 25 February 2018) and has found an additional 2 new studies to be included in a future update.

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Evaluation of pilot LSRs

Aims

- Explore feasibility, and implications for contributors, processes and workflows
- Identify opportunities to improve the LSR model(s)

Participants

- Author teams, editorial staff, peer reviewers
- Cochrane and non-Cochrane

Data collection

• 3 x interviews and monthly surveys

Results

• Available September 2018



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Resources



Home > Review production > Production resources > Living systematic reviews

Visit Project Transform

News

Now 4 living systematic reviews on the Cochrane Library

1 living systematic review re-published

Living systematic review series published in Journal of Clinical Epidemiology

- What is a living systematic review?
- Why living systematic reviews?
- Living systematic review pilots
- Living systematic reviews interim guidance for pilots
- Other LSR Resources
- LSR News
- LSR Network

Living systematic review

JOURNAL OF CLINICAL EPIDEMIOLOGY

A systematic review that is continually updated, incorporating relevant new evidence as it becomes available.

cochrane.org/lsr

DOC 200+ LSR NETWORK MEMBERS

LSRs PUBLISHED ON COCHRANE LIBRARY

LSR GUIDANCE PUBLISHED LSR PROTOCOL APPROVED

Series published Sep 2017

- 1. Introduction why, what, when, how
- 2. Combining human and machine effort
- 3. Statistical methods for updating M-As
- 4. Living guideline recommendations

Cochrane Living Systematic Reviews

Interim guidance for pilots (Version 0.3, 21 April 2017)

cochrane.org/lsr



Presentation 2 LSR Searching

Robin Featherstone

Information Specialist, Alberta Research Centre for Health Evidence (ARCHE), Cochrane Child Health



Created by Laymik from Noun Project





LSR Challenges for Information Specialists (IS)

- Translating bespoke strategies into LSR production models
- Accounting for publication bias
- Assessing and revising strategies as needed
- Maintaining strategies over time











LSR Searching Goal

Maximize efficiency while ensuring quality













Adapting Bespoke Strategies

Considerations

- How well did the original search perform?
- Can it be replicated?
- Can it be automated (in full or in part)?

What revisions to the search are needed:

- To reduce workload?
- To ensure precision?



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Search Reporting – Why Standards Matter

Table 1. Literature search st	rategy		
Торіс	Search terms		
Food environment	Food environment OR nutrition environment OR retail food OR neighbourhood OR neighborhood OR environment OR food desert* OR food swamp OR food availability OR food cost OR food affordability OR food pric* OR food quality		
Retail food outlets	Supermarket OR grocery store OR convenience store OR corner store OR dollar store OR fast food OR restaurant OR food store OR bodega OR tienda		
Dietary intake	Food OR fruit OR vegetable OR diet* OR nutrition OR processed food		
Weight- and health-related outcomes	Obes* OR overweight OR BMI OR body mass index OR waist circumference OR anthropometric OR health OR cardiovascular OR cancer OR diabetes OR hypertension OR disease OR illness		
Socio-economic status	Income OR disparity OR equity OR inequity OR inequality OR disadvantage OR poverty OR depriv* OR marginaliz*		
Canada	Canada OR Canadian OR British Columbia OR Alberta OR Saskatchewan OR Manitoba OR Ontario OR Quebec OR Nova Scotia OR New Brunswick OR Prince Edward Island OR Newfoundland OR Yukon OR Northwest Territories OR Nunavut		

* A Boolean search function indicating truncation, allowing multiple forms of a given word (e.g., depriv* identifies deprived, deprivation).













Automated Alerts

Considerations

- Do search sources support auto-alerts?
- Will auto-alerts match planned update frequency?
- How to apply date limits?
- How to identify and remove duplicates?
- Who will manage results?













Objectives of LSR Auto-alerts

Retrieve precise, ready-to-screen, unique search results on predictable intervals



Created by Laymik from Noun Project











Facilitated LSR Searching

Complementary search approaches

- Simplified search strategies
- Cited/citing references
- Handsearching

Grey literature

- Trial registers
- Agency reports
- Industry websites
- Funded research databases



Created by Anton Noskov from Noun Project









Facilitated Searches in LSR Production Models

Considerations

- Which grey literature sources are likely to yield new unique evidence?
- How to integrate results with auto-alerts?
- Should frequency be the same as auto-alerts (in full or in part)?
- Who should conduct?













Objectives of LSR Facilitated Searching

Complement (not replicate) auto-alerts



Created by Yazmin Alanis from Noun Project





from Noun Project









Group Activity 1 Search planning exercise



Discussion questions for small groups

- 1. Is the topic appropriate for a living systematic review?
- 2. How will you ensure new evidence is retrieved on a monthly basis?













Discussion questions for small groups

- 1. Is the topic appropriate for a living systematic review?
- 2. How will you ensure new evidence is retrieved on a monthly basis?



Group A

What influence does marijuana legislation have on attitudes and behaviours towards tobacco smoking?

Group B

For patients with Non-Small Cell Lung Cancer (NSCLC), what is the costeffectiveness and economic impact of second-line treatment with nivolumab, pembrolizumab and atezolizumab, with and without the use of PD-L1 (Programmed death-ligand 1) testing, for patient selection?



Presentation 3

LSR search: Assessment and Maintenance

Robin Featherstone *Information Specialist, Alberta Research Centre for Health Evidence (ARCHE), Cochrane Child Health*



LSR Challenges for Information Specialists (IS)

- Translating bespoke strategies into LSR production models
- Accounting for publication bias
- Assessing and revising strategies as needed
- Maintaining strategies over time













Potential Pitfalls of LSR Searching





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Assessing LSR Searches

Considerations

- Which assessment methods to use?
- How to maximize knowledge gained from the review process?











Case Study: Retrospective Search Assessment

- Data from a 2018 update of a 2016 systematic review
- Number of included studies = 139

	Records retrieved	Total included studies retrieved	Precision	NNTR (Number Needed to Read)	Unique studies retrieved
MEDLINE	4037	118	0.029	34	3
Embase	2623	121	0.046	22	6
CENTRAL	970	128	0.132	8	3
CINAHL	254	34	0.134	7	0

Maintenance Required

Considerations

- Is the topic question maturing over time?
- What new indexing terms (e.g., MeSH) are available?
- What database enhancement will impact auto-alerts?
- Which new evidence sources are available?
- How often should the strategy by examined?













Objectives of LSR Search Assessment and Maintenance

Improve performance and enhance strategies on a recurring basis



Created by Yu Luck from Noun Project













Group Activity 2 Data analysis



Discussion questions for small groups

- What do the precision, NNTR and unique studies data tell you about the original search?
- How can we enhance our search based on these data?

Created by lastspark

from Noun Project

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COFFEE BREAK





Presentation 4 LSR Enablers

James Thomas Associate Director, Evidence for Policy and Practice Information and Coordinating (EPPI)-Centre, UK Anna Noel-Storr Information Specialist, Radcliffe Department of Medicine, University of Oxford, UK



Enablers in a nutshell...

Involves taking research curation outside the confines of individual reviews

Uses three core 'technologies':

- 1. Human effort in Cochrane Crowd
- 2. Machine Learning
- 3. Re-use of data











Systematic review 'pain points'



Cochrane Crowd

You can make a difference!

Become a Cochrane citizen scientist. Anyone can join our collaborative volunteer effort to help categorise and summarise healthcare evidence so that we can make better healthcare decisions.

Give it a try

A platform for crowdsourced **micro-tasks** that helps produce high quality health evidence











The task: making it doable



Reviews are complex but they are made up of a number of ruledriven, systematic tasks. These kinds of tasks can be re-formed as 'microtasks'.



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The microtask: is it an RCT?

Restricted versus continued standard caloric intake during the management of refeeding syndrome in critically ill adults: A randomised, parallel-group, multicentre, single-blind controlled trial. [2015522581]

Background: Equipoise exists regarding the benefits of restricting caloric intake during electrolyte replacement for refeeding syndrome, with half of intensive care specialists choosing to continue normal caloric intake. We aimed to assess whether energy restriction affects the duration of critical illness, and other measures of morbidity, compared with standard care. Methods: We did a randomised, multicentre, single-blind clinical trial in 13 hospital intensive care units (ICUs) in Australia (11 sites) and New Zealand (two sites). Adult critically ill patients who developed refeeding syndrome within 72 h of commencing nutritional support in the ICU were enrolled and allocated to receive continued standard nutritional support or protocolised caloric restriction. 1:1 computer-based randomisation was done in blocks of variable size, stratified by enrolment serum phosphate concentration (>0.32 mmol/L vs <0.32 mmol/L) and body-mass index (BMI; >18 kg/m² vs <18 kg/m²). The primary outcome was the number of days alive after ICU discharge, with

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Cochrane Citizen Scientists can see a title and an abstract and have to decide whether they think the record is describing a randomised trial

More microtasks





Results: collective accuracy

	Info specialist and methodologist			
Cochrane	True positives 457	False positives 58		
scientists	False negatives 4	True negatives 5522		

Sensitivity: 99.1% Specificity: 99.0%

Natural sample; blinded to crowd decision; dual independent screeners as reference standard.



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Results to date



2 million classifications





99% accuracy











Text mining

Machine learning

Deriving high-quality information from text

Models that learn from data to make predictions or decisions



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WS12: Living Systematic Reviews **OXFORD** HTAi 2018, Vancouver

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Machine classifiers



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File Attachments

RCT Classifier

- First iteration is implemented in CRS Web and EPPI-Reviewer
- Trained on 400,000 classifications by the Crowd
- Provides a score for each citation (0-100)
- Recall of 99.8% at 10% threshold
- 25,000 records
- 15,655 very unlikely to be RCT
- 99.9% correct



Deployed in Cochrane Register of Studies

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Search Simple MeSH Classifier Saved Tracking	Cochrane Register of Studies	Anna Noel-Storr [DE	MENTIA] logout
Classifier search	Search Layout1 Layout2 Layout3 Layout4 e and the search Layout1 Layout2 Layout4 e and the search Layout1 Layout4 e and the search Layout5 e and the search Layout5 e and the search Layout5 e and the search Layout6 e and the search Layout6 e and the search Layout7 e and th	New reference New study	Users Help
have probabilities assigned to them to indicate how likely they are to have certain	Search results Export Find and replace Add to folder Add to	o Remove from Add to r	narked list 🛃
properties, like whether they are of interest to a review group, or whether they are likely to be an RCT. Choose the classifier model you		∂records) Page 1 of 8 ∢ Author ≑	. < > »
are interested in, set the model parameters and click Search to find the records	 Cognitive effects of treating obstructive sleep apnea in Alzheimer's disease: a randomized controlled study Efficacy of galantamine in probable vascular dementia and Alzheimer's disease combined with cerebrovascular disease: a rando 	Ancoli-Israel S // Palmer Erkiniuntti T // Kurz A // G	3W // Cooke jauthier S //
RCT 🛇	3 Donepezil improved memory in multiple sclerosis in a randomized clinical trial	Krupp LB // Christodoulo	u C // Melvil
	A randomized, 26-week, double-blind, placebo-controlled trial to evaluate the safety and efficacy of galantamine in the treatme	Auchus A	
80240,000 180,000 120,000 60,000	6 A Controlled. Double-Blind. Randomized Pilot Clinical Trial of Hydroxysafflor Yellow a on Cognitive Function in Patients With Vas Record Fields Duplicates Links Reviews Classifier Files Audit CENTRAL REGISTER The bar chart below shows the classifier scores for this record. Scores are presented in the range 0 -1 00 where higher scores mean a higher likelihood that the record if a group about this record if it doesn't already have it in it's segment by clicking the bar for that group. In register In segment Not in segment Not relevant to my group	Tian J is of interest to the group. Ye	iu can tell
20 40 60 80 100 Score Approximately 32129 records that are between 99 and 100 percent likely to be of interest Search You can find your records that are currently being processed by the classifier by seaching for INPROCESS:CLASSIFIER	There is a 99% likelihood that this record is an RCT [Confirm this is not an RCT] [Confirm this is an RCT]	11 10	9

Cochrane, the Crowd and the Machine

The story so far













Machine/Crowd synergy



Efficiency: four completed pilots



Re-using existing data

What evidence do we have so far?



11 review updates published in Sept 2016 that were looking for RCTs and had searched Embase using a methodological filter

Re-using existing data

What evidence do we have so far?



Crowd has **already screened between 62% to 98%** (mean 83%) of records identified from Embase searches done for review updates.

'Screen 4 Me' workflow

A new service which is just being rolled out for Cochrane authors

- 1. Upload search results
- 2. Non-RCTs removed using:
 - a) Data reuse
 - b) Machine learning
 - c) Crowdsourcing
- 3. Remaining records returned to authors

Offers huge efficiencies for these reviews













Use of enablers by LSR pilots

Pilot 1 – reviews on anticoagulation in cancer patients

- Monthly searches of Cochrane, MEDLINE and Embase
- ~50-130 citations p/month sent to RCT Classifier
 - Citations scoring 10-99 (~20-50 p/month) >>>> AUTHORS
 - Citation scoring 0-9 (~30-80 p/month) >>>> CROWD
- 1 new RCT; no RCTs from among citations sent to Crowd

Pilot 2 – fruit and veg review

- Monthly searches of Cochrane, MEDLINE and Embase
- 2,600 citations since Sep 2017 sent to RCT Classifier
 - Citations scoring 10-99 (1260, ~50%) >>>> AUTHORS
 - Citation scoring 0-9 (1340) >>>> CROWD
- 16 new RCTs; 1 RCT from among citations sent to Crowd



http://community.cochrane.org/tools/project-coordination-and-support/transform

Living Evidence



A Living Systematic Review is a systematic review which is continually updated, incorporating relevant new evidence as it becomes available



Group Activity 3 Discussion and presentations



Discussion questions

Finalize and present your plan for a "living" search

Questions

- What is your topic? Is this a good candidate for an 1. LSR?
- How will you ensure new evidence is identified each 2. month?
- How will you ensure search performance over time? 3.
- What enablers could assist your LSR production 4. model?













Summary and Recommendations

- LSRs are an emerging approach to evidence syntheses
- LSR searches combine automated and facilitated strategies
- LSRs provide opportunities for continual improvement of search performance
- LSR production models embrace enabling technology











References & Recommended Resources

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More Info

- cochrane.org/lsr
- Slides available under 'Other LSR Resources'









