Early **E**conomic **E**valuation of **E**merging Technologies: A Systematic Review

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Outline

1. **Background**

2. **Objectives**

3. **Methods**

4. **Preliminary results**

5. **Discussion**

6. **Limitations**

7. **Next steps**

Background

Health System Challenges

- Sustainability
  - Technologies drive cost upward
- Technological innovations can
  - improve health
  - *drive economic growth and employment.*

Technological Innovations

- **Infrequently discovered**
  - 1 approved medicine per 5000 screened compounds

- **Development process is slow and costly**
  - Average ~ 9 years,
  - ~800 million for a new medicine

Development Plan

Phase	Clinical data	Economic Data
Pre-clinical studies	Key mechanism of action, biological impacts ➔ Developing the **indication** (e.g., PICO)	Costs and health consequences of the **effectiveness gap(s)** in current practice, maximum attainable price

Development Plan

Phase	Clinical data	Economic Data
Pre-clinical research	Key mechanism of action, toxicity ➔ Development of **indication**	Costs and health consequences of the **effectiveness gap(s)** in current practice, maximum attainable price
Clinical research	Phase I: e.g., dose range, side effects Phase II: e.g., dose response, side effects *Phase III: clinical benefits, harms*	Phase I-II: **Likely** cost-effectiveness of the emerging technology

Go/No-Go Decisions

- What is the cost-effectiveness of the emerging technology **once it is fully developed**?
  - How much would payers be willing to pay for the final product?
- Given what we know now, is it worth investing in the next phase?

Economic Evaluation To Inform Go/No-Go Decisions

- Expected cost-effectiveness ratio of the technology relative to the best alternative.

- Expected monetary value of additional evidence, given what we know now.

Proponents of Early Evaluation

- Assessment **should** be conducted early, and updated often
  - e.g., Ijzerman et al. 2011, Hartz et al. 2008, 2009; Sculpher et al. 1997

- To inform product development
  - By manufacturers, developers, inventors, investors

- To inform policy development
  - When public R&D is used to support technology
    - e.g., Early HTA initiatives from governments or academia
    - e.g. UK, Netherlands, Austria, Ontario

Empirical Questions

- Why is an evaluation needed early?

- Can early evaluation contribute to decision-making for product and policy development?

- When is the optimal timing of early EE?
  - Too early, too much uncertainty
  - Too late, results may not be useful

Objective

- To conduct a systematic review of early economic evaluation of emerging technologies.

Methods

Inclusion Criteria

- Economic evaluation study
  - Compares costs, health outcomes of alternatives
- Regulated health technologies
  - e.g., pharmaceuticals, biologics, high-risk medical devices, biomarkers
- Evaluation must be early
  - Conducted before regulatory approval
- *Excluded studies of low-risk medical devices, surgical procedures, health promotion activities.*

Systematic Review Conduct

- Literature search of multiple databases
  - MEDLINE, EMBASE, CRD, EconLit.
- Pairs of independent assessors
- Protocol registered with Prospero
  - International Prospective Register of Systematic Reviews
- Protocol submitted to the open-access Journal of Systematic Reviews

Unpublished Studies
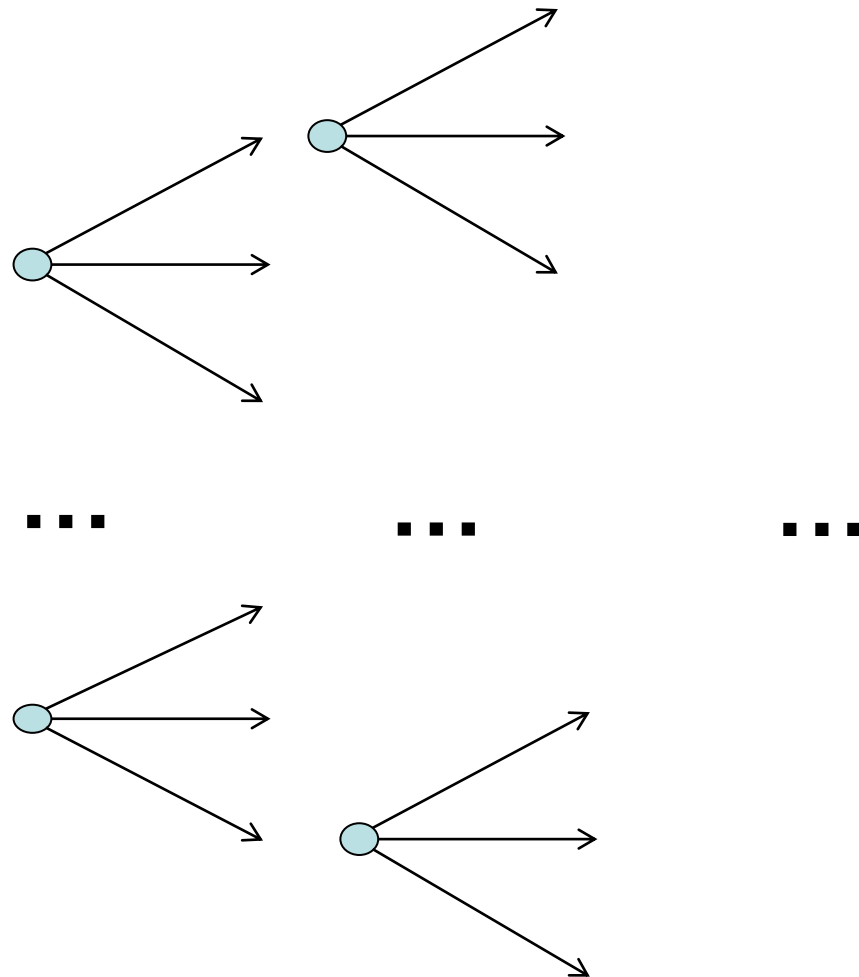## Chain-Referral Sampling

Stage 0:

Authors of included studies

Content experts we know

Working in industry

Stage 1   Stage 2   Stage *n*

. . .   .

Preliminary Results

Literature Search Results

	Medline*
	# Early EE citations (# EE citations)
Jan. 2010 – March 2013	1,036 (6,804)
1960 – Dec. 2009	3,722 (35,578)

Notes: EE: economic evaluation.

*We still need to search other databases and unpublished studies.

# Citation Screening

Medline 2010-Current Search n=1036 citations

Economic evaluation?

Not EE: 450

Regulated medical products?

No: 219

Early evaluation?

Not early: 297

Full-text retrieval n= 70

Not EE: 14;
Not early: 42

Included studies n= 14
Searching reference lists n=2
Total included studies: 16
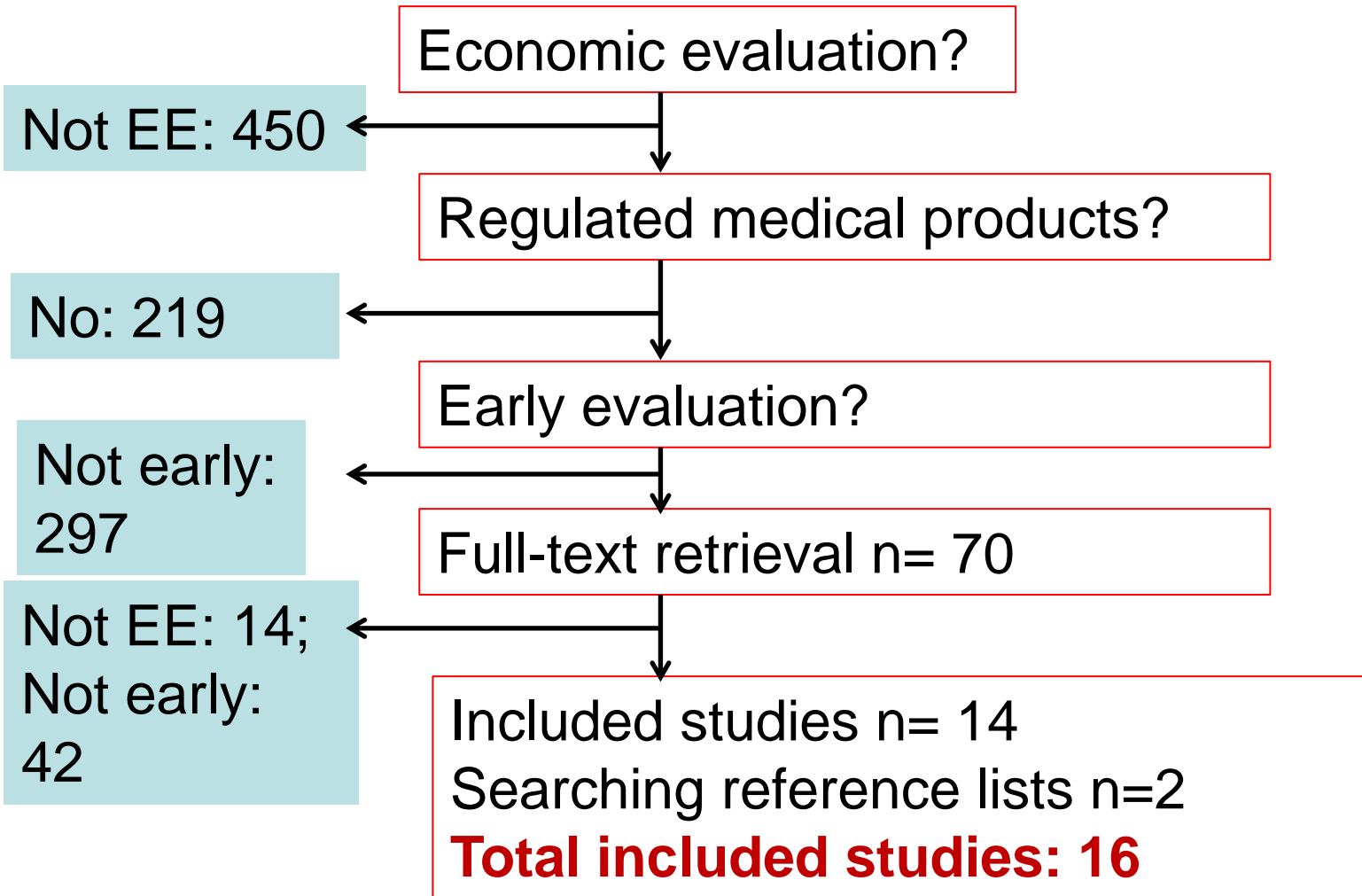
Decision Context

- Who initiated the evaluation?
- Who was the primary target audience?
- Why was an evaluation needed now?
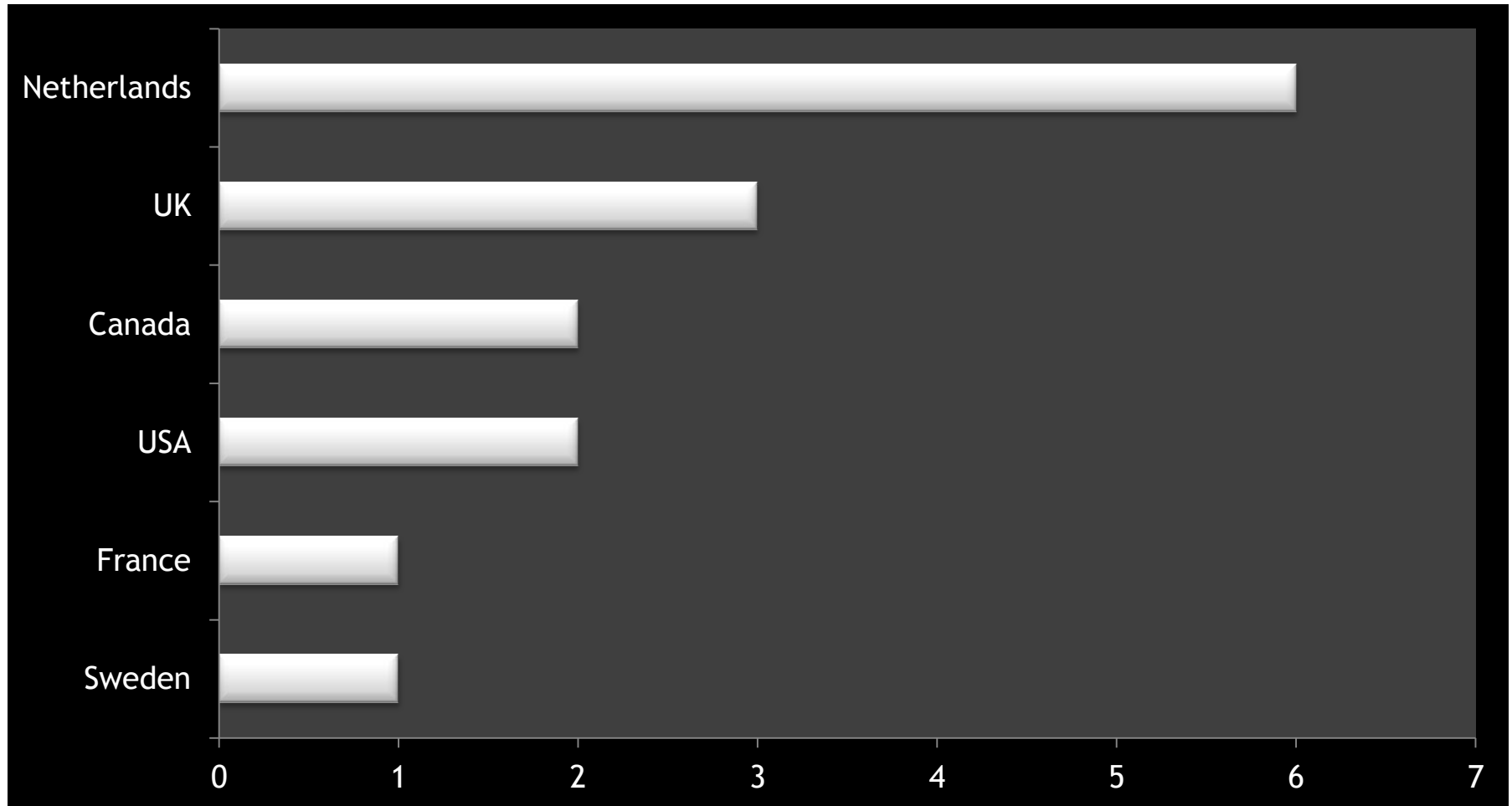- *Answers are not explicitly stated in the included studies*.
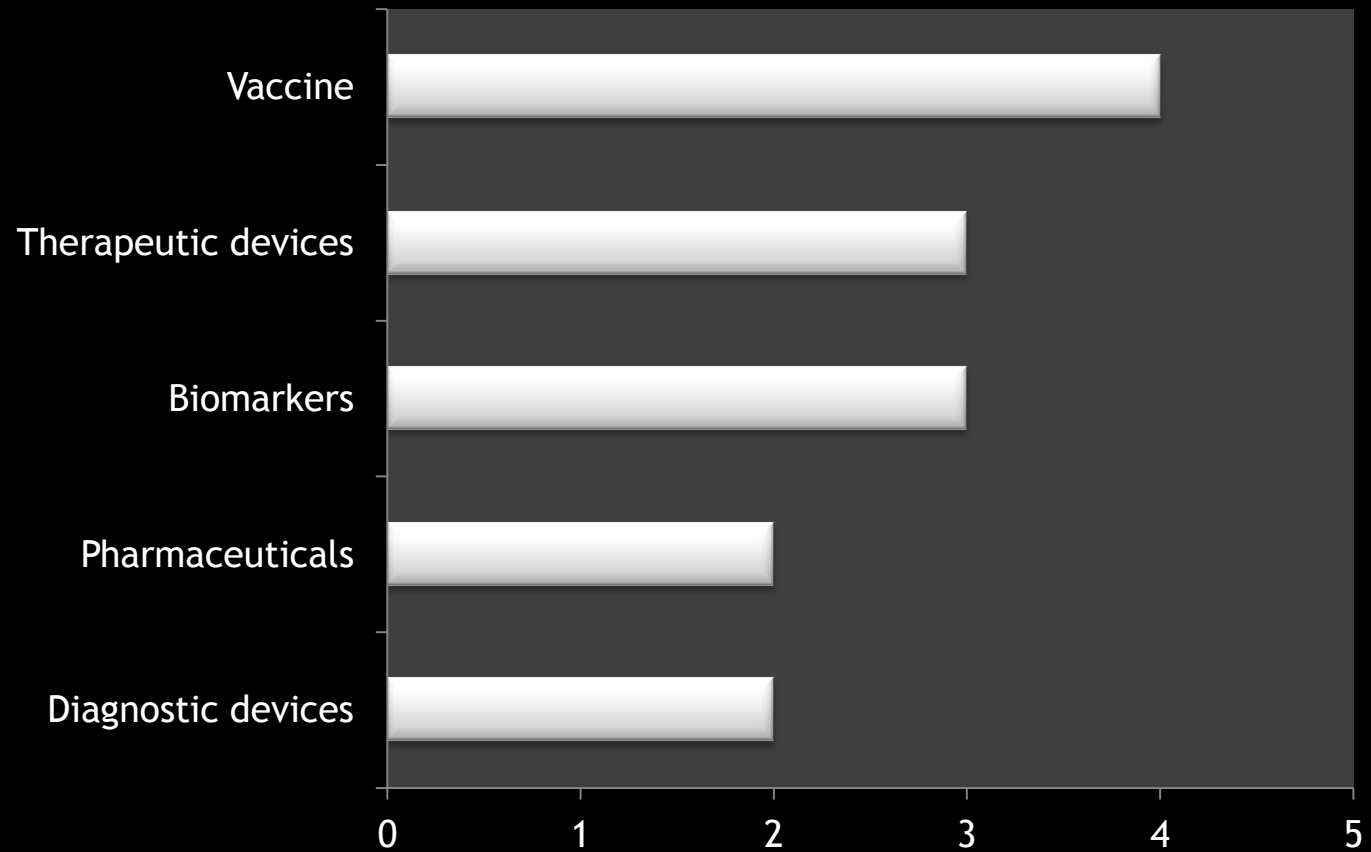
Characteristics – Funding Sources (n=16 studies)
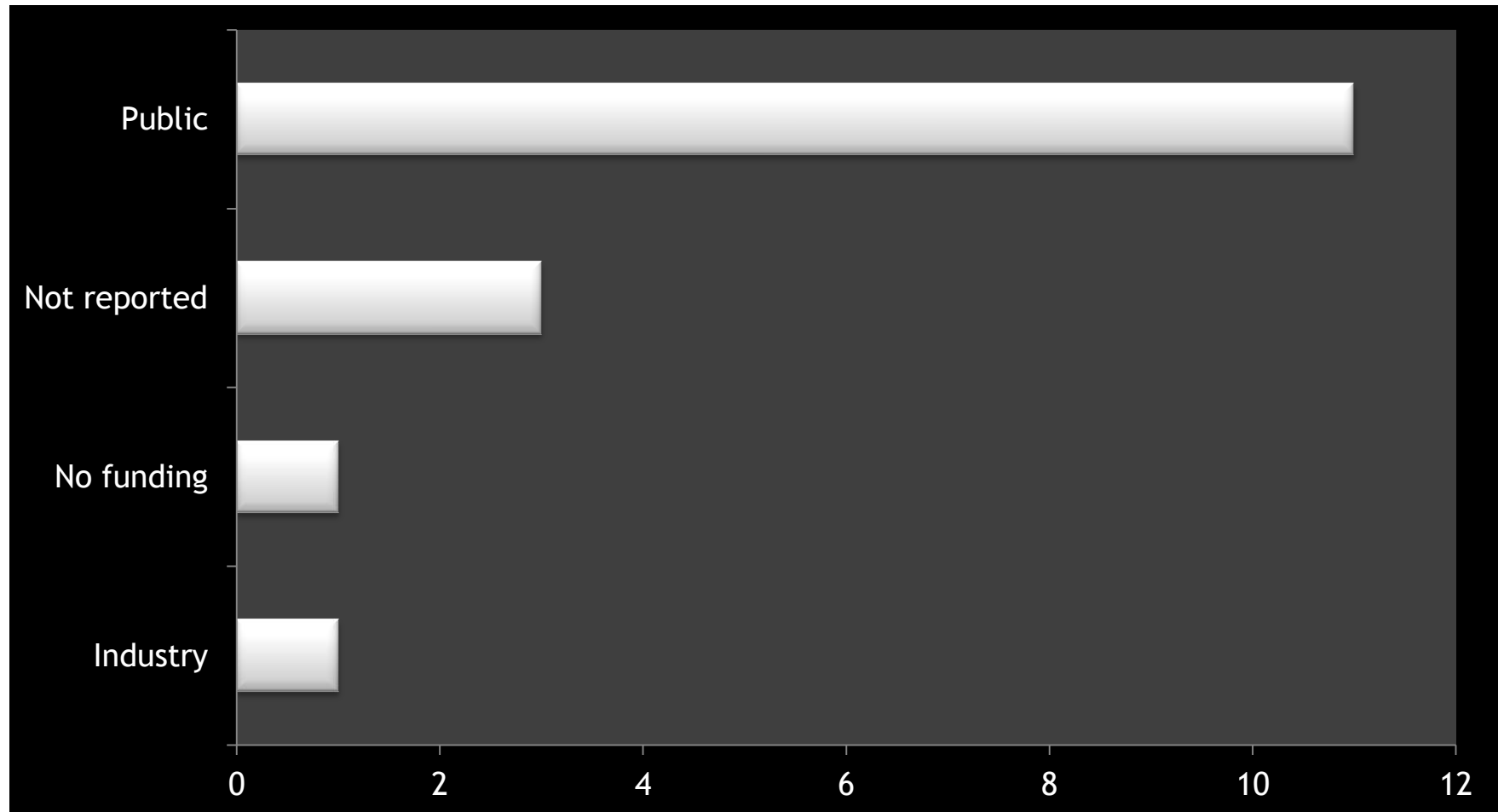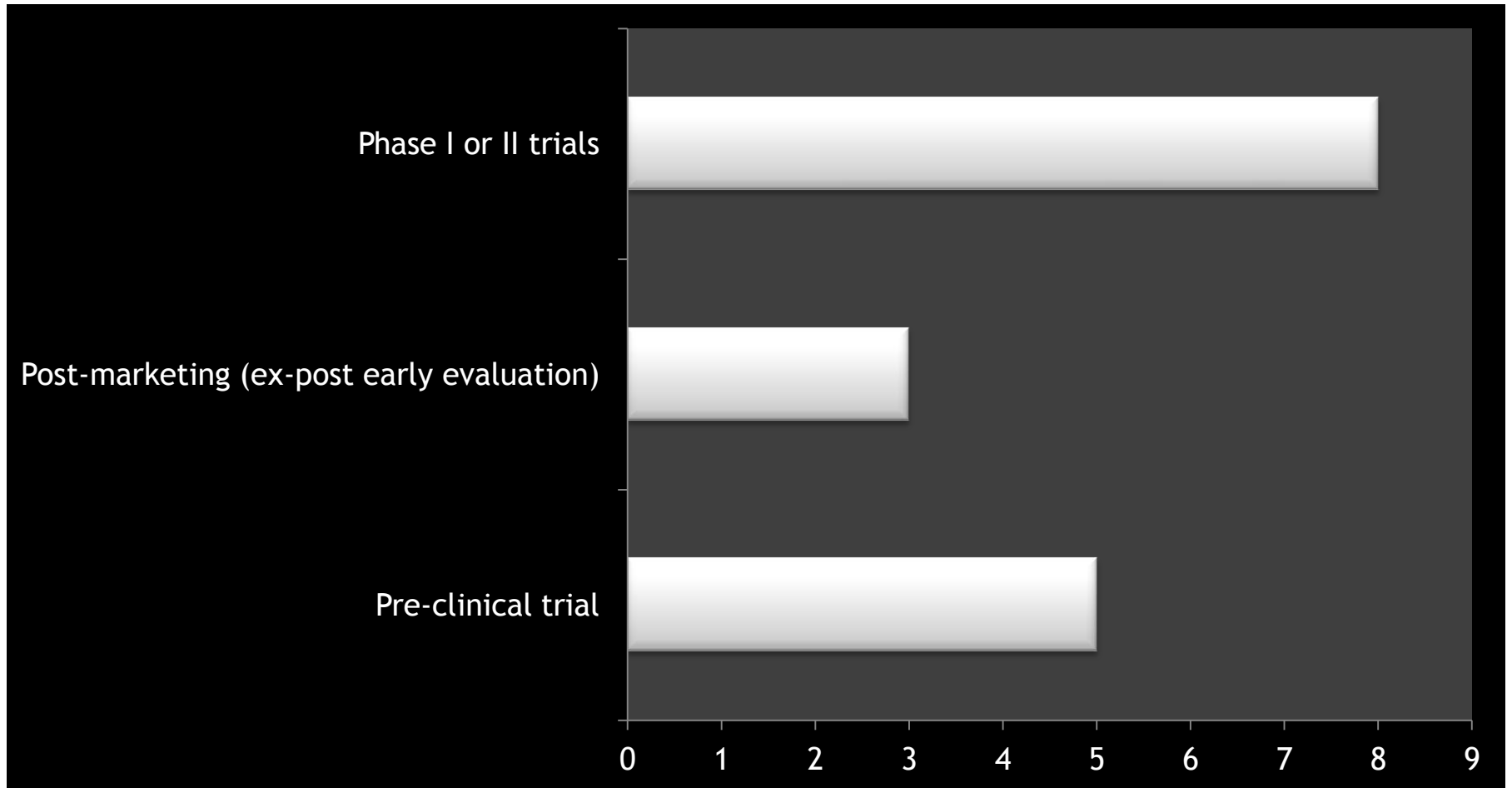
Study Characteristics – Country (n=16 studies)
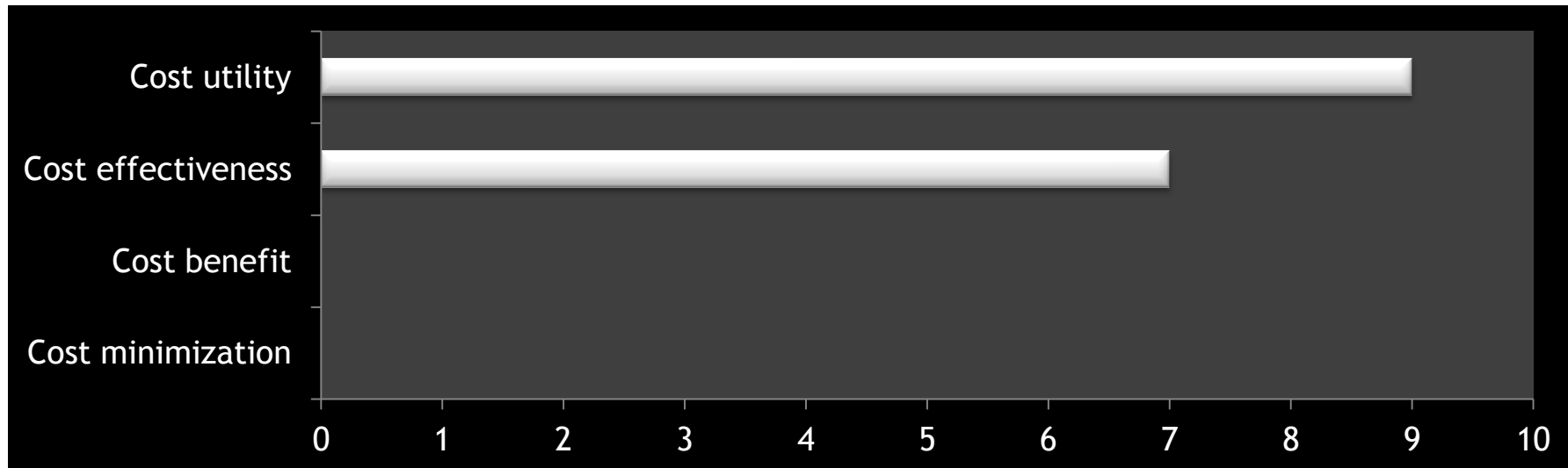
Health Technologies
(n=16 studies)

Evaluation Type
(n=16 studies)

Likely Effectiveness Estimates

1st Author	Data Sources	Likely effectiveness estimate
Soares	Literature review, expert opinions, a pilot RCT	Estimate derived from multiple data sources
Nagelkerke	Related RCT	Estimate derived from related RCT data
Gaultney	Related RCT	Estimate derived from related RCT data
Pink	Related RCT	Estimate derived from related RCT data
Dempsey	Related RCT	Estimate derived from related RCT data
Gold	Related RCT	Estimate derived from related RCT data
Multinghe	Genetic association studies	Estimates from genetic association studies
Retel	Selected studies	Estimates from small validation studies
Biasutti	Selected studies	Estimates from studies of "similar" indication
Postmus	Selected studies	Estimates from studies of "similar" indication
Meijboom	Basic research	Estimates based upon immunological characteristics
Bartha	Literature review	Estimates from studies of "similar" indication
Lu	Content experts	Estimates from clinical or expert opinions
Garrison	Content experts	Estimates from clinical or expert opinions
Carrasco	Not reported	Stated estimates without justifications
Tseng	Not reported	Stated estimates without justifications
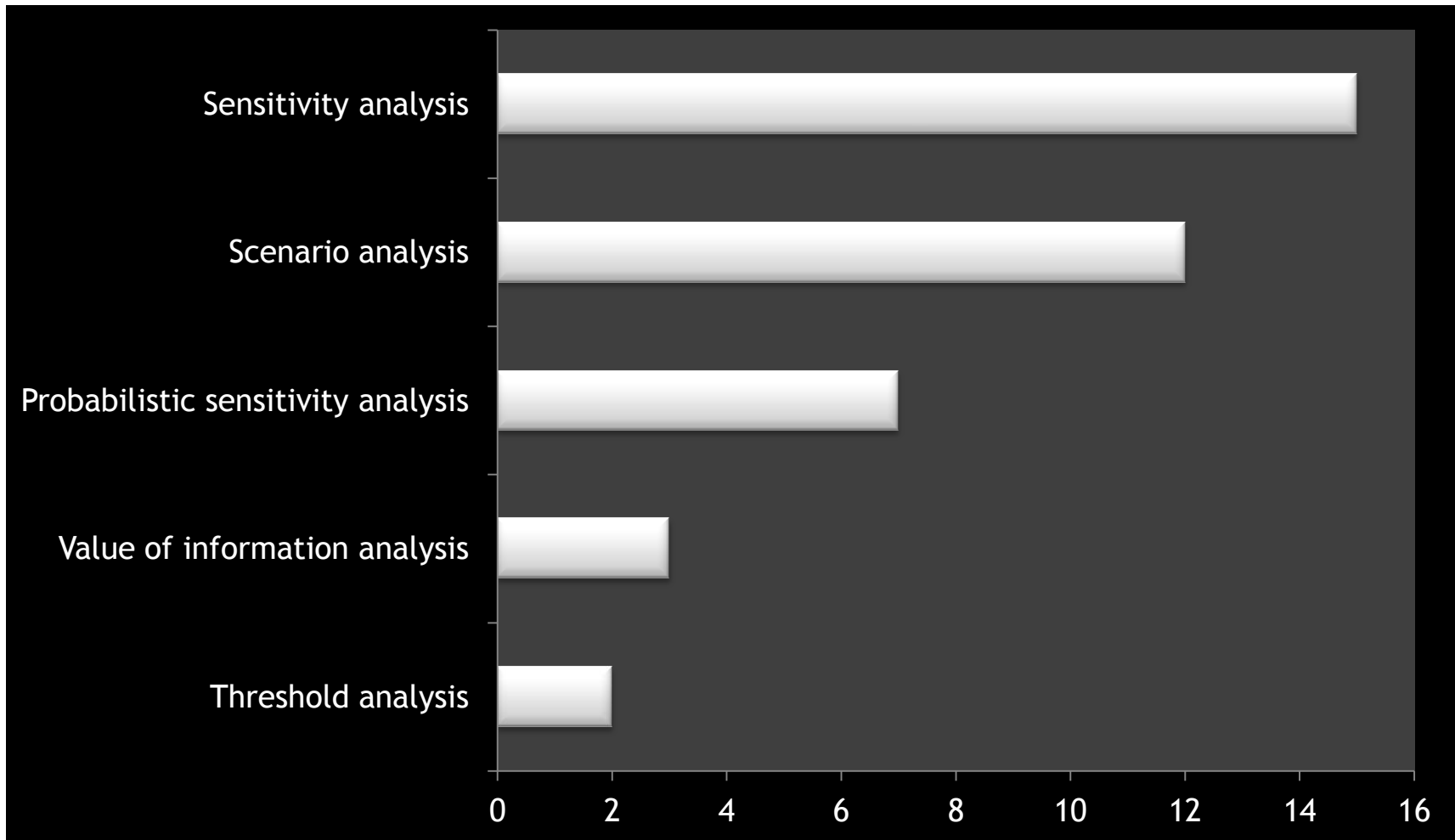
Can the results address the main study question or objective? (n=16 studies)
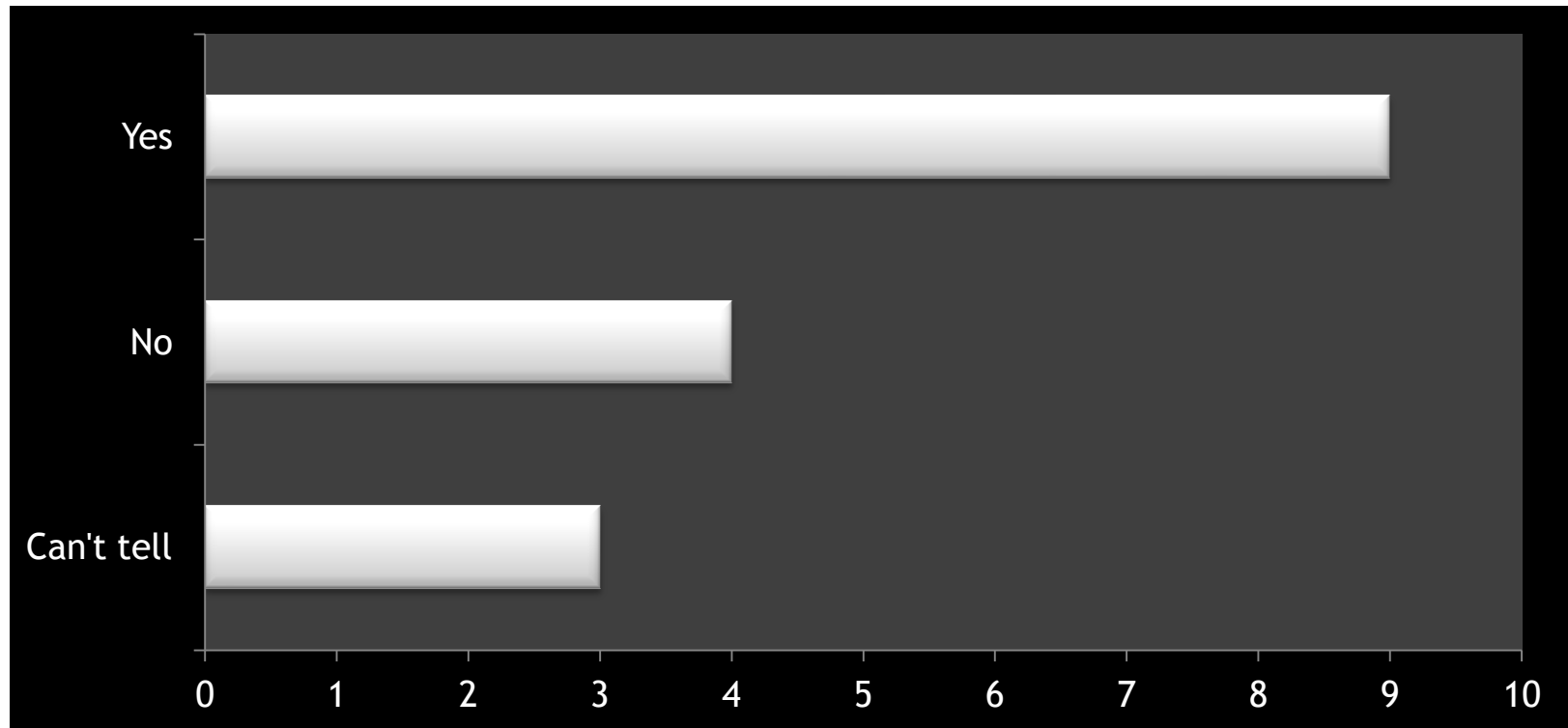
Notes: Results are reasonably similar according to
- authors
- reviewers

Discussion

Key Findings

- ## < 1% of published EE studies are early evaluation.

  - ### Early EE may be conducted for internal use only.

- ## Early evaluation may contribute to decision making, but the decision context is unknown.

Suggestions for Product Development

- **Better understanding the decision context of early evaluation**
  - Drugs, biologics, medical devices, biomarkers
  - Early evaluation is routine practice for vaccines
- **There may be room for better uptake of analytical approaches to early evaluation.**
  - Iterative economic evaluation

Suggestions for Policy Development

- **Explore the use of early evaluation in public investment decisions**
  - Select technologies for early evaluation
  - Design research program to evaluate the new technologies.

Next Steps

- **Completing the systematic review**
- **Chain-referral sampling of content experts working in industry.**
  - To obtain unpublished studies, if possible.
  - To survey responders regarding the decision context of early evaluation.

Next Steps

- **Conducting a methodological review of decision analytic modeling for early economic evaluation.**
  - Collaborating with authors of published studies

Limitations

- **Preliminary results**

- **Final results may be different**
  - Unpublished studies
  - Studies from other timeframes
  - Studies from other databases
    - (e.g., European CEA studies in EMBASE)

Questions and Comments
Thank you!