

REVIEW PROTOCOL FOR MINE WORKERS AND MINE HEALTH AND SAFETY TOPIC AREA

Highlights

- The objective of the Mine Workers and Mine Health and Safety review is to determine the quality of existing causal evidence on the effectiveness of interventions on mine worker and mine workplace health and safety and on mine worker return to work following injury or illness.
- The review focuses on studies of interventions that seek to reduce or prevent mine worker injury, illness, disability, exposure to hazards, and death; decrease the time for mine workers to return to work following injury or illness; or improve mine workplace health and safety, including the impact of mining technology and equipment on these outcomes.
- Only research with causal designs is reviewed for this topic area.

Introduction

This systematic review assesses the quality of existing causal evidence on the effectiveness of program interventions on mine worker and mine workplace health and safety and on mine worker return to work outcomes. Interventions may include mine inspection, enforcement, and citations; mine administrator and worker training; outreach and education programs; implementation of new technology, processes, or equipment; and mine workers' compensation and benefit programs.

The review addresses the following research questions:

- What is the quality of existing causal evidence on the effectiveness of interventions in reducing or preventing the occurrence of mine workplace illnesses, injuries, exposure to hazards, and/or deaths?
- What is the quality of existing causal evidence on the effectiveness of interventions in increasing mine worker return-to-employment, earnings, and benefits receipt, including workers' compensation, following illness or injury?

Domains of Interest

The primary domain of interest is health and safety:

- **Health and safety** includes mine worker injury, illness, disability, exposure to hazards, and death outcomes and mine-level aggregate injury rates and reported health and safety penalties/violations outcomes. This includes outcomes that prevent injury or illness and enhance safety practices (e.g., increased reaction time or reduction of respirable dust).

For studies addressing the primary domain of interest, secondary domains of interest may also include:

- **Benefit receipt** includes but is not limited to unemployment compensation and workers' compensation.
- **Employment** includes mine worker time to return to work, employment rate, employment tenure, and consecutive months employed.
- **Earnings** includes hourly, monthly, quarterly, or annual wages.

Eligibility Criteria

CLEAR conducts a broad literature search to identify research papers and reports that examine at least one of the research questions of interest. This systematic review only includes causal studies. The identified research is examined against the eligibility criteria described below, and studies meeting these criteria receive a second-level review, including an assessment of the quality of the causal evidence presented in the study.

- 1. The research must examine an intervention designed to impact mine worker health and safety and/or mine workplace health and safety outcomes** as primary outcomes. To be eligible for review, the research must examine an intervention designed to affect at least one outcome in the primary domain of interest of health and safety. These may include interventions focused on individual mine worker health and safety and those designed to improve mine workplace health and safety (for example, through inspections, certifications, training, and mining equipment such as roof bolts and lighting). Studies that use existing Mine Safety and Health Administration (MSHA) data to evaluate the impact of the enforcement of MSHA regulations and programs are included in the review. Studies that address benefit receipt, return to work, and earnings/employment as secondary outcomes may be included.
- 2. The study must examine effectiveness of an intervention using quantitative methods.** To meet this criterion, the research must use quantitative methods to assess the effectiveness of a program or intervention. This includes research that claims to identify a causal impact even if the study design did not support such claims.
- 3. The study must be published and conducted in a relevant time and place.** The research must have been published since January 2008 on a program or intervention implemented in the United States or its territories or in Australia, Canada, South Africa, Poland, or Sweden, as countries similar to the United States in the scope of industry, technological advancements, and safety practices.
- 4. The study must be published in English.** All research studies must be published in English to be considered for inclusion in CLEAR.

Review Process and Causal Evidence Guidelines Specific to this Topic Area

CLEAR employs a standardized, systematic review process as documented in its CLEAR Policies and Procedures document.¹ The Mine Workers and Mine Health and Safety review includes both experimental and nonexperimental causal research which are reviewed and rated based on the eligibility criteria previously described and the CLEAR Causal Evidence Guidelines.² In assessing the quality of the evidence, CLEAR uses ratings of high, moderate and low. Only two types of studies may receive a high rating: well-conducted randomized controlled trials (RCTs) with low attrition and no obvious confounds to the RCT design and interrupted time series (ITS) designs with sufficient replication. The CLEAR Causal Evidence Guidelines describe the criteria for rating the quality of evidence. In addition, Table 1 provides the additional guidance specific to this review.

¹ CLEAR Policies and Procedures may be found at <https://clear.dol.gov/>.

² The CLEAR Causal Evidence Review Guidelines may be found <https://clear.dol.gov/>.

Table 1: Mine Workers and Mine Health and Safety Review Specific Guidance

	CLEAR Causal Evidence Guidelines	Topic Area Specific Guidance
Attrition Standard	Study must have low attrition at the cluster or subcluster level to meet Criterion RCT.2.	Use conservative attrition standard.
Control Variables	<p>To meet Criterion Regression.1 and receive a moderate rating, nonexperimental causal research must include specific control variables in its regression analysis (other than those using fixed effects).</p> <p>Regression methods that incorporate a matching design must match on these control variables; if not, they must include them as controls in the regression.</p>	<p>Studies with individual-level outcomes must control for:</p> <ul style="list-style-type: none"> • Age of miner and/or years of experience. • A pre-intervention measure of each outcome of interest. <p>Studies with firm-level outcomes must control for:</p> <ul style="list-style-type: none"> • At least one measure of mine or company size, such as the number of employees, number of sites, hours worked, annual revenue, or tonnage produced. • A pre-intervention measure of each outcome of interest.
Changes in Group Composition	Studies with nonexperimental designs and analysis at the group level must meet Criterion Regression.4 to receive a moderate causal evidence rating.	Use conservative migration standard.
Pre-intervention Data	An ITS design must use data drawn from a sufficiently long period of time before an intervention’s implementation to meet Criterion ITS.2.	Data must cover at least one year before the implementation of the intervention.

Appendix: Literature Search

CLEAR conducts a comprehensive literature search to identify research meeting the eligibility criteria described in the review protocol. This process includes (1) a database search, (2) a search of selected internet sites for grey literature, (3) a snowball search, and (4) a Google Scholar search for specific intervention names.

1. Database Search

All CLEAR searches use the following databases to identify causal literature: Scopus, Academic Search Premier, Business Source Corporate Plus, E-Journals, EconLit, Education Research Complete, SocINDEX with full text, ERIC, PsycINFO, ProQuest Dissertations and Theses. In addition, for this topic area, CLEAR searched MEDLINE with Full Text and PubMed. In conducting the search, CLEAR uses “and” to connect terms from each category (design, outcome, impact, and keyword terms) and “or” among terms within a category.

Table 2. Keywords used in database searches for Mine Workers and Mine Safety Topic Area

Design terms	Causal, evaluation*, experiment*, cross-sectional, random*, regression, quantitative, quasi*, statistical, difference in differences, double differences, propensity score matching, interrupted time series
Outcome terms	<p><i>Health and Safety</i> Safety, health, illness, disabilit*, injur*, fatal*, disaster, death, hazard, accident, exposure*, mortality, pneumoconiosis, “black lung,” explosion, blast*, electrocution, respiratory, "hearing loss", "musculoskeletal injuries", tuberculosis, black lung, silicosis, progressive massive fibrosis</p> <p><i>Worker Return to Work</i> Return to employment, back to work, re-employ*, reemploy*, employ*, hours, rate of return, earnings, wage, salary, pay, income</p> <p><i>Worker Benefits</i> Work* compensation, benefit, medical, unemployment insurance</p>
Impact terms	Effect*, efficac*, impact, improv*, progress, gain, growth, increase, benefit, reduc*, decrease, prevent, diminish
Keyword terms	["Mine*" OR "miner*" OR mineworker* OR "mine worker*" OR “Mine Safety and Health Administration” OR “Mine Improvement and New Emergency Response Act” OR “MINER Act” OR “Mine Safety and Health Act of 1977” OR “MINE Act”] AND intervention, standards, strategy, program, practice, model, inspect*, citation, order, requirement, enforcement, compliance, law, regulation, training, curricul*, injur*, work* compensation, prevention

An asterisk indicates a truncation. When used in a search term, all words with the root are returned. For example, a search on “occupation*” returns citations with the words that have “occupation” as the first ten letters, including “occupation,” “occupations,” and “occupational.”

2. Internet Sites Grey Literature Search

CLEAR also searches the websites of organizations conducting research in this topic area using a limited set of keywords. This search identifies studies that may not be published elsewhere, such as technical reports from government agencies or working papers, and studies not available through the database search. The study team uses a Custom Google Search engine with an abbreviated set of keywords to review the following sites. The limited set of keywords for this search are: mine health and safety, fatality rates, injury rates, prevention, employ*, earn*, impact, effect* using “and” to connect these terms.

- Alpha Foundation
- American Industrial Hygiene Association
- Bureau of Land Management
- Centers for Disease Control (CDC)
 - National Institute for Occupational Safety and Health (NIOSH)
- Colorado School of Mines
- Department of Labor
 - Chief Evaluation Office
 - Mine Safety and Health Administration
 - Occupational Safety and Health Administration
 - Office of Workers’ Compensation Programs
- Missouri University of Science and Technology
- Montana Technological University
- National Academies of Sciences, Engineering and Medicine
 - National Academies Press
- National Institutes of Health (NIH)
- National Research Council
- Pennsylvania State University
- Society of Mining, Metallurgy and Exploration
- South Dakota School of Mines
- United Mineworkers of America
- University of Alaska at Fairbanks
- University of Arizona
- University of Kentucky
- University of Nevada– Reno
- University of Utah
- Virginia Polytechnic Institute and State University
- West Virginia University
- Workers’ Compensation Research Institute

3. Snowball Search

The study team conducted a snowball search to identify relevant literature using the reference list of a study or studies to identify other studies to include in the review. The following sources were used:

Department of Health and Human Services, Centers for Disease Control and Prevention, & National Institute for Occupational Safety and Health. (2017). *NIOSH exposure assessment program*:

Evidence package for 2006-2016. https://www.cdc.gov/niosh/programs/review/pdfs/NIOSH_EXA_Evidence_Package_April_2017-508.pdf

DuCarme, J. (2019). Developing effective proximity detection systems for underground coal mines. In J. Hirschi (Ed.). *Advances in productive, safe, and responsible coal mining* (pp. 101-119). Woodhead Publishing. <https://doi.org/10.1016/B978-0-08-101288-8.00003-1>

Trevits, M. A., Yuan, L., Smith, A. C., & Thimons, E. D. (2009, November). *NIOSH mine fire research in the United States* [Paper presentation]. Mine Ventilation: Proceedings of the Ninth International Mine Ventilation Congress, New Delhi, India.

4. Google Scholar Search

CLEAR also conducts a Google Scholar search using a specific list of intervention/program names that may prompt specific interventions in order to comply with their content. For this topic area, the search includes:

- Brookwood-Sago Mine Safety Grants
- Faster, Safer Mine Rescue with Cutting Edge Technology
- Final Rule on Proximity Detection Systems for Continuous Mining Machines in Underground Coal Mines
- Fire Suppression System Initiative
- Mine Improvement and New Emergency Response Act of 2006
- Mine Safety and Health Act of 1977
- Pattern of Violations or POV regulation promulgated in 2013
- Powered Haulage Safety Initiative
- Preventive Roof/RIB Outreach Program (PROP)
- Respirable Coal Dust Rule