

Methodology

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Methodology

Introduction to Scoping Reviews

Scoping reviews or scoping studies are a form of knowledge synthesis. The Canadian Institutes for Health Research (2005) defines synthesis as “the contextualization and integration of research findings of individual research studies within the larger body of knowledge on the topic. A synthesis must be reproducible and transparent in its methods, using quantitative and/or qualitative methods” (para. 7). Scoping reviews are not simply narrative literature reviews; rather, as a form of knowledge syntheses, these types of reviews employ systematic searching of the research literature as well as in-depth analysis of the evidence. Thus, while shedding light on the gaps in knowledge, scoping reviews simultaneously create new knowledge. Scoping reviews represent one type of review methodology; Grant and Booth (2009) provide a typology of 14 different review types and associated methodologies. A scoping review, or scoping study, is one of these methodologies that is used for undertaking systematic literature searching and knowledge synthesis.

The definition of scoping reviews has evolved from Arksey and O’Malley’s foundational work on this topic in 2005. At that time, the authors employed Mays, Roberts, and Popay 2001 definition and noted the aim of scoping reviews was “to map *rapidly* the key concepts underpinning a research area and the main sources and types of evidence available” (as cited in Arksey & O’Malley, 2005, p. 21, emphasis in original). Since 2005, various authors have defined and reported on scoping reviews in various ways leading to the call for clarity and consistency in scoping review definitions, methods and reporting (Colquhoun et al., 2014). For the purposes of this project, the SESEMI research team subscribed to the following revised definition: “A scoping review or scoping study is 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 defined area or field by systematically searching, selecting, and synthesizing existing knowledge” (Colquhoun et al, 2014, p. 1292). There are other review methodologies that are available to researchers, such as systematic reviews, meta-syntheses, and rapid reviews.

The SESEMI research team chose the scoping review methodology as its rationale aligns with Objective 2 of this research project: *develop a current and comprehensive knowledge-base of existing research in this area* as well as Objective 4: *articulation of specific research questions to be pursued in future research*. The scoping review methodology afforded the team the ability to systematically map the literature in selected topic areas, provide analysis as to the depth and breadth of the research available while also identifying gaps and areas for further investigation (Arksey & O’Malley, 2005). A scoping review proved to be a good fit for this project as the methodology provided a well-defined framework while also affording the team flexible and iterative processes, both of which fit the scope of the project. Other review methodologies, such as a systematic review, would not have aligned with the intent of this project.

Arksey and O’Malley (2005) outline several methodological principles for conducting a scoping review. These principles include the importance that the methodology employed throughout a scoping review be transparent and thorough. Meticulously documenting the details and rigour of the processes ensures the scoping review can be replicated; a hallmark of good research. As demonstrated throughout

this report, the SESEMI research team was diligent in documenting every step undertaken in this large project thus ensuring transparency and replication. To meet the main purposes of scoping review, the methods used to identify the evidence must retrieve literature that is both in-depth and broad and not guided by a narrowly defined research question or specific study design (Arksey & O'Malley, 2005, p. 22). The scoping review findings presented by the SESEMI research team demonstrate the expansiveness of the literature that exists within all of the research topics.

Scoping Review Training

The SESEMI research team was responsible for developing the training documentation as well as delivering the scoping review training for colleagues and students involved in this project. This was done separately by both institutions in 2014 under the guidance of the team librarians. The Saskatchewan Polytechnic (SP) team consisted of faculty-led teams whom were responsible for their research topic from inception to completion. The training consisted of a large group meeting wherein all teams were introduced to the project and the scoping review process. The SP project coordinator met with each team on a monthly basis to teach next steps to the scoping review process. The librarian offered training sessions at the beginning of the study and on an as-needed basis for each team.

The University of Saskatchewan (UofS) team hired several students and employed several student-volunteers to assist with the scoping review process. The students' time was dedicated to searching the literature, reading and summarizing the literature, obtaining the online articles for review, and finally assisting with creating the topic chapters. The UofS team provided a multi-day intensive training for students that included an introduction to the project and related literature, instruction on systematic search strategies, documentation, and citation management software, as well as detailed information on the steps and accompanying processes and procedures for conducting a scoping review. Following the initial training session, the UofS team met regularly to discuss any issues or questions as well as to provide additional training that was needed.

A focus group discussion was held with the initial cohort of UofS students after their first three months of full-time employment (Summer 2014). The purpose of the discussion was for students to reflect on their work experiences and to assist the UofS research team with assessment of the summer work program. The findings of this focus group discussion were quite rich as the students reflected on the skills and knowledge gained by participating with the project. Through their participation with this project, the students gained systematic searching skills, critical thinking skills (through screening copious amounts of references), analytical skills (by summarizing academic journal articles), as well as information technology skills (by learning the intricacies of library databases and RefWorks).

Scoping Review Search Rationale

As noted, the SESEMI team represented the two research teams at the UofS and SP, where both institutions implemented a scoping review methodological framework. While the SESEMI team worked collaboratively at the project level, the individual teams were unique in some aspects on the approach employed for searching the literature for the individual research topics. The SP followed a tiered approach to the literature search where the first step was to find current, relevant, focused research specific to miners' safety engagement behaviors. If the literature was not available, the next step was to

broaden the literature search to include research from other industries. Contrarily, the UofS team was interested in exploring safety broadly and identifying how safety concepts were addressed in the literature at the individual, organizational, and program levels. This broad approach meant the UofS team did not limit by specific industry sector or by a specific population (other than adults). It was the desire of the team to not limit to mining but rather cut-across all industrial sectors that could potentially be applied in novel ways for the benefits of the mining industry.

Scoping Review Methodological Framework

The original framework for scoping reviews (Arksey & O'Malley, 2005) consists of five stages, with an optional stage six:

Stage 1: identifying the research question

Stage 2: identifying relevant studies

Stage 3: study selection

Stage 4: charting the data

Stage 5: collating, summarizing, and reporting the results

Stage 6 (optional): consultation exercise

For the purposes of this project, the research team subscribed to this framework along with some of the recommendations by Levac, Colquhoun, and O'Brien (2010). What follows is a general description of each stage that pertains to all the topics. Specific details of the search strategy related to the individual research topics can be found in the proceeding chapters. As this was a large, multi-institutional collaboration, some of the processes were different depending on the institution; this is noted where necessary.

Stage 1: Identifying the Research Question. For a scoping review, it is important to identify the research question or questions at the beginning of the process. This sets the stage for the remainder of the process including the development of the search strategies as well as search parameters (Arksey & O'Malley, 2005). At this stage, the research question is not narrowly focused to ensure a broad scoping of the literature.

The development of the research questions for each topic was an iterative process starting with very broad questions related to the major safety concepts with various outcomes to more specific ones, guided by the evolving search results and discovered information. The SESEMI project teams did not always specify research questions when starting the research investigation for each topic. Rather, general research avenues for topics were identified at the start where teams would brainstorm potential avenues of investigations. These initial avenues of investigations were later transformed into research questions. As some of the topics did not have explicit research questions from the beginning, it was sometimes a struggle to determine what literature should be included in the review. The broad research areas were not always granular enough to provide clear direction when faced with research that appeared useful and relevant. Levac, Colquhoun, and O'Brien (2010) echoes this challenge where the lack of a clear question can result in lack of direction, clarity and focus, all of which assist with future stages of the research process (p. 4).

Stage 2: Identifying Relevant Studies

2.1. Search Strategy

2.1.1. Search Strategy: Terminology. After identifying the research question(s) or research areas, the next stage was to locate the relevant research. The first step in this process was to dissect the research question by parceling the question into key concepts. For example, the research question: *how is personality related to employee safety behaviour* contains two main concepts: *personality* and *safety behaviour*. For each research question, a concept chart was developed where team members would brainstorm possible synonyms (e.g., keywords, phrases, subject headings) related to each of the core concepts. The purpose of this process was to begin to develop search strategies to employ across the databases thus ensuring search consistency.

The actual search syntax for each research question was unique to the database searched. When possible, the researcher searched by the database's subject headings. Subject headings are a form of controlled vocabulary where standardized terminology is assigned to a concept to assist with retrieval of relevant information. For example, a database may use the subject heading 'occupational stress' to describe different synonyms of work-related stress such as burnout, job stress, work stress, etc. By searching the main subject heading, the searcher does not have to also search for all the different synonyms of occupational stress. Some databases do not support controlled vocabularies and therefore keyword searching or natural language searching was implemented in lieu of subject heading searching. It was most often the case that a combination of both subject heading and keyword searching was used in the database searches.

As the concept of safety was core to each research topic, the UofS research team developed a standardized safety search strategy for each of the major databases to be searched. This safety search was then combined with the other core concepts in the research question.

2.1.2. Search Strategy: Boolean Operators. Several search techniques were implemented throughout the search process. The Boolean operators *AND* and *OR* were used to connect the core concepts in each of the searches. *OR* is used to broaden a search as placing this operator between synonyms ensures all of the synonyms are searched and retrieves results where any one of the synonyms is present. For this example: *Risk Management OR Risk Assessment OR Risk Perception*, the search results will be large as any one of these terms can be present to be retrieved.

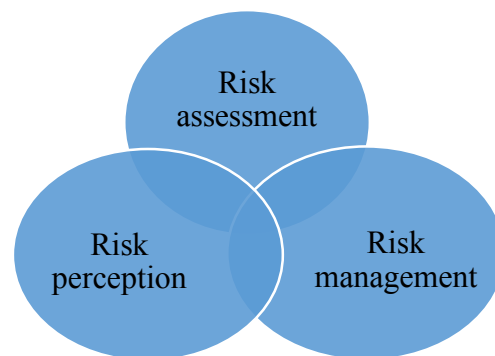


Figure 1. Boolean representation of implementing the OR operator.

Alternatively, using the operator *AND* narrows the search as the search results must contain all of the search terms. In this example: *Safety AND Motivation*, using the *AND* between these two concepts limits the results as both terms must be present to be retrieved.

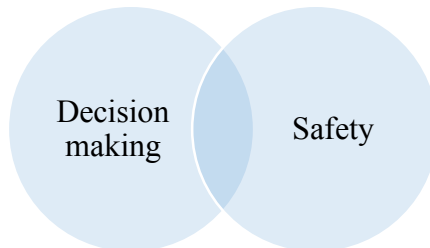


Figure 2. Boolean representation of implementing the *AND* operator.

The above examples can be combined to demonstrate a more advanced search string: *(risk assessment OR risk management OR risk perception) AND (decision making AND safety)*.

The research teams used a combination of Boolean operators with every search strategy for each topic. From the main research question, several core concepts were isolated (for example: Concept A and Concept B) and then within each concept, synonyms were noted. In the database search, Concept A was searched by entering all synonyms, separated by *OR*. This resulted in a large set of results for Concept A. Concept B was then searched in the same way (i.e. *OR* between the synonyms). The two result sets from Concept A and Concept B were then combined using *AND* to see where there was unique overlap between the two concepts. The following is a sample search string from the *Sociological Abstracts* database to demonstrate this process (note, *su* = subject heading):

Concept A: Safety

su(safety) OR su((industrial safety OR occupational safety and health)) OR su((risk assessment OR accidents)) OR su(hazards) OR ("safety behavio*r" OR "risk taking") OR ("risk perception" OR "risk management") OR ("accident prevention" OR "accident proneness") OR ("industrial accidents" OR "safety devices") OR ("safety climate" OR "safety culture") OR "culture of safety"

Results: 8,007

Concept B: Gender

su(feminism OR males OR females OR gay OR heterosexuality OR masculinity OR femininity) OR (machoism OR "sex differences" OR "sex roles") OR ("gender variance" OR "gender binary" OR "gender queer" OR "third gender" OR "third sex") OR ("human sex differences" OR "sex role attitudes")

Results: 95,996

Concept A (8,007) *AND* Concept B (95,996) = Final search: 1,063 results

2.1.3. Search Strategy: Truncation and Phrase Searching. A truncation symbol, usually an asterisk (*), can be used to find variant word endings and spellings of a search term. For example, environment*

will retrieve environment, environments, environmental, environmentalist.

Phrase searching was also used to retrieve results that are more relevant. Placing a phrase in quotation marks, such as “culture of safety”, signifies that the exact phrase must be searched in that specific word order. Without quotations marks, the words would be searched but not necessarily as a phrase.

2.1.4. Search Strategy: Limiters. Most databases offer the ability to limit search results through a variety of search filters. The most commonly used limiters applied for this project were:

- Language: English only. The large majority of the research articles retrieved were written in English. The research team did not have the capacity to hire a translator for this project nor was it deemed necessary.
- Age range: In some of the databases searched (specifically *PsycINFO*, *MedLine*, *Embase*, and *Cinahl*), the team limited to adults, 18 years plus.

After the searching was complete, other exclusion criteria were applied to the search results. More detailed information about this is provided in Stage 3, Study Selection.

2.2. Sources Searched

2.2.1. Sources Searched: Licensed Library Databases. The main source of literature retrieved and analyzed for this project were journal articles (original research articles and review articles). These journal articles were found by systematically searching a variety of licensed library databases. While databases typically index journal articles, other formats of research literature are also indexed including conference proceedings, dissertations, books, and book chapters. The table below represents the major databases that were searched for this project. Some databases are subject-specific (e.g., *PsycINFO* is specific to the discipline of psychology) while others are multi-disciplinary, covering a variety of subject areas (e.g., *Academic Search Complete* and *Scopus*). Specific databases were selected for each topic and are noted in the individual topic chapters. Not all databases listed below were searched for each topic. For example, for the topic of ethno-cultural factors, the database *Bibliography of Native North American* was searched but *MEDLINE* and *Embase* were excluded.

Table 1 Master List of Databases Searched

| NAME | DESCRIPTION |
|---|---|
| ABI/INFORM Complete | Business research database |
| Academic Search Complete | Comprehensive scholarly, multi-disciplinary database |
| Bibliography of Native North American | Native Studies database |
| CBCA Complete (Canadian Business & Current Affairs) | Multidisciplinary Canadian database |
| CINAHL | Comprehensive database covering nursing and allied health fields |
| Embase | Biomedical database indexing journals in fields including medicine, pharmacology, public health, and occupational health |
| Engineering Village (Compendex, Inspec, GEOBASE) | A collection of databases covering scientific, applied science, technical and engineering disciplines, earth sciences, ecology, oceanography and more |
| Environment Complete | Environmental studies database covering areas of agriculture, ecosystem ecology, energy, and affiliated areas of study. |

| | |
|---|---|
| ERIC | Education database, sponsored by the U.S. Department of Education, covering the literature of education |
| Google Scholar | Scholarly, multidisciplinary search engine |
| Justis | Legal database |
| MEDLINE | Major database for clinical medicine, biomedicine, nursing, and allied health |
| Nursing and Allied Health | Health care database covering areas such as nursing, allied health, and alternative and complementary medicine. |
| ProQuest Dissertations & Theses: Global | Database of doctoral dissertations and selected masters theses from universities in North America and Europe |
| PsycINFO | Expansive database from the American Psychological Association (APA) indexing peer-reviewed journals, books, and dissertations in all areas of psychology |
| Public Administration Abstracts | Public administration database |
| Scopus | A very large database covering research literature in the science and social sciences |
| SocINDEX | A comprehensive scholarly sociology database |
| Sociological Abstracts | Covers international literature in sociology |
| Web of Science | Collection of three citation databases: Arts and Humanities Citation Index; Science Citation Index; and Social Sciences Citation Index. Also includes two conference proceedings indexes (for the sciences and the social sciences/humanities). |

The databases were systematically searched using the search techniques listed above. The results from the searches were then exported to reference management software (UofS used RefWorks software while SP used Endnote software). The search strategies were saved within the databases and individual database search histories were saved as Word documents. Both techniques ensured searches could be easily re-run if needed and provided documentation for reporting purposes.

2.2.2. Sources Searched: Grey Literature. The grey literature was also systematically searched for this scoping review. “Grey literature is a field in library and information science that deals with the production, distribution, and access to multiple document types produced on all levels of government, academics, business, and organization in electronic and print formats not controlled by commercial publishing i.e. where publishing is not the primary activity of the producing body” (GreyNet, n.d.).

Grey literature is typically produced by organizations such as government departments, non-government organizations, private companies, associations, and research institutes. There are a variety of formats or publication types that can be classified as grey literature such as annual reports, working papers, evaluations, and discussion papers. Unlike most journal article databases, grey literature is not regulated or controlled by commercial publishers. Grey literature is typically not peer-reviewed. Because of this, searching for grey literature is often more time consuming as these types of publications are not systematically indexed. The benefit of consulting grey literature is that the publications are usually free and accessible to anyone with internet access. These types of publications can also be more topic focused, current, and timely as the publication process is less onerous than with the traditional academic publishing model.

The purpose of the grey literature search was to find publications related to the broad topics within the large project, produced by various stakeholders, such as mining companies, government departments, and

university research centres.

The following list represents the broad categories that were systematically searched in Google:

- Mining associations (Saskatchewan, Federal, and United States)
- Mining organizations (Canada and Australia)
- Safety research centres and institutes (Canada, Australia, United Kingdom, Europe, and United States)
- Canadian government agencies
- Work Safe organizations and worker compensation boards (Provincial, Federal, and Australia)

The grey literature searching was employed through a variety of search syntaxes in Google by the project librarians in the Fall 2015. The exact search strategies were dependent on the broad category, as listed above. For example, when searching for Canadian research centres and institutes, the following searches were conducted in Google:

Canada safety institute (reviewed first 10 pages)

safety research Canada (reviewed first 25 pages)

safety research Canada center (reviewed first 10 pages)

safety research Canada centre (reviewed first 10 pages)

The first ten pages of results were analyzed for the majority of the grey literature searches. In addition to targeted keyword searches, the librarians also noted additional organizations and publications to follow-up on based on the findings of the original search. This technique is often referred to as snowballing. Relevant information from the grey literature search was then transferred to a document where each organization was represented as a table, each containing the following information: name, website, purpose/function, publications, and information of potential interest. Once the grey literature search was completed, the document was provided to the SESEMI team to review (see Appendix B “Sources Identified via Grey Literature Search”). At this stage, the grey literature findings have not been systematically reviewed or incorporated into the final report.

2.2.3. Sources Searched: Books. In addition to the database and grey literature searches, a general book search was also conducted in *WorldCat*. *WorldCat*, dubbed the world’s largest library catalogue, is a website that allows users to search the content of thousands of libraries around the world through a single interface. *WorldCat* is accessible at <https://www.worldcat.org/>. Similar to the grey literature search, the *WorldCat* search strategy was broad in scope and not specific to any one topic. The searches consisted of a combination of subject headings and keywords and the results were limited to English-language book materials, published between 1995 and 2015 (the year the search was conducted). The following searches were executed:

Search #1: Subject heading “Psychology, Industrial” AND keyword “safety”

Search #2: Subject heading “Industrial safety” AND Keywords (psycholog* OR behavio*)

Search #3: Subject heading “Industrial hygiene” AND Keywords (psycholog* OR behavio*)

Search #4: Subject heading “Mine safety” AND Keywords (psycholog* OR behavio*)

Search #5: “Psychology of safety”

The search results were exported into RefWorks, de-duplicated, and then screened for relevancy. Notable

publishers were included (such as university presses) as well as titles that appeared immediately relevant. Excluded titles were those that were in formats such as encyclopaedias, booklets, safety manuals, as well as titles dealing with general industrial psychology. Once the initial screening was complete, the UofS Principal Investigator reviewed the list of books, including many of the physical books themselves, and determined the majority of the books' content did not add any novel information to the project. A decision was made by the research team not to focus on the book literature at this stage of the research project; however, this systematic list of relevant books may be useful in subsequent phases of this research.

2.3. Reference Management Software

Reference, or citation, management software allows users to work with large number of references in a shared, online environment. There is a variety of citation managers available; some free, some licensed. The University of Saskatchewan currently licenses RefWorks and therefore the UofS team chose this product for their workflow. Saskatchewan Polytechnic used Endnote as it was easily accessible for all team members (available online), and a desktop copy was purchased for each of the principle investigative team members.

Reference management software enables users to import large number of references from a variety of products, such as journal article databases. Users are then able to organize the imported references into folders and move references as needed. The UofS team became quite fluent in the functionality of RefWorks as this software was used to screen and manage over 383,000 references. Large number of references were imported into RefWorks, de-duplicated, sorted and screened, based on inclusion and exclusion criteria. While this software was not foolproof (for example there were issues with importing large reference sets from some databases), RefWorks proved invaluable in organizing and tracking all of the references in this large project. As RefWorks is a web-based software, all members of the UofS research team, including research assistants, could access the online account at any time and any location.

Stage 3: Study Selection. The next stage in the scoping review process was to determine which evidence was to be included for further analysis and what evidence was deemed irrelevant. The systematic search strategies retrieved large amounts of references and therefore a process was needed to remove the references that did not address the research topic. Similar to Arksey and O'Malley's (2005) approach, the research teams developed a series of inclusion and exclusion criteria to be used to screen references. The specific inclusion / exclusion criteria for each topic is noted in the individual topic chapters.

The Saskatchewan Polytechnic approach. The SP team based the article selection on the following pre-determined basic inclusion / exclusion criteria: articles that were relevant to the topic's key concepts, published within the last five years, written in English, and peer reviewed. Once the initial screen was complete, references underwent the following review process: a first screen based on title or abstract; this was done by an individual team member. A second screen where the team members read the article's abstract, assigning it with a *yes*, *no*, or *maybe*. The team reviewed all maybe's and a team decision was made. The third screen involved a full reading of the article followed by completing the

data extraction form (see stage 4 for more detailed information) which included a recommendation for final inclusion or exclusion of the article. SP results were tracked in terms of the number of results retrieved and the number selected at each stage of the screening process (title selection, abstract selection, and full article review selection). If the quality of the articles or the number of articles selected were insufficient, then a broader search strategy was undertaken for those topics needing this additional step.

The University of Saskatchewan approach. As the UofS team undertook a broad sweep of the literature, most of the searches retrieved copious amounts of references. It was vital that the team adopt a standardized screening, sorting, and reporting process. The UofS team adapted the PRISMA flow diagram chart, which is a commonly-used reporting tool for systematic reviews (<http://prisma-statement.org/PRISMAStatement/FlowDiagram.aspx>). The PRISMA flow diagram captures the lifecycle of each of the research topics, including these stages:

1. Identification: number of references retrieved and number of references after duplicates removed.
2. Screening: reference sorted by publication date (pre 2005, 2005-2009, 2009-2013, note: all reviews: literature reviews, systematic reviews, meta-analysis, were included regardless of date); irrelevant content; excluded from this topic but potentially included in other topics; irrelevant safety domains (e.g., extreme sports, gambling); and medium (e.g., books, dissertations).
3. Eligibility: references screened based on inclusion / exclusion criteria.
4. Included: references to summarize.

After the initial screening, the remaining references were screened based on unique inclusion / exclusion criteria. This criteria was developed post-hoc, after the researcher was exposed to the literature on the topic; this is similar to Arksey and O'Malley's approach (2005 p. 26).

At the beginning of the project, two individuals screened each reference using the inclusion / exclusion criteria. This was done to help ensure reliability and consistency of the screening process. The practice of two screeners proved very timely and was thus discontinued after a few months. From that point forward, each reference was initially screened by only one individual. While this may be deemed a limitation of the research methodology (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010), given the scale of the project, there simply was not enough personnel to screen references by multiple individuals.

Once the references were screened, the next step was to obtain the full-text articles for review.

Stage 4: Charting the Data. The fourth stage in the scoping review process was to extract the relevant information from the screened articles. The Saskatchewan Polytechnic team developed a data extraction form (Appendix C) to chart information from the screened references. The decision to ultimately include or exclude an article was based on the findings in the data extraction form. Any discrepancies about including and excluding studies were discussed as a team.

The UofS team created two templates to aid in summarizing the screened references: one for original research articles (Appendix D) and a second for review articles, which includes literature reviews, systematic review, and meta-analyses (Appendix E). The purpose of these summary templates was to ensure consistent information was recorded for each article read. It was also important that the templates included enough detail that would enable another reader to understand the substance of the

article without having to re-read the article itself. This would prove necessary for completing the next stage of the process (i.e. collating and reporting the results). The templates followed Arksey and O'Malley's descriptive-analytical method, "which involves applying a common analytical framework to all the primary research reports and collecting standard information on each study (2005, p. 26). The standard information collected included the research question, methodology, population studies, and results. In addition, the templates also asked the reader to note limitations of the research as well as the relevance of the study to the SESEMI project and to the individual topic. This relevance portion of the template proved invaluable for contextualizing the given research articles to the SESEMI project.

It is important to note that within this stage, articles were removed from the study if deemed irrelevant after closer review.

Stage 5: Collating, Summarizing and Reporting the Results. The next stage of the scoping review was to analyze the data extraction forms and article summaries for each topic and present a conceptual analysis of the findings. The conceptual analyses, represented as the report's topic chapters, were based on a template, which standardized the writing of each chapter. Arksey and O'Malley (2005) echo the importance of creating such a template to ensure a consistent approach to reporting the findings (p. 28). Final PRISMA flow charts were also completed for the topics (Appendix F).

Arksey and O'Malley (2005) recommend the analysis be presented in two ways: a descriptive numerical summary and a thematic analysis (p. 27-28). The descriptive summary includes characteristic information about the included articles. For the individual topic chapter, this information is presented both in a description of included articles (noted as Stage 1 in the chapters) as well as in the PICO tables (Appendix G). The descriptive summary information found in the PICO tables for each included study includes geographical location of the study, methodology employed, population studied, issue or intervention, comparison, and outcomes or important findings.

The thematic analysis involved grouping articles within each topic into unique themes or factors, each of which affects safety in a different way. Each factor was then described based on the summaries and primary findings of the existing literature. These factor descriptions are identified by subheadings in the subsequent chapters and include content related to how the factor is conceptualized and theorized to affect safety, seminal research concerning the factor conducted within the past five years, whether literature included on the factor is harmonious or contradictory, and any unique information related to the factor that is supported by empirical research.

Descriptive and thematic summaries allowed the researchers to identify gaps in existing research as well as specific recommendations for industry partners. These gaps, recommendations, and further insights from the research team are provided in the discussion section of each topic chapter and re-occurring discussions are highlighted in the general discussion chapter.

Stage 6 (optional): Consultation Exercise. Arksey and O'Malley (2005) proposed that consultation is an optional, but recommended, final stage of the scoping review framework wherein stakeholder consultations provide a value-added element to the overall review process (p. 29). Information gleaned from consultations with key informants can include additional references (i.e. sources of information) as well as more practical insights perhaps not found in the literature. A scoping

review that provides analysis of both the academic literature as well as information from stakeholders, represents a much richer and more holistic picture of the current state. Levac, Colquhoun, and O'Brien (2010) argue this final stage should be required, not optional, as it adds "methodological rigor" to the study (p. 7).

Conclusion

To achieve the goals of this project, the SESEMI research team structured our work using Arksey and O'Malley's (2005) original scoping review framework along with recommendations from Levac, Colquhoun, and O'Brien (2010). Using a scoping review framework afforded the team a methodology to systematically search the literature to better understand the breadth and depth of the research while also identifying gaps and areas for future investigation.

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