Cochrane PICO: Using linked data technologies to semantically annotate *outcomes in* Cochrane evidence

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Better health.

Chris Mavergames
Head of Informatics & Knowledge Management
Cochrane Central Executive

Acknowledgements

Many thanks to Lorne Becker, Alex Garcia Castro, James Thomas, Anna Noel-Storr, and the whole linked data project team at Cochrane.

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Outline

- Cochrane Linked Data Project
  - PICO Annotator
  - Annotating O in PICO
  - PICOfinder
  - Moving towards semi-automation
- Questions
- Ideas for collaboration?

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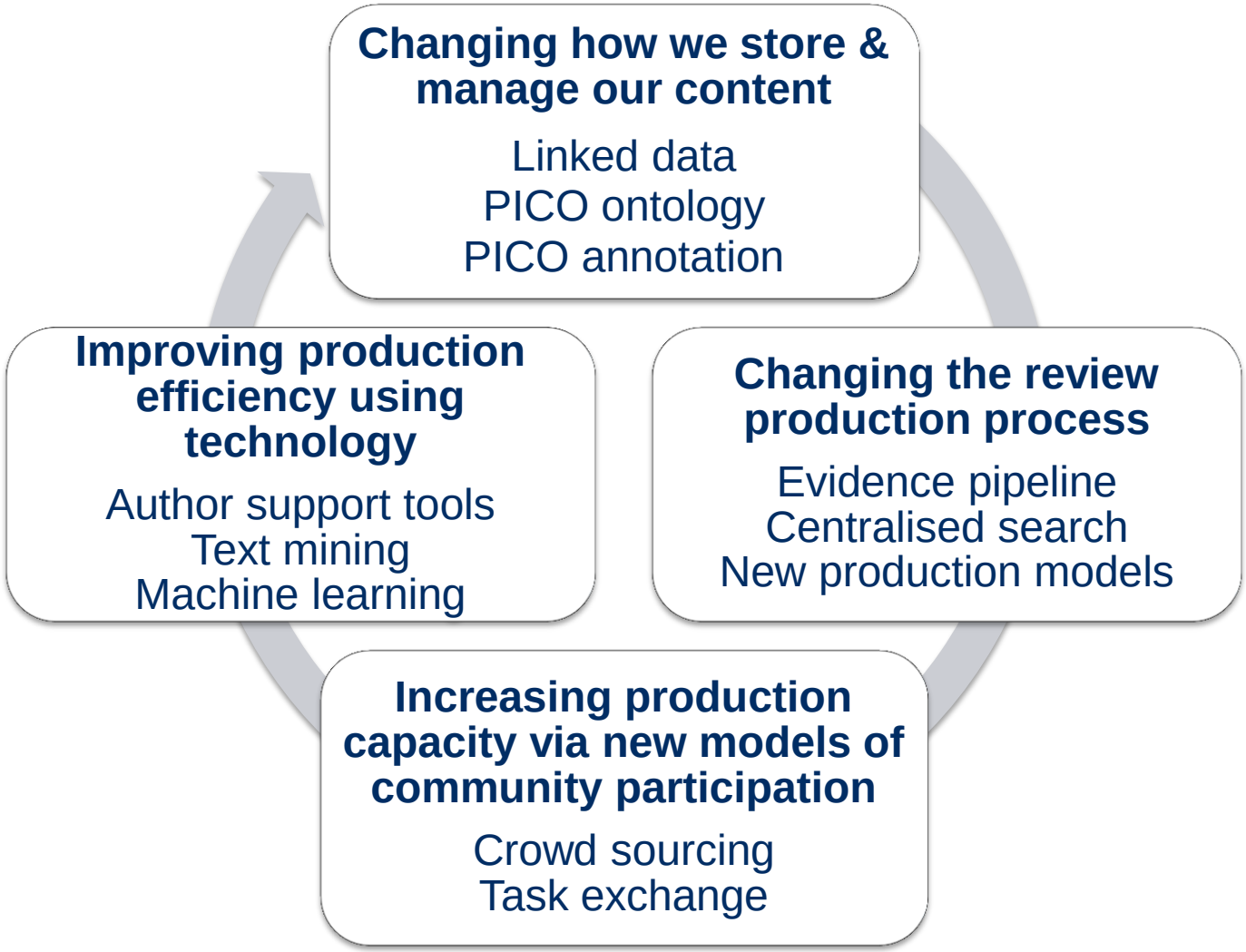
Linked Data Project

Making Cochrane evidence more accessible

Cochrane

Cochrane operational projects



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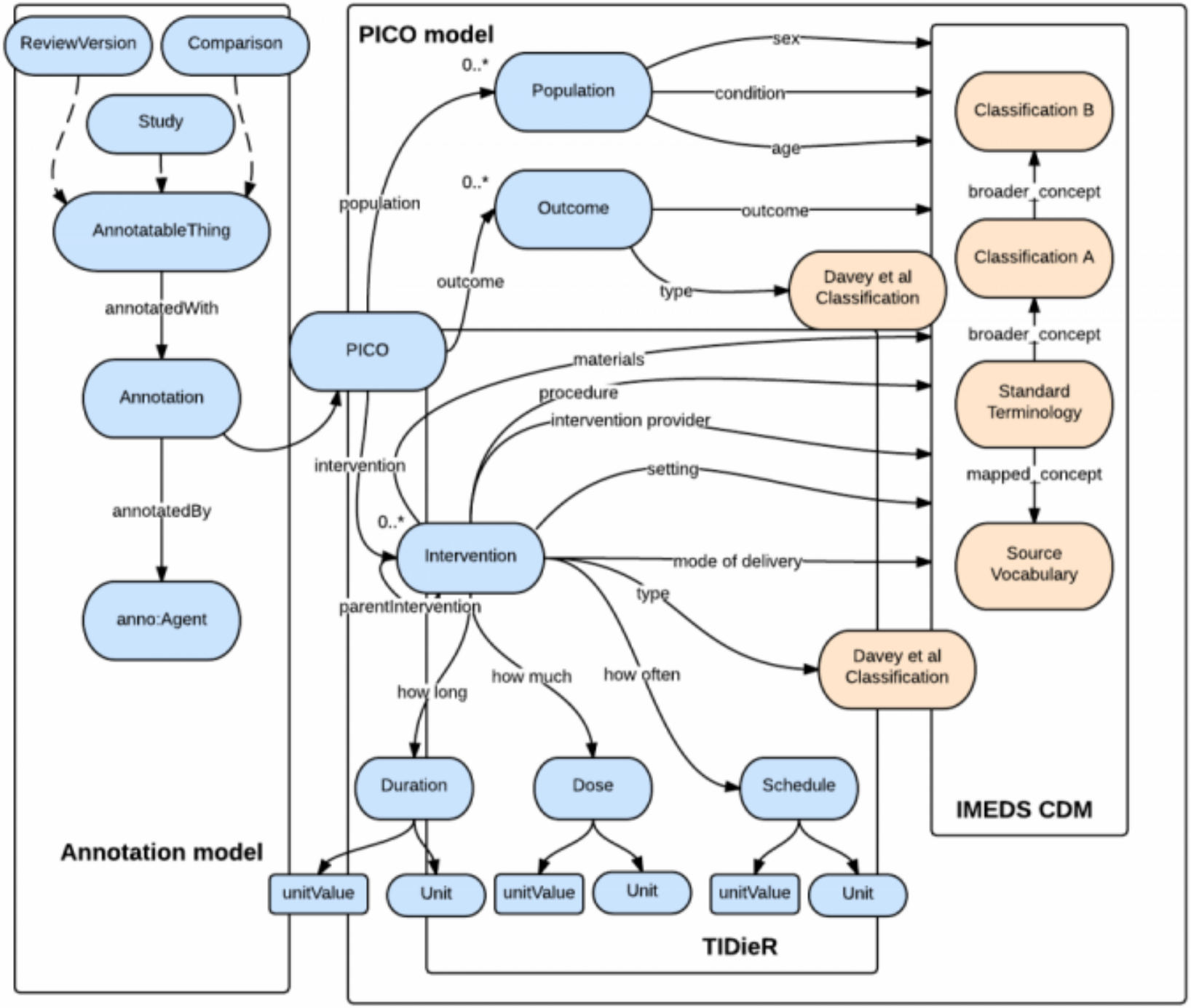
Linked Data: Overarching goals

- Enrich our content and data with metadata using controlled vocabularies (SNOMED CT, etc.)
- Construct knowledge models and structures (ontologies) that will allow re-use of this metadata (annotations) for both downstream (dissemination) and upstream (production) use
- Become more interoperable with other projects, products, datasets, and systems
- Improve production (“smarter data”) and dissemination of evidence (“unlocking the evidence”)
- http://linkeddata.cochrane.org

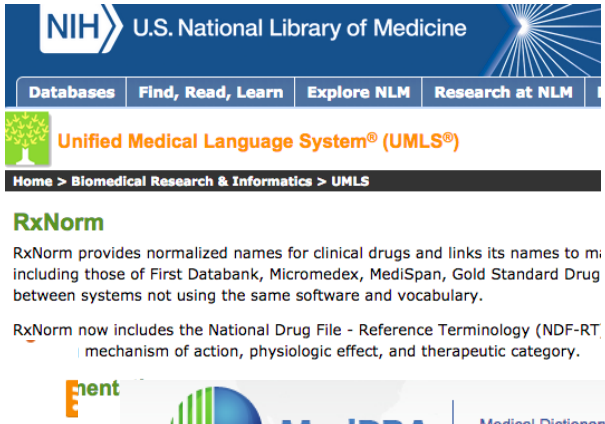
“Enabling” technology

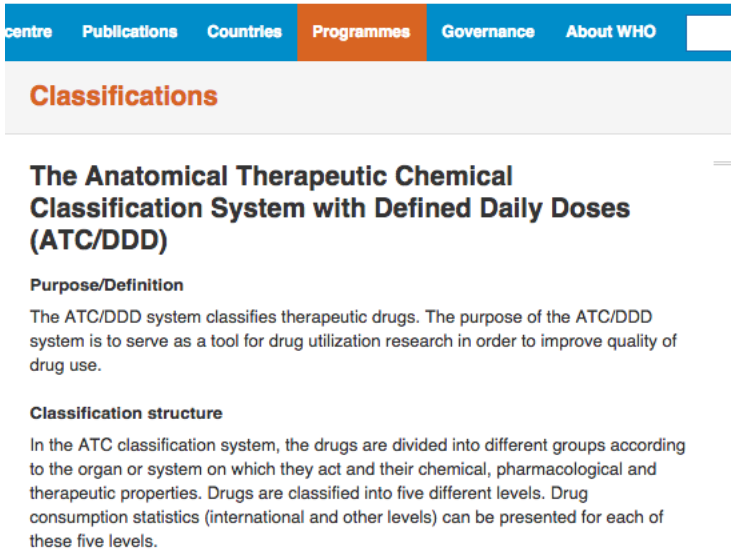
- New interfaces and products for Cochrane evidence such as:
  - Dynamically-generated topic portals and interfaces
  - Improved discoverability
  - Comparator tools
  - APIs for third-party systems and data feeds
- Facilitating:
  - Data re-use and repurposing
  - Review production efficiency and intelligence
  - Living sys reviews into living guidelines
  - Creation of standards (PICO) for interoperability


ReviewVersion
Comparison
Study
AnnotatableThing
annotatedWith
Annotation
annotatedBy
anno:Agent
Annotation model
PICO model
0..*
Population
sex
condition
age
0..*
Outcome
outcome
type
population
outcome
Davey et al Classification
PICO
materials
procedure
intervention provider
setting
intervention
0..*
Intervention
mode of delivery
type
parentIntervention
how long
how much
how often
Davey et al Classification
Duration
Dose
Schedule
unitValue
Unit
unitValue
Unit
unitValue
Unit
TIDieR
Classification B
broader_concept
Classification A
broader_concept
Standard Terminology
mapped_concept
Source Vocabulary
IMEDS CDM

Cochrane

Controlled terminology sets (vocabularies)





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New Cochrane Review Ecosystem

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New Cochrane Review Ecosystem

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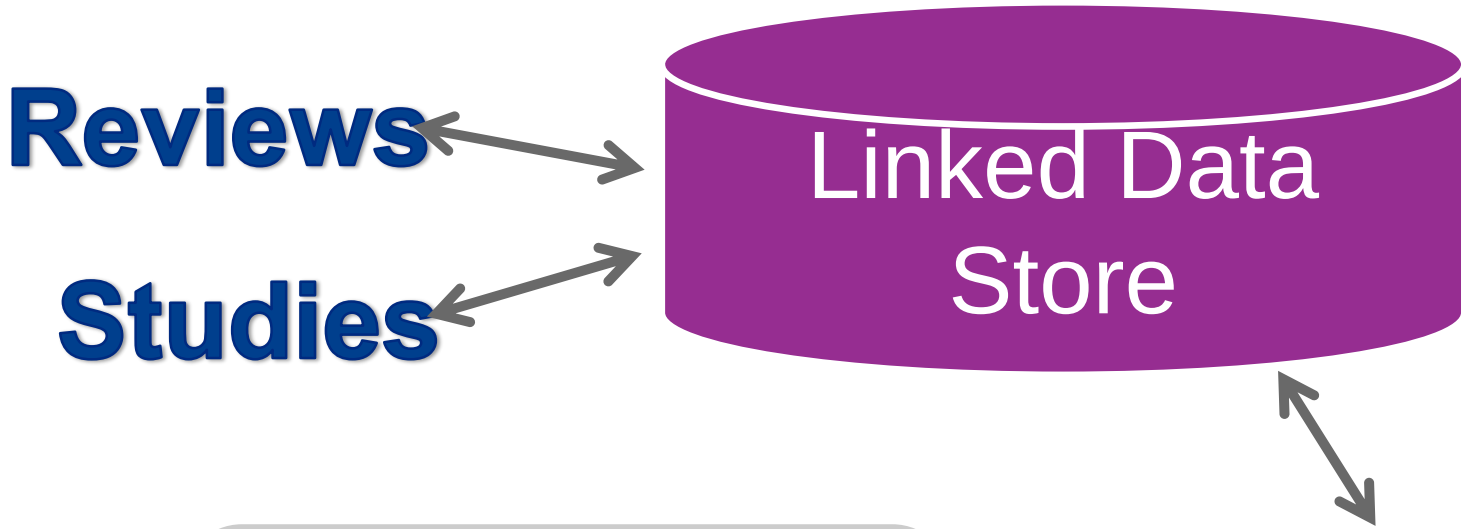
A new Cochrane *PICO database*



PICO annotations:

- Reviews (question, studies, analyses)
- CRS/CENTRAL
- Data sets (Covidence, EPPI-R)

User interfaces…

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PICO Annotator

Annotating Cochrane Review content

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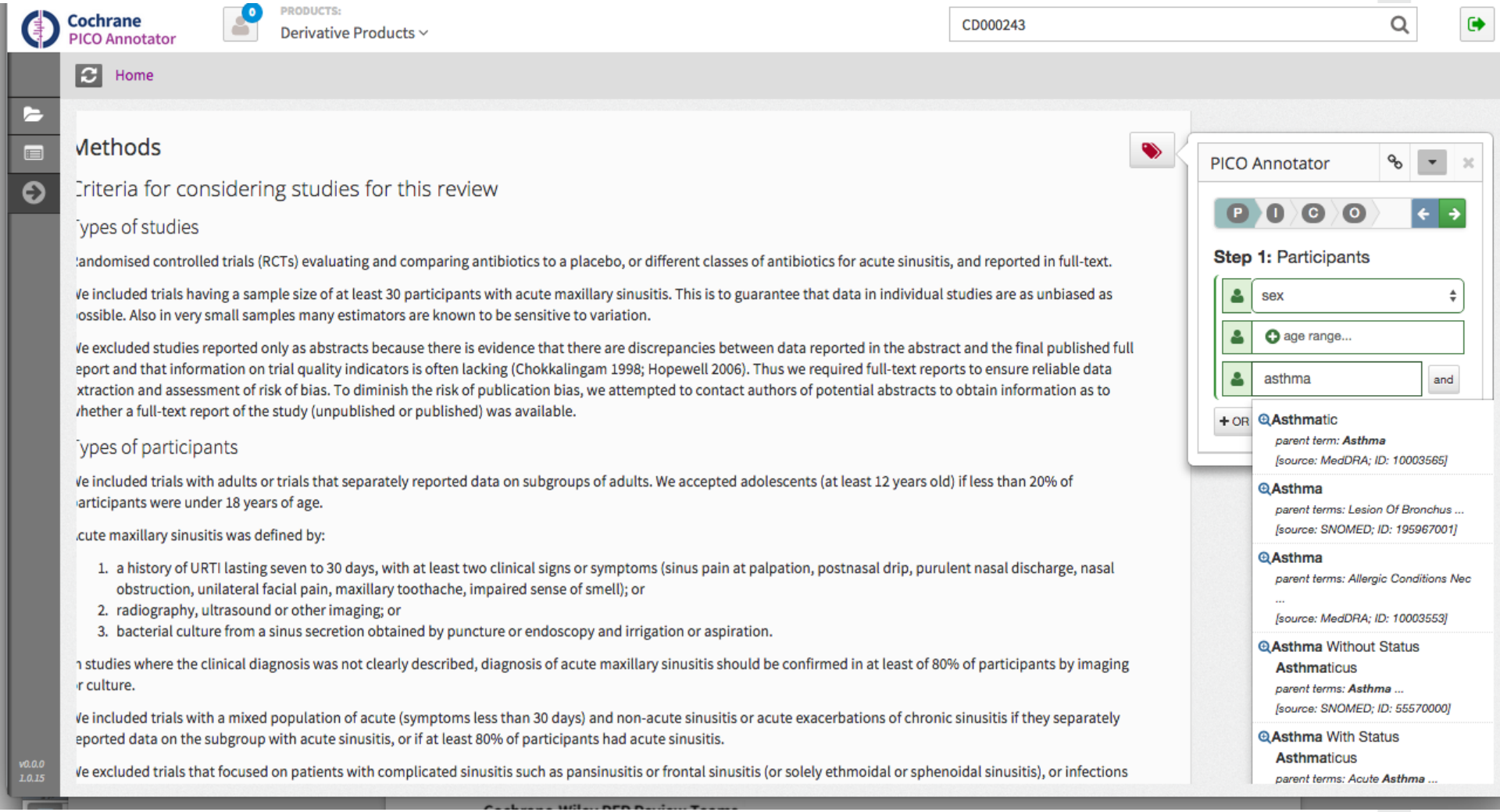
Cochrane
PICO Annotator
PRODUCTS:
Derivative Products
CD000243
Home
Methods
Criteria for considering studies for this review
Types of studies
Randomised controlled trials (RCTs) evaluating and comparing antibiotics to a placebo, or different classes of antibiotics for acute sinusitis, and reported in full-text.
We included trials having a sample size of at least 30 participants with acute maxillary sinusitis. This is to guarantee that data in individual studies are as unbiased as possible. Also in very small samples many estimators are known to be sensitive to variation.
We excluded studies reported only as abstracts because there is evidence that there are discrepancies between data reported in the abstract and the final published full report and that information on trial quality indicators is often lacking (Chokkalingam 1998; Hopewell 2006). Thus we required full-text reports to ensure reliable data extraction and assessment of risk of bias. To diminish the risk of publication bias, we attempted to contact authors of potential abstracts to obtain information as to whether a full-text report of the study (unpublished or published) was available.
Types of participants
We included trials with adults or trials that separately reported data on subgroups of adults. We accepted adolescents (at least 12 years old) if less than 20% of participants were under 18 years of age.
Acute maxillary sinusitis was defined by:
1. a history of URTI lasting seven to 30 days, with at least two clinical signs or symptoms (sinus pain at palpation, postnasal drip, purulent nasal discharge, nasal obstruction, unilateral facial pain, maxillary toothache, impaired sense of smell); or
2. radiography, ultrasound or other imaging; or
3. bacterial culture from a sinus secretion obtained by puncture or endoscopy and irrigation or aspiration.
In studies where the clinical diagnosis was not clearly described, diagnosis of acute maxillary sinusitis should be confirmed in at least of 80% of participants by imaging or culture.
We included trials with a mixed population of acute (symptoms less than 30 days) and non-acute sinusitis or acute exacerbations of chronic sinusitis if they separately reported data on the subgroup with acute sinusitis, or if at least 80% of participants had acute sinusitis.
We excluded trials that focused on patients with complicated sinusitis such as pansinusitis or frontal sinusitis (or solely ethmoidal or sphenoidal sinusitis), or infections
v0.0.0
1.0.15
PICO Annotator
P I C O
Step 1: Participants
sex
age range...
asthma
and
+ OR
Asthmatic
parent term: Asthma
[source: MedDRA; ID: 10003565]
Asthma
parent terms: Lesion Of Bronchus ...
[source: SNOMED; ID: 195967001]
Asthma
parent terms: Allergic Conditions Nec ...
[source: MedDRA; ID: 10003553]
Asthma Without Status Asthmaticus
parent terms: Asthma ...
[source: SNOMED; ID: 55570000]
Asthma With Status Asthmaticus
parent terms: Acute Asthma ...

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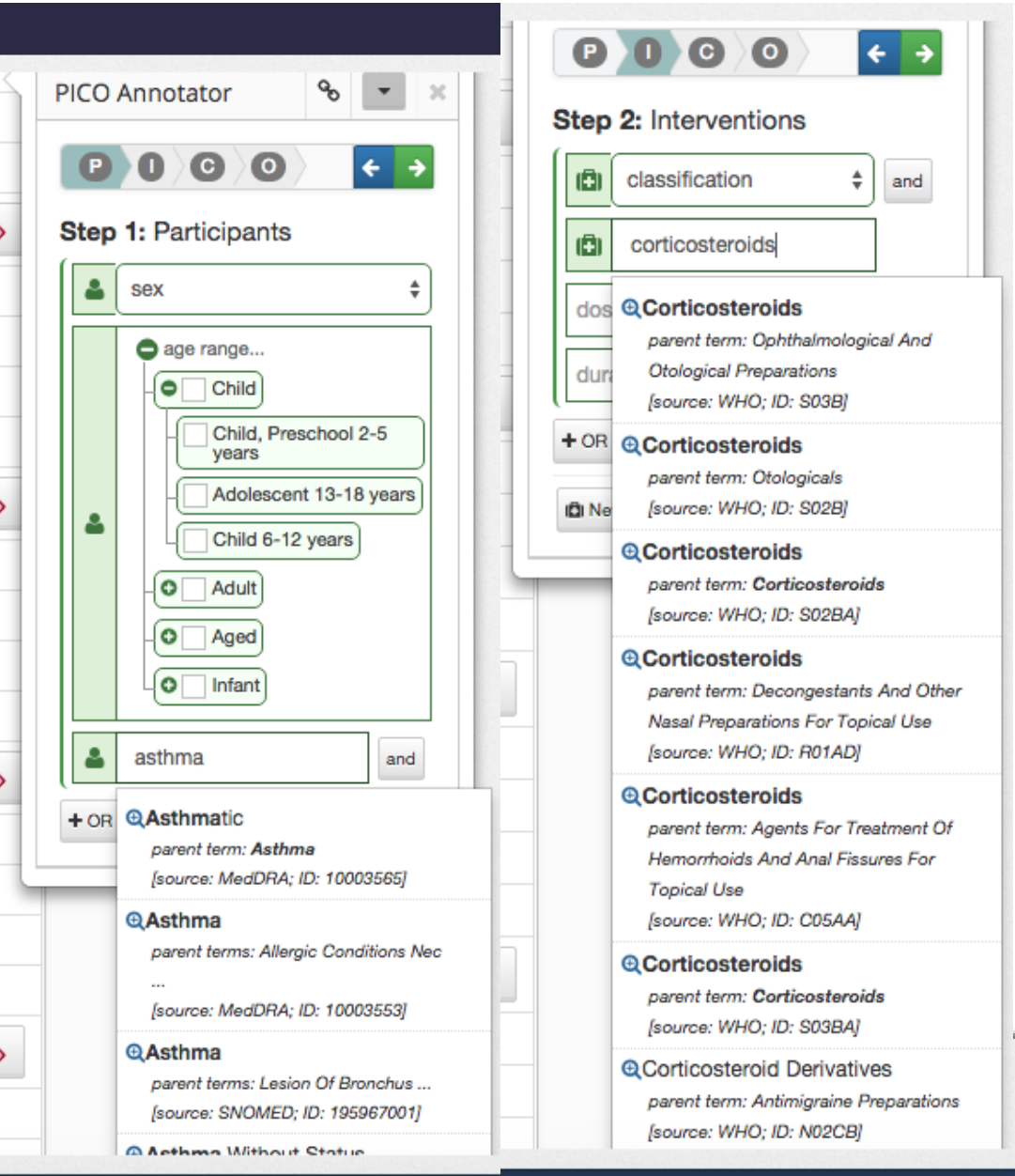
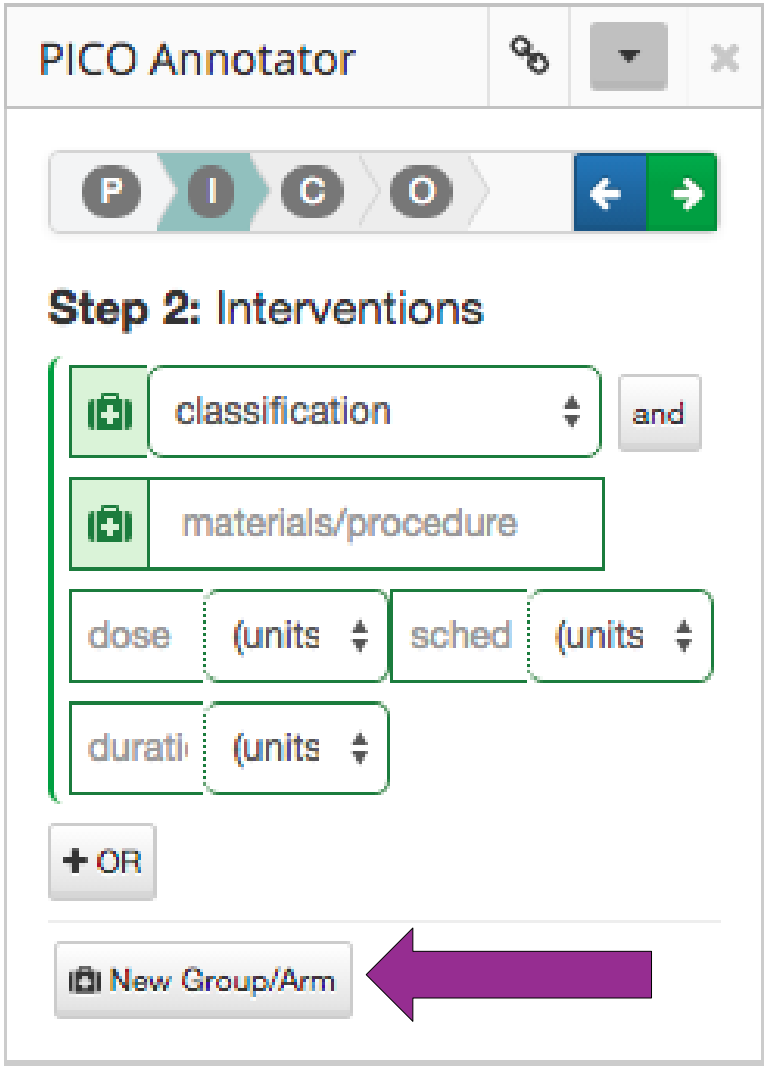
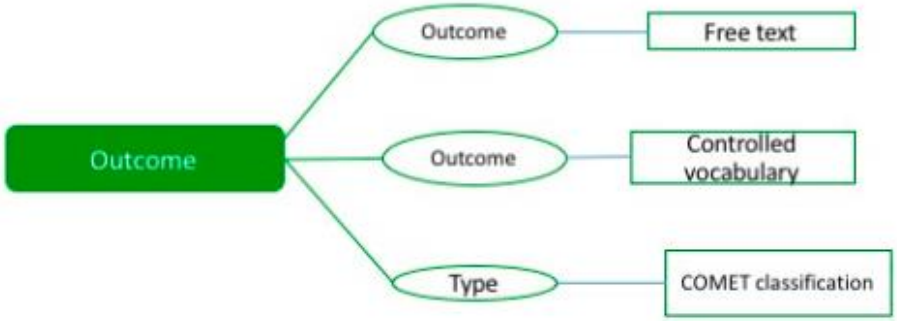
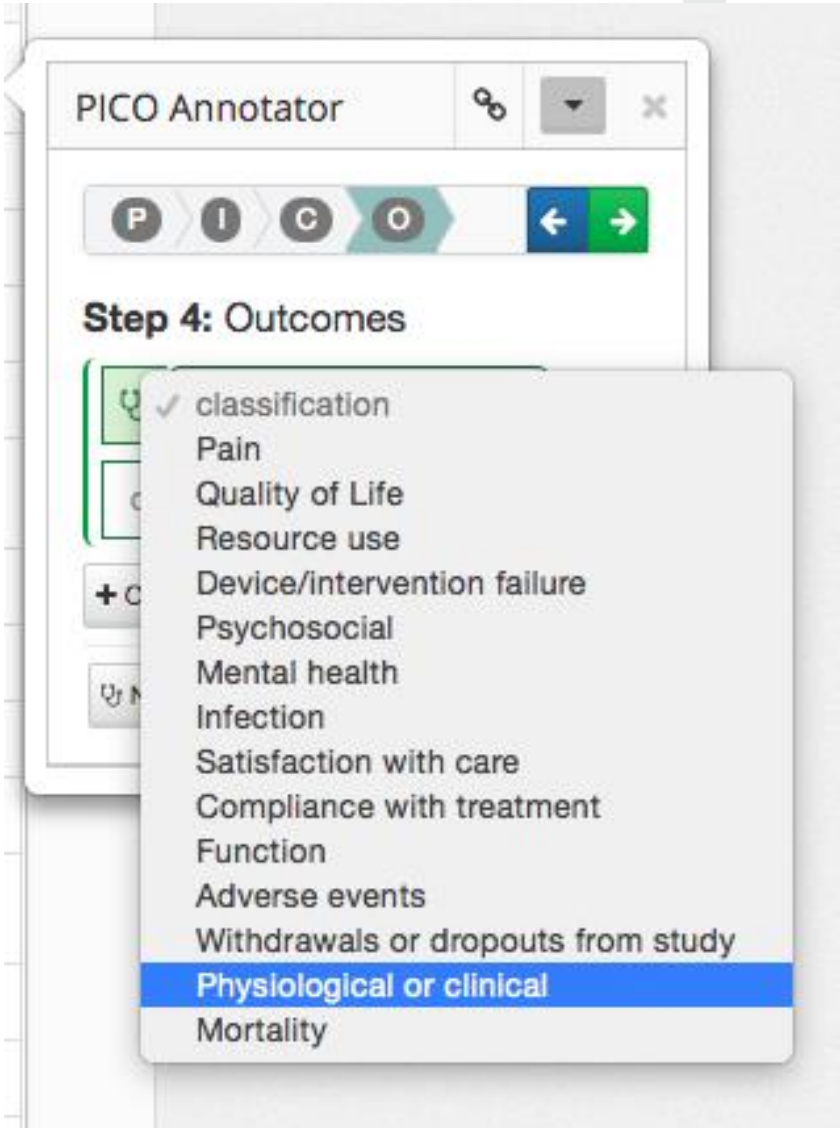

PICO Annotator
P I C O
Step 1: Participants
sex
age range...
Child
Child, Preschool 2-5 years
Adolescent 13-18 years
Child 6-12 years
Adult
Aged
Infant
asthma
and
+ OR
Asthmatic
parent term: Asthma
[source: MedDRA; ID: 10003565]
Asthma
parent terms: Allergic Conditions Nec ...
[source: MedDRA; ID: 10003553]
Asthma
parent terms: Lesion Of Bronchus ...
[source: SNOMED; ID: 195967001]

P I C O
Step 2: Interventions
classification
and
corticosteroids
+ OR
Corticosteroids
parent term: Ophthalmological And Otological Preparations
[source: WHO; ID: S03B]
Corticosteroids
parent term: Otologicals
[source: WHO; ID: S02B]
Corticosteroids
parent term: Corticosteroids
[source: WHO; ID: S02BA]
Corticosteroids
parent term: Decongestants And Other Nasal Preparations For Topical Use
[source: WHO; ID: R01AD]
Corticosteroids
parent term: Agents For Treatment Of Hemorrhoids And Anal Fissures For Topical Use
[source: WHO; ID: C05AA]
Corticosteroids
parent term: Corticosteroids
[source: WHO; ID: S03BA]
Corticosteroid Derivatives
parent term: Antimigraine Preparations
[source: WHO; ID: N02CB]


PICO Annotator
P I C O
Step 2: Interventions
classification
and
materials/procedure
dose
(units
sched
(units
durati
(units
+ OR
New Group/Arm



What outcomes are there
For this comparison?



Core domain	Smith	Williamson/Clarke	Williamson/Clarke
Adverse events	1: AEs	1: AEs	1: AEs
Death	2: Mortality/survival	2: Mortality/survival	2: Mortality/survival
Physiological or clinical	3: Physiological/ clinical	3: Physiological/ clinical	3-24: **Physiological**
	4: Infection	4: Infection	
	5: Pain	5: Pain	
Life impact	6: ADLs	6: ADLs	**Functioning** 25. Physical 26. Social 27. Role 28. Psychological/wellbeing 29. Cognitive
	7: Psychosocial	7: Psychosocial	
		8: Mental Health	
	8: QoL	9: HRQL	30 : HRQL
	9: Compliance	10: Compliance	31: Delivery of care (includes satisfaction, patient preference, adherence, withdrawal, tolerability, etc.)
	10: Withdrawal		
	11: Satisfaction	11: Satisfaction	
Resource Use	12: Medication	12: Resource Use	**Resource Use** 32: Economic 33: Medication 34: Hospital 35: Operative
	13: Economic		
	14: Hospital		

Annotating ‘O’

Some examples and challenges

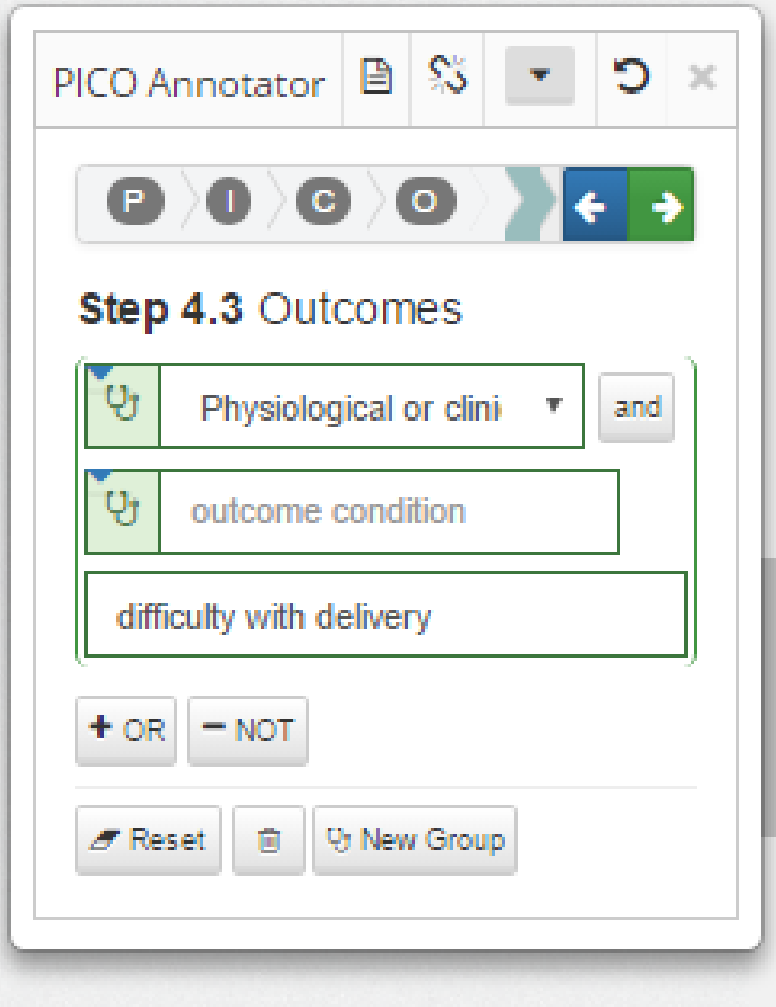
Types of outcome measures

Primary Outcomes

1. Death or serious neonatal morbidity (significant trauma, encephalopathy, authors).

Secondary Outcomes

1. Duration of second stage of labour.
2. Difficulty with delivery.
3. Five-minute Apgar score less than seven or death.
4. Umbilical artery pH less than 7.2 or death.
5. Neonatal trauma or death.
6. Neonatal encephalopathy or death.
7. Neonatal intracranial haemorrhage or death.
8. ICU admission > 24 hours or death.
9. Childhood disability or death.
10. Perinatal death.
11. Maternal trauma.
12. Maternal satisfaction.



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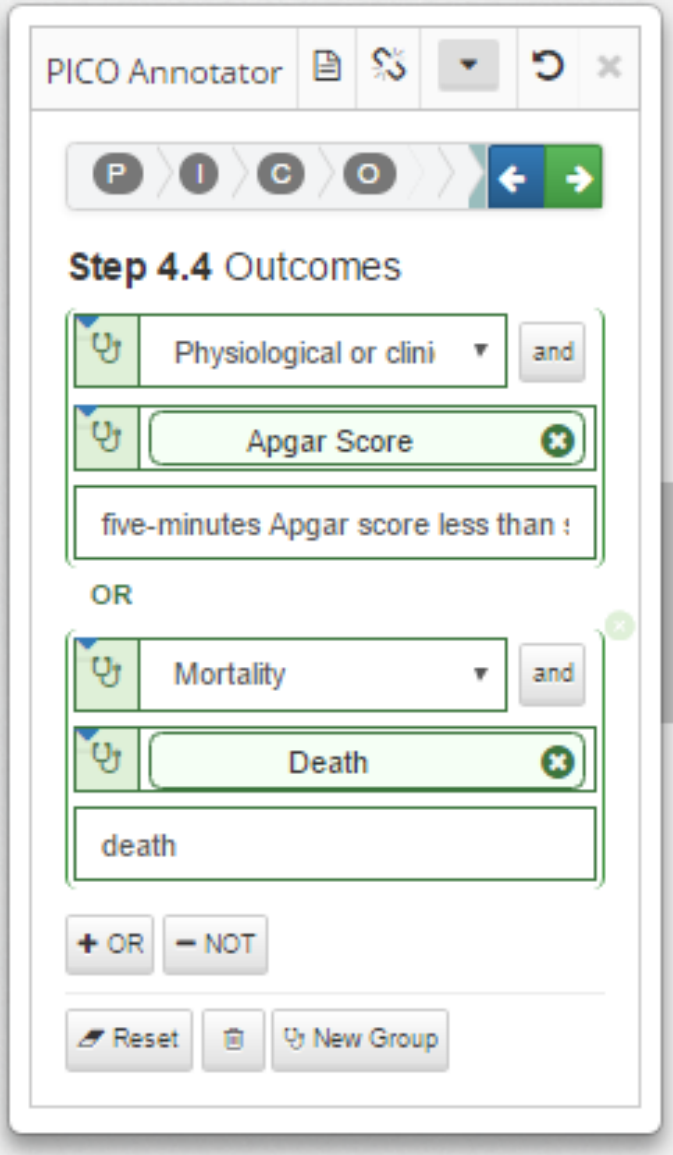

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All | Table | Notes

Search..

'cd007579' ✖

Outcomes

1. Maternal adverse effects: e.g. sedation, restlessness, extra-pyramidal effects, surgical bleeding, hypotension, atonic uterus.
2. Neonatal morbidity: e.g. Apgar scores less than seven at five minutes.
3. Initiation of breastfeeding.
4. Duration of exclusive breastfeeding.
5. Maternal satisfaction (using a validated questionnaire).

In this review, when authors reported retching and vomiting separately, we combined

1.) Physiological or clinical - Nausea intraoperatively;
2.) Vomiting (and/or retching) intraoperatively;
3.) Physiological or clinical - Nausea postoperatively;
4.) Physiological or clinical - Vomiting (and/or retching) postoperatively;
5.) Adverse events - Maternal adverse effects;
6.) Physiological or clinical - Neonatal morbidity;
7.) Physiological or clinical - Initiation of breastfeeding;
8.) Physiological or clinical - Duration of exclusive breastfeeding;
9.) Satisfaction with care - Maternal satisfaction (using a validated questionnaire);

♥ Nausea intraoperatively | ϟ Nausea | ϟ Vomiting | ♥ Nausea postoperatively | ϟ Nausea
♥ Vomiting (and/or retching) postoperatively | ϟ Nausea | ♥ Maternal adverse effects
ϟ Adverse Event | ♥ Neonatal morbidity | ♥ Initiation of breastfeeding | ϟ Breastfeeding Started
♥ Duration of exclusive breastfeeding | ♥ Maternal satisfaction (using a validated q...

Outcomes

4. Stroop black and white test;
5. Stroop interference tests;
6. Wechsler Adult Intelligence Survey III symbol searching raw score;
7. Quality of life using a modified Sickness Impact Profile scale.

Physiological or clinical - Cognition: ADAS-Cog; Quality of Life - Quality of life using a modified sickness impact profile scale; Physiological or clinical - Cognition: Wechsler adult intelligence survey III symbol searching raw score; Physiological or clinical - Cognition: Stroop interference tests; Physiological or clinical - Cognition: UHDRS-symbol digit modalities; Physiological or clinical - Cognition: UHDRS-verbal fluency;

♥ Cognition: ADAS-Cog
♥ Quality of life using a modified sickness i...
♥ Cognition: Wechsler adult intelligence su...
♥ Cognition: Stroop interference tests
♥ Cognition: UHDRS-symbol digit modalities
♥ Cognition: UHDRS-verbal fluency

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Cochrane PICO Annotator

PRODUCTS: Derivative Products

CD010177

Home

Methods

Criteria for considering studies for this review

Types of studies

We included randomised controlled trials (RCTs) with a parallel-group design, of at least 12 weeks' duration. We did not exclude studies on the basis of blinding. We excluded cross-over trials, as we were looking at long-term effects including adverse events.

Types of participants

We included RCTs that recruited participants with a clinical diagnosis of COPD based on the following (GOLD 2013).

1. Forced expiratory volume after one second (FEV_1)/forced vital capacity (FVC) ratio < 0.7, which confirms the presence of persis
2. Several of the following key indicators:
    1. Progressive and/or persistent dyspnoea (breathlessness);
    2. Chronic cough;
    3. Chronic sputum production; and
    4. History of exposure to risk factors (tobacco smoke, smoke from home cooking and heating fuels, occupational dusts and chemicals).

We excluded RCTs in which participants had to have asthma as well as COPD to be included.

Types of interventions

We included studies in which participants were randomly assigned to receive the following.

1. Salmeterol 50 µg or placebo twice daily.
2. Formoterol 12 µg or placebo twice daily.
3. Formoterol 24 µg or placebo twice daily.

We included studies that allowed concomitant short-acting bronchodilators, provided they were not part of the trial treatment under study. We did not include studies in which most participants were receiving other COPD treatments.

Types of outcome measures

Primary Outcomes

PICO Annotator

Population:
Male and Female, Young Adult 19-24 years and Adult 19-44 years and Middle Aged 45-64 years: Chronic Obstruct Airways Disease;

Interventions:
1.) [Pharmacological] Salmeterol: ;
2.) [Pharmacological] Formoterol: ;

Comparators:
[No active treatment] Placebos: ;

Outcomes:
1.) Quality of Life - Quality of life;
2.) Physiological or clinical - Severe COPD exacerbations;
3.) Physiological or clinical - Moderate COPD exacerbations;
4.) Mortality - Mortality; all-cause;
5.) Adverse events - Non-fatal serious adverse events; all-cause;
6.) Physiological or clinical - lung function;
7.) Withdrawals or dropouts from study - Withdrawals from study treatment:

v0.0.0
1.0.15

PICOfinder demo interface

Exploring, filtering, and visualizing Cochrane evidence using PICO

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PICOfinder
Powered by Cochrane linked data

Population

- condition
- age
- sex

Intervention / Comparator

- classification
- materials / procedures

Outcome

- classification

Search..

Reviews (272) | Studies (209) | Analyses (60) — Show Comparators

Prev — Next (10-272)

- **CD008800** (v3) Acetaminophen (paracetamol) for the common cold in adults
- **CD008827** (v2) Huperzine A for mild cognitive impairment
  Mild Cognitive Impairment | Male and Female | Huperzia Serrata Extract
- **CD008900** (v2) Cerebrolysin for vascular dementia
  Vascular Dementia | Ages 19 to 80 years and over | Male and Female | Other Psychostimulants And Nootropics
- **CD002955** (v7) Naftidrofuryl for dementia
  Dementia | Male and Female | Naftidrofuryl
- **CD007546** (v3) Interventions for preventing and reducing the use of physical restraints in long-term geriatric care
  Ages 65 to 80 years and over | Male and Female | Physical
- **CD007769** (v2) Ginseng for cognition
  Dementia | Male and Female | Ginseng Preparation
- **CD005380** (v9) Metal protein attenuating compounds for the treatment of Alzheimer's dementia
  Dementia Due To Alzheimer's Disease | Male and Female | Pharmacological
- **CD006929** (v4) Functional analysis-based interventions for challenging behaviour in dementia
  Dementia | Behavioural And Psychiatric Symptoms Of ... | Male and Female | Complex
- **CD002854** (v8) Vitamin E for Alzheimer's dementia and mild cognitive impairment
  Dementia Due To Alzheimer's Disease | Mild Cognitive Impairment | Male and Female | Pharmacological | "outcome measures had to derive from va...
- **CD000012** (v10) Alternative versus conventional institutional settings for birth
  Infants, birth to 23 months | Male and Female | Testosterone | test

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Search..

Outcome

classification

Physiological or clinical	819
Resource use	491
Mortality	420
Adverse events	307
Quality of Life	130
Infection	102
Satisfaction with care	92
Mental health	85
Device/intervention failure	73
Function	66

condition

CD002309 (v8) Phosphodiesterase 4 inhibitors for chronic obstructive pulmonary disease

Chronic Obstructive Pulmonary Disease | Ages 19 to 80 years and over | Male and Female | Pharmacological

CD004393 (v8) Vitamin B6 for cognition

Elderly | Ages 45 to 80 years and over | Male and Female | Vitamin B6 | Preventing cognitive impairment | Slowing the progression of cognitive impai...

CD008827 (v2) Huperzine A for mild cognitive impairment

Mild Cognitive Impairment | Male and Female | Huperzia Serrata Extract

CD006221 (v4) Dehydroepiandrosterone (DHEA) supplementation for cognitive function in healthy elderly people

Elderly | Ages 45 to 80 years and over | Male and Female | Dehydroepiandrosterone Output Measure... | Cognitive function | Quality of life

CD007220 (v3) Carbohydrates for improving the cognitive performance of independent-living older adults with normal cognition or mild cognitive impairment

Mild Cognitive Impairment | Ages 45 to 80 years and over | Male and Female | Carbohydrates

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Search..

Outcome

classification

condition

- Death 165 — MedDRA 10011906
- Caesarean Section 61 — MedDRA 10006924
- Death Neonatal 49 — MedDRA 10011912
- Intensive Care 41 — MedDRA 10022519
- Neurodevelopmental Delay 37 — SNOMED 751391000000106
- Stillbirth 31 — SNOMED 237364002, MedDRA 10042062
- Chronic Lung Disease 31 — SNOMED 413839001
- Adverse Event 31 — MedDRA 10060933
- Mechanical Ventilation 30 — MedDRA 10067221
- Apgar Score 26 — MedDRA 10062552

Chronic Obstructive Pulmonary Disease | Ages 19 to 80 years and over | Male and Female | Pharmacological

CD004393 (v8) Vitamin B6 for cognition
Elderly | Ages 45 to 80 years and over | Male and Female | Vitamin B6 | Preventing cognitive impairment | Slowing the progression of cognitive im...

CD008827 (v2) Huperzine A for mild cognitive impairment
Mild Cognitive Impairment | Male and Female | Huperzia Serrata Extract

CD006221 (v4) Dehydroepiandrosterone (DHEA) supplementation for cognitive function in healthy elderly people
Elderly | Ages 45 to 80 years and over | Male and Female | Dehydroepiandrosterone Output Measure... | Cognitive function | Quality of life

CD007220 (v3) Carbohydrates for improving the cognitive performance of independent-living older adults with normal cognition or mild cognitive impairment
Mild Cognitive Impairment | Ages 45 to 80 years and over | Male and Female | Carbohydrates

CD005381 (v5) Aerobic exercise to improve cognitive function in older people without known cognitive impairment
Ages 45 to 80 years and over | Male and Female | Physical | Cognition | Drop-out, as a measure of acceptability | Adverse events

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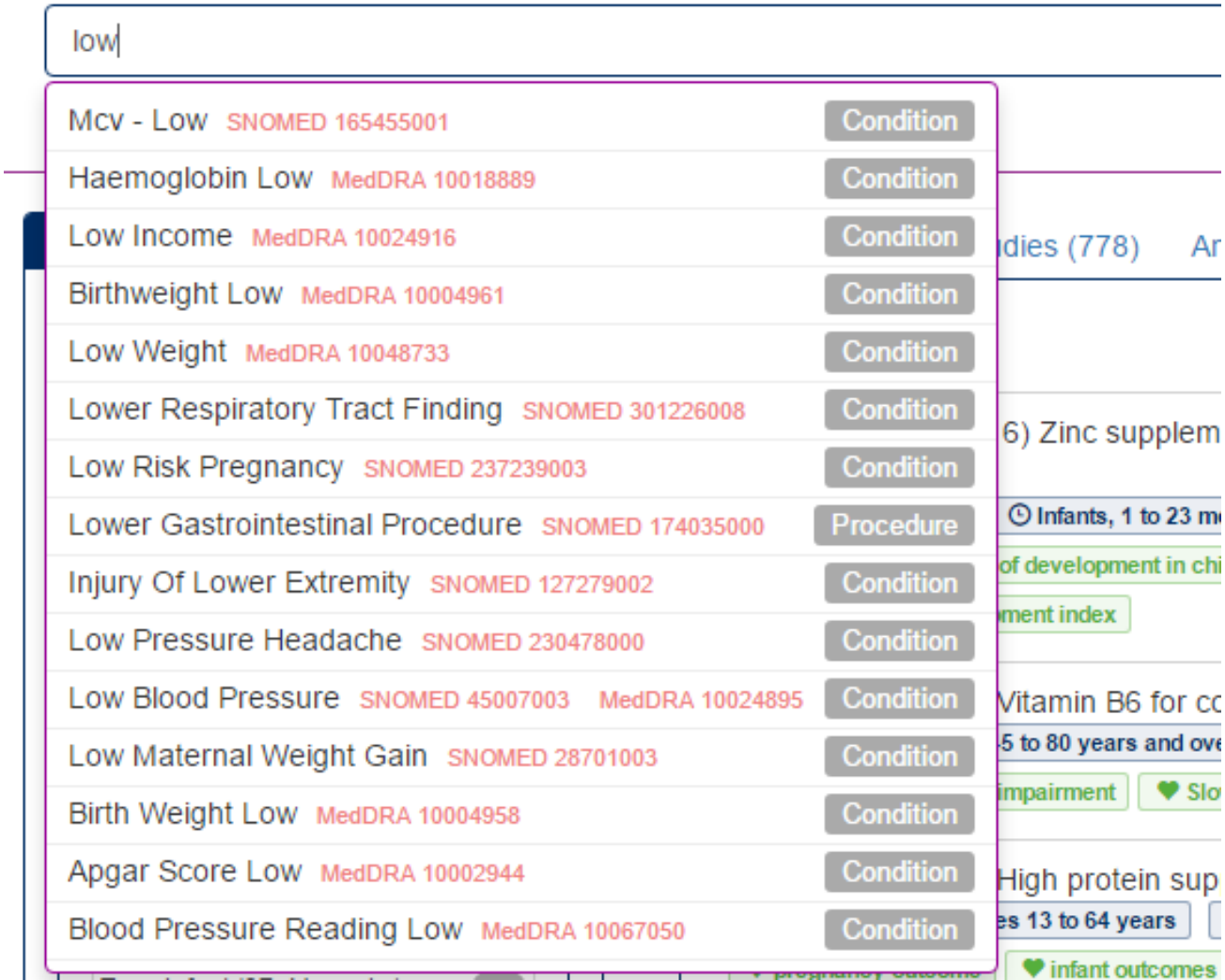

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Transivity example

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Search..

Lifestyle Issues ✖

Population

- condition
- age
- sex

Intervention / Comparator

- classification
- procedure
- materials

Reviews (15) | Studies (5) | Analyses (0) | Show Comparators

Prev | Next

CD007208 (v6) High feedback versus low feedback of prenatal ultrasound for reducing maternal anxiety and improving maternal health behaviour in pregnancy

Ultrasonography | Pregnancy | Ages 13 to 64 years | Female | Screening | Maternal anxiety measured by State Trait ... | Anxiety | Cessation of alcohol | Psychosocial | Cessation Of Smoking | Women's views of level of feedback

CD011135 (v1.1) Unconditional cash transfers for reducing poverty and vulnerabilities: effect on use of health services and health outcomes in low- and middle-income countries

Ages 2 to 80 years and over | Infants, birth to 23 months | Male and Female | Resources and Infrastructure | use of health facilities or services, such a... | Finding Related To Ability To Interact With ... | mortality | Death | morbidity | Morbidity Index - Finding | nutritional outcomes | Finding Of Nutritional Status | anthropometric measures | alcohol use | Alcohol Use | tobacco use | Tobacco Use | consumption of unhealthy foods

Moving towards semi-automation

Evidence Pipeline and Cochrane Crowd

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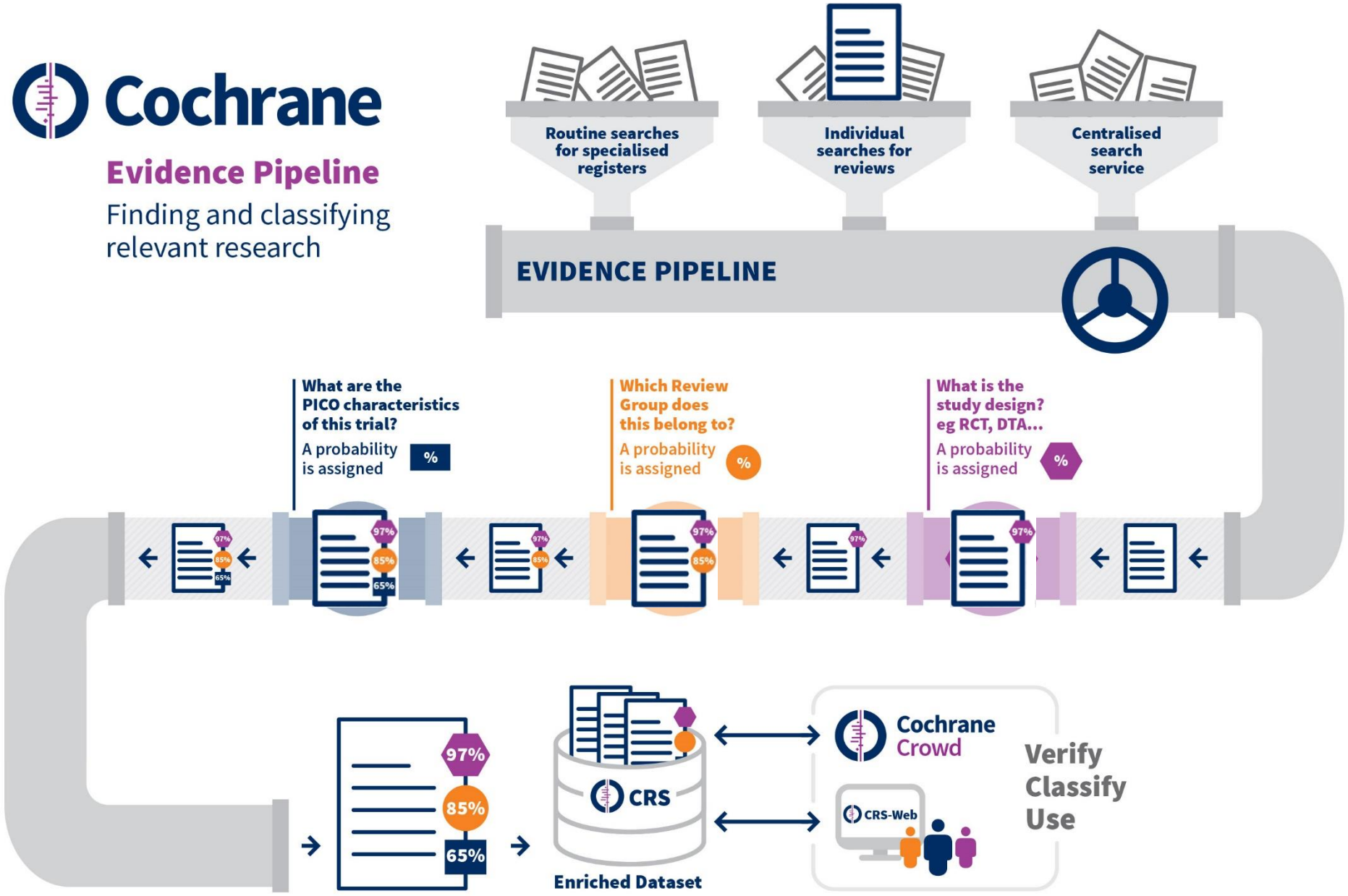
Evidence Pipeline

Finding and classifying relevant research



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

crowd.cochrane.org

Just 60 seconds a day can make a difference

Cochrane Crowd

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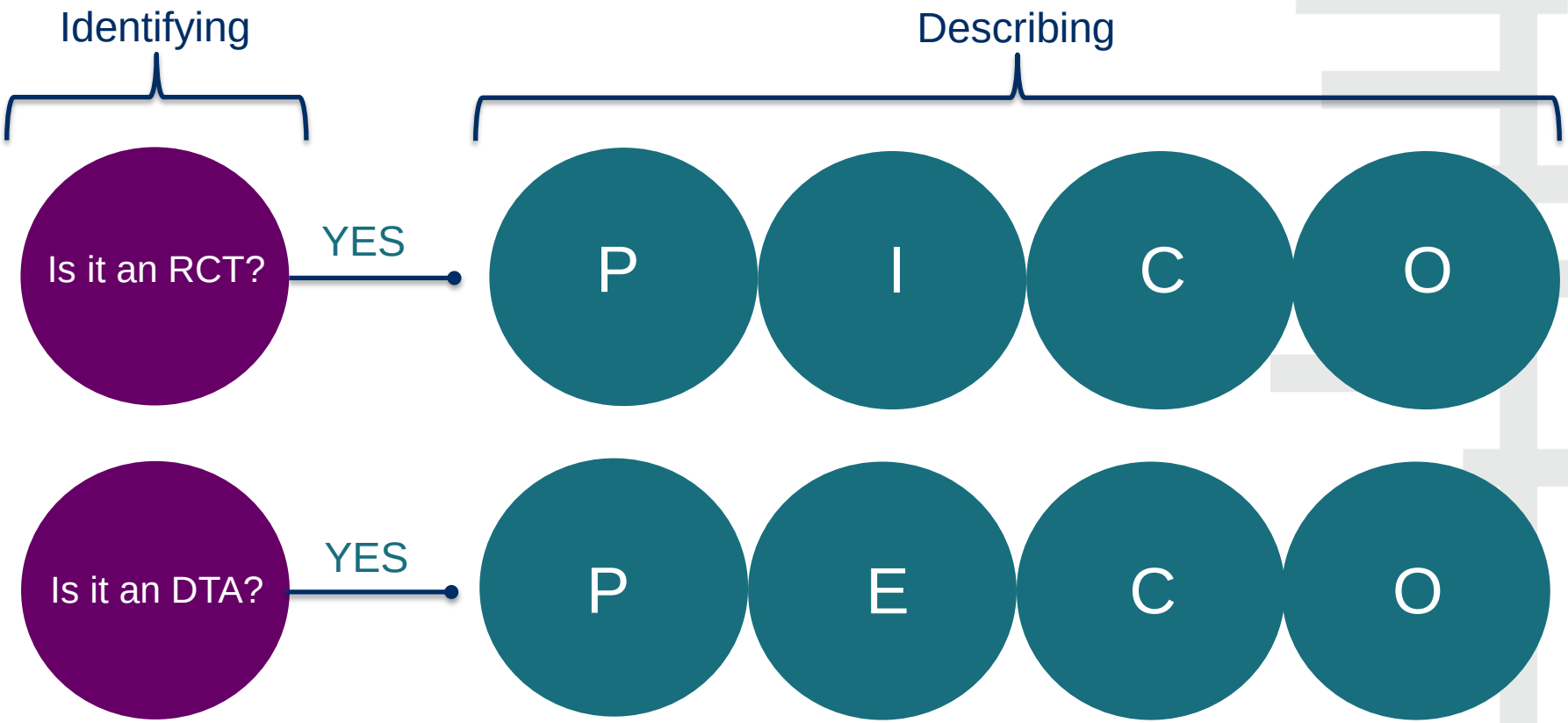
Available

Planned

More microtasks



Questions and ideas

- We think we've taken a complementary approach to that of COMET
- What are we missing?
- What questions do you have?
- What use cases do you have?
- What ideas do you all have in how we can work together? Collaboration opportunities?
  - For example, curating outcome sets together?
  - Mapping our annotations to COSs?
  - Our process will surface loads of issues that could inform your work

Thank you