

PRISMA 2020 Checklist and Protocol

Carbon Capture Utilisation and Storage (CCUS) and Public Perceptions: A Systematic Literature Review

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PRISMA 2020 Checklist.

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 1, line 2
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 1, lines 9 -21
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Page 3, lines 49-51
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 3, lines 51-57
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 5, lines 96-100, Page 6, lines 136-138, Page 7, lines 161-165
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 5, lines 106-107
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 5 - 6, lines 115-130
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6, lines 134-141
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Page 8, lines 170-173
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Not Applicable
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	Not Applicable
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Pages 8-9, lines 189-191
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Not Applicable
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 8, lines 177-189
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Not Applicable
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Not Applicable
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Pages 8-9, lines 189-193
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Not Applicable
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Not Applicable
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not Applicable
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not Applicable

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Not Applicable
Study characteristics	17	Cite each included study and present its characteristics.	Dataset
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Pages 8-9, lines 181-193
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Not Applicable
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Not Applicable
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Not Applicable
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Not Applicable
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Not Applicable
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not Applicable
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not Applicable
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 18-19, lines 421-436
	23b	Discuss any limitations of the evidence included in the review.	Page 9, lines 197-203
	23c	Discuss any limitations of the review processes used.	Page 9, lines 197-199
	23d	Discuss implications of the results for practice, policy, and future research.	Page 19-26, lines 440-600
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 26, line 611
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	PRISMA Protocol below
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Not Applicable
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 26, lines 606-611
Competing interests	26	Declare any competing interests of review authors.	Page 26, line 603
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 27, line 620 and Dataset

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

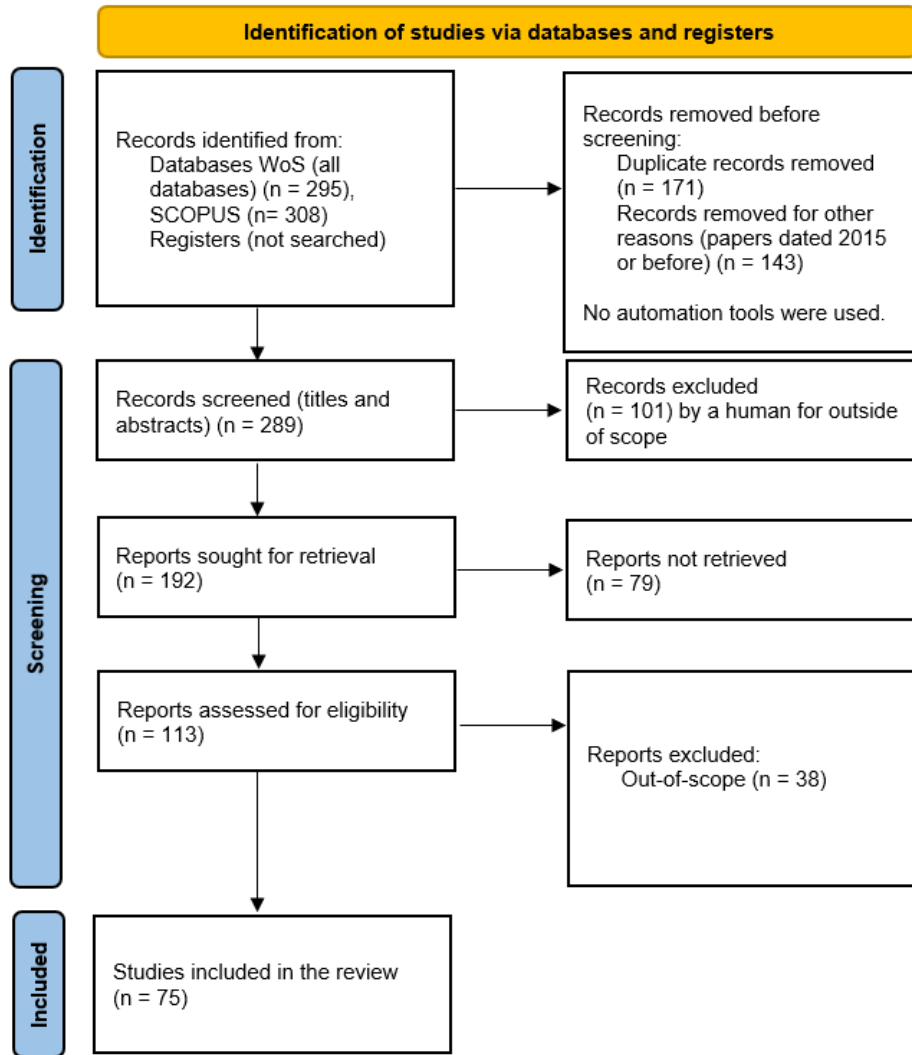


Figure 1 – PRISMA 2020 flow diagram of studies to be included in the systematic literature review.

PRISMA PROTOCOL

1 Purpose and aim

To understand public perception towards CCUS technologies and identify how those perceptions vary across stakeholder groups according to multiple factors – such as social, cultural, environmental and economic impacts, benefits, costs, risks and safety concerns – to ultimately inform strategies for positive communication and engagement with communities about CCUS.

2 Patient Intervention Comparison Outcomes (PICO)

PRISMA cites the PICO framework to compare studies. This provides the first brainstorming session for searching keywords and themes.

2.1 Patients

Who perceives and what is perceived?

- a. Government – Policymakers and regulators: policy requirements
- b. Consumers and General Public: needs and perceptions
- c. Environmental NGOs: needs and perceptions
- d. Experts: technical issues

What is perceived? Examples:

- Impacts, benefits and costs:
 - _ Social;
 - _ Cultural;
 - _ Environmental;
 - _ Economic;
- Risk and safety concerns.

2.2 Intervention

The infrastructure itself:

- CO2 capture plant;
- Onshore transport (pipelines, trucks, rail);
- Buffer storage;
- Offshore transport (pipelines, ships);
- Onshore CO2 Injection facilities;
- Offshore CO2 Injection facilities.

Stages:

- Early/design/planning;
- Implementation;
- Operation;
- Maintenance.

2.3 Comparison

What is seen as affecting public perceptions of CCUS? Examples are:

- Technologies;
- Procedures/processes including:
communication/engagement/outreach/participation/consultation at various stages;
- Implementation/operation/maintenance;
- Impacts and concerns;
- Costs;
- Benefit sharing/compensation/payout.

2.4 Outcomes

Different public perceptions of CCUS technologies about social, cultural, environmental and economic impacts, benefits, costs, risk and safety concerns – what can be lost, gained, and maintained – accordingly different stakeholders and how those perceptions can inform strategies for positively communicating and engaging with communities about CCUS.

3 Databases

Search in WoS (all databases) and SCOPUS. Exclusions:

- Non-English language documents;

4 Searches strategy development

4.1 Previous most cited reviews

The most cited literature reviews about public perception of CCUS technologies found in WoS and SCOPUS were:

Literature review:

1. P. Tcvetkov, A. Cherepovitsyn and S. Fedoseev (2019). Public perception of carbon capture and storage: A state-of-the-art overview. *Heliyon* Vol. 5 Issue 12 Pages 28. DOI: 10.1016/j.heliyon.2019.e02845 54 citations
2. N. Koukouzas, M. Christopoulou, P. P. Giannakopoulou, A. Rogkala, E. Gianni, C. Karkalis, K. Pyrgaki, P. Krassakis, D. Panagiotaras, P. Petrounias. (2022). Current CO₂ Capture and Storage Trends in Europe in a View of Social Knowledge and Acceptance. A Short Review. *Energies* Vol. 15 Issue 15 Pages 30. DOI: 10.3390/en15155716 6 citations

Systematic literature review:

3. K. Witte (2021). Social Acceptance of Carbon Capture and Storage (CCS) from Industrial Applications. *Sustainability* Vol. 13 Issue 21 Pages 29. DOI: 10.3390/su132112278 6 citations

Systematic meta-narrative literature review:

1. J. A. E. Nielsen, K. Stavrianakis and Z. Morrison (2022). Community acceptance and social

impacts of carbon capture, utilization and storage projects: A systematic meta-narrative literature review. Plos One Vol. 17 Issue 8 Pages 33. DOI: 10.1371/journal.pone.0272409 6 citations

4.2 Search string

Both databases were searched for Titles, Abstracts and Keywords.

Keywords:

(CCS OR “Carbon Capture and Storage” OR CCUS OR “Carbon Capture Usage and Storage”)
(public OR social OR stakeholder OR local* OR *owner OR community OR resident* OR indigenous)
(perception OR awareness OR attitude OR willingness OR support OR benefit OR acceptance OR tolerance OR opposition OR resistance OR cost OR safety OR compensation OR licen*)
(environm* OR econom* OR soci* AND benefits OR impacts OR risk)
(infrastructure OR transport* OR storage OR injection)

However, those terms returned too many irrelevant papers. Hence, we used the proximity function. The keywords (public OR social OR stakeholder OR local* OR *owner OR community OR resident* OR Indigenous) and (perception OR awareness OR attitude OR willingness OR support OR benefit OR acceptance OR tolerance OR opposition OR resistance OR cost OR safety OR compensation OR licen*) are related and should be part of the same sentence. To search this way, we used the proximity search function, which allows us to ensure the words are in proximity and specify how close.

We selected within 4 words to allow for latitude and yet make sure that the terms were in the same sentence becoming (public OR social OR stakeholder OR local* OR *owner OR community OR resident* OR indigenous) NEAR/4 (perception OR awareness OR attitude OR willingness OR support OR benefit OR acceptance OR tolerance OR opposition OR resistance OR cost OR safety OR compensation OR licen*).

Regarding First Nation stakeholders, we used the keyword Indigenous as the keywords First Nation/Aboriginal/Traditional owner/Custodian did not change the search outcome. Also, we did not include industry/firms/investors/suppliers, as these words directed to CCUS technology and project developments more than public perception.

4.2.1 WoS string and results

((TS=(CCS OR “Carbon Capture and Storage” OR CCUS OR “Carbon Capture Usage and Storage”)) AND TS=((public OR social OR stakeholder OR local* OR *owner OR community OR resident* OR indigenous) NEAR/4 (perception OR awareness OR attitude OR willingness OR support OR benefit OR acceptance OR tolerance OR opposition OR resistance OR cost OR safety OR compensation OR licen*))) AND TS=(environm* OR econom* OR soci* AND benefits OR impacts OR risk)) AND TS=(infrastructure OR transport* OR storage OR injection)

Only peer-reviewed papers

Only papers in English

295 results from Web of Science Core Collection – 09/05/23

No filter by subject area was applied.

4.2.2 Scopus string and results

(TITLE-ABS-KEY (ccs OR "Carbon Capture and Storage" OR ccus OR "Carbon Capture Usage and Storage") AND TITLE-ABS-KEY ((public OR social OR stakeholder OR local* OR *owner OR community OR resident* OR indigenous) W/4 (perception OR awareness OR attitude OR willingness OR support OR benefit OR acceptance OR tolerance OR opposition OR resistance OR cost OR safety OR compensation OR licen*)) AND TITLE-ABS-KEY (environm* OR econom* OR soci* AND benefits OR impacts OR risk) AND TITLE-ABS-KEY (infrastructure OR transport* OR storage OR injection) AND LANGUAGE (English))

Only peer-reviewed papers

Only papers in English

308 documents found – 09/05/23

No filter by subject area was applied.

5 Paper screening

References are imported into EndNote from Scopus and WoS. Total 603.

Find duplicates in EndNote, count with Excel. Keep the record.

Screen title abstract in EndNote, add comments if needed.

Remove papers according to the exclusion criteria. Exclusion criteria: the main focus is not on social aspects (a large portion of documents are focused on technical parts), papers dated 2015 or before. Keep the record.

Discuss undecided papers.

Define the list of papers to be sought for retrieval.

Retrieve full text.

Remove papers with no pdf. Keep the record.

Define the list of papers assessed for eligibility.

6 Thematic Analysis

Import references from EndNote into NVivo.

Assess and exclude other papers according to the exclusion criteria, if necessary. Keep the record.

Assess and include new papers from previous studies' references and according to the inclusion criteria, if necessary. Keep the record.

Define the final list of papers to be included in the review.

Update EndNote references.

Code papers on NVivo according to themes raised by the papers.

7 Metadata Analysis

Import references included in the review from EndNote into Ryann.

Label papers.