Request for Office of Management and Budget Review and Approval for Federally Sponsored Data Collection

Improving Organizational Management and Worker Behavior through Worksite Communication

Section B

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1. Respondent Universe and Sampling Methods

Potential Respondent Universe

This project includes metal/nonmetal and sand, stone, and gravel mines. Active mines are mining operations that reported mine operator employment during the year. In 2012, the Mine Safety and Health Administration (MSHA) reported the following number of mines, by commodity in which we are recruiting [NIOSH 2014]:

- 351 metal mines;
- 641 nonmetal mines;
- 4,433 stone mines; and
- 6,797 sand & gravel mines.

Within these commodities, the same database showed that there are roughly 169,312 mine operator employees. A more specific breakdown by commodity is as follows:

- metal - 44,458 employees
- nonmetal - 21,586 employees
- stone - 66,201 employees
- sand and gravel - 7,067 employees

Subjects for this research project will be employees from these commodities.

Sampling Methods

Corbin and Strauss (2008) state in terms of sampling variation, "there is the 'ideal way' and there is the 'practical way' and sometimes research has to settle for the latter (p. 153). In this mixed-methods project we are using nonprobabilistic sampling methods in order to recruit people/texts that will allow for conceptual explanations of the topic being studied, rather than representation [Given 2016]. Therefore, this study utilizes a convenience, albeit purposive sampling strategy [Yin 2011]. In this sampling approach, individual workers and sites are identified and sought out because they meet some sort of criteria for the goals of the study [Given 2016]. Besides purposive sampling when recruiting mine sites, we also utilize convenience sampling at the mine site because we intend to utilize cases that are easily available and accessible while we are present on site [Yin 2011]. For the current study, convenience, purposive sampling allows researchers to obtain a variety of information and perspectives during the intervention, meaning that participants can offer differing views [Kuzel 1992]. However, we will recruit and engage a wide range of cases to help avoid bias in this research project [Yin 2011]. For example, when recruiting individual workers at a mine site, purposive sampling would be used in asking the mine operator the area(s) where they want to know dust levels/have concerns with dust levels. These areas are likely to differ across mine sites and commodities, therefore purposive sampling would result in a variety of job types being selected for participation.

In an effort to recruit as wide of a range as possible for this study, we are aiming to recruit a variety of commodities. This way, a broad sample can be analyzed and differences compared between commodities (not statistically, only qualitatively). Because these data collection efforts are primarily qualitative in nature, we will not be able to generalize from one mine to all mines and from one commodity to another.

Qualitative research does not aim to be representative [Corbin & Strauss 2015]. However, according to scholars in this research area, the goal is not to obtain representation but rather, to learn from the study of one or more sites and how the findings may have application to another [Corbin & Strauss 2015]. Therefore, it is possible that findings from one mine or commodity within our convenience sample will inform what we know about communication and leadership practices as well as actions for reducing respirable dust exposures, in another organization or commodity. Therefore, even if communication practices and leadership practices are high at one site and low at another site, these practices and performance measures can be used to inform final considerations from the project to be disseminated in outputs.

NIOSH believes that one to two mines from each commodity may be recruited, based on previous data collection efforts and mine contacts. Even if NIOSH has a list of mine contacts, some of those contacts may have not participated in NIOSH research for several years. Therefore, our goal is to recruit a pilot site in which we have worked closer with in more recent years. Then, for subsequent recruitment efforts, we intend to contact corporations that we have not worked with as much in recent years, to help recruit a wider range of corporations and commodities. In addition, within those commodities, NIOSH researchers have been contacted by mine operators from a variety of commodities who requested assistance in dust assessments and/or behavioral assessments from a technology and health and safety management perspective. We intend to fulfill these requests to the best of our ability and continue to recruit mines owned by different companies, to obtain a diverse data set as well as diverse management systems within the organizations. A description of the mines where data is collected will be provided in any publications of the data (e.g., size, location, type of extraction method utilized, etc.). To date, we have a rough estimate of potential participating mines – illustrated in the table in the next section. As illustrated, the breakdown of commodity, size, and geographic location is dispersed, allowing us to study communication practices and worker perceptions/behaviors based on a variety of conditions and factors.

Respondent Selection Methods and Anticipated Sample

It is expected that the participants, both workers and members of management, of the participating mines will vary across a number of variables including age, gender, and experience. Convenience sampling will occur based on the availability of mine workers at the point in time when the interventions are conducted. Generally, within a particular area of a mine a very small number of workers are working during the shift. Because of the small sample of workers in a particular area, randomization is not possible because all workers working in the area may participate. For example, the blasting crew at gold mines usually consist of 5-6 workers during a shift. Therefore, all of these workers would be given the option to wear the Helmet-CAM. However, because shift schedules and rotations vary from mine to mine and we cannot predict this rotating schedule, nor can the mine operator, randomization is inherent in the data due to the fact that our visits are not planned based on who is working. Across the participating mine sites it is expected that over the course of the three-year study no more than 180 individuals will participate in some capacity. Because this is primarily a qualitative study, statistical methods for stratification and sample selection are not necessary. Although a pre and post-test survey is administered as part of the intervention, if the desired power level (.8) is not achieved, statistical tests for this survey, in the form of t-tests, will not be completed. Rather, only means of survey scales will be used to inform the qualitative data analysis. For each separate mine case, power calculations would not occur because the samples at one mine would be so small. However, at the end of the study, after participation from approximately five

mines, then power calculations may be necessary because we will have a higher sample and can perform more tests to determine statistical significance of the intervention.

The primary purpose of the intervention is to document how the management communication and worker behavior changed, using the Helmet-CAM, to identify areas in need of discussion and corrective action. Because this study is longitudinal, it is more important to assess employees over a period of time rather than more but at only one time point. The number of employees at medium-sized mines often ranges from 50-299 [NMA, 2014]. It is expected that at each participating mine, roughly 10-30 individual workers will participate in the intervention and wear the Helmet-CAM and roughly 1-6 mangers will participate in the intervention at each mine site. So, the response rate at each mine is intentional and appropriate given the time intensive case study design for each mine. Below is a sample table of the anticipated range of commodities, corporations, and respondents we expect, based on previous experience with field research and who we have been in touch with during preliminary conversations about the study. As the table shows, we have representation from metal, industrial minerals, and stone/gravel among four corporations and have varying demographic locations, mine sizes, and experience using the Helmet-CAM and participating with NIOSH.

Anticipated Sample of Respondents

Mine Site	Commodity	Owner	Geographic Location	# of Employees	Used Helmet -CAM	Recruitment Effort	Year of last NIOSH field visit
Pilot	Industrial Mineral - Silica Sand	Badger Mining Corporation	Wisconsin	70	Yes	Site secured via phone call to mine H&S manager	2014
1	Industrial Mineral - Silica Sand	Badger Mining Corporation	Wisconsin	125	Yes	Site secured via phone call to mine H&S manager	2012
2	Metal - Gold	Barrick Gold Corporation	Nevada	2,800	No	Company contacted NIOSH for assistance with dust exposure and Helmet-CAM	N/A
3	Stone/Gravel	Unimin Mining Corporation	Illinois	90	No	VP of health and safety expressed interest during a regional safety meeting. Local mine operator to be contacted via phone	N/A
4	Stone/Gravel	Unimin Mining Corporation	West Virginia	300	Yes	Site expressed interest during conversations at a mining conference in 2015	2011
5	Industrial Mineral - Sand	Fairmont Minerals	Ohio	200	No	Intend to contact this H&S manager for participation via phone or e-mail	N/A

2. Procedures for the Collection of Information

Sampling and Recruitment Procedures

A purposive and convenience sampling approach will to first recruit the mines and then occur while NIOSH researchers are present at each participating mine site. Mines are recruited using previously established contacts that may be recent relationships or previously established relationships. We tend to recruit mines using e-mail but sometimes will call contacts on the phone to discuss a study. In other instances, we network with mine operators at mining-specific conferences. In the current study once mines are recruited and we are working with our mine point of contact, generally the mine would not be concerned with a specific individual, but rather, with the dust levels in a certain area. Therefore, operators are expected to choose work roles in which higher levels of dust may be generated. Therefore, selecting specific participants would not occur, rather job tasks would be selected. It is also expected that varying job tasks experience higher exposures at one site to another and therefore, we would have varying job tasks/roles that participate. Our goal is to engage workers from 2-3 different areas at each mine, which would also help limit any biases workers may have toward their supervisor or the safety culture at the site in general. Although findings will not be representative or generalizable across all mines, it is possible that findings from mine to mine within our convenience sample will inform what we know about communication and leadership practices as well as actions for reducing respirable dust exposures, across commodities. Therefore, even if communication practices and leadership practices are high at one site and low at another site, these practices and performance measures can be used to inform future, broader considerations about health and safety management, communication, and behavior.

Upon traveling to a participating mine site the study will be introduced to the group(s) and then facilitated by key personnel on the project (NIOSH researchers trained in mixed methods data collection). Consent forms will be read and provided to participants before any data collection begins. After reading the consent form, each individual has the option to choose whether they would like to participate. Any individual who decides to participate will stay in the room. Those who decline participation can simply leave the room. In addition, contact information will be provided for participants to take home for future reference in case they have any questions after the study.

Data Collection and Organization

The three trips and data collected during the three trips per case study are summarized in the Table below. The data collection instruments are further discussed after the table.

Estimated Time Table:

Type of Respondents	Data Collection Effort and average response time (in minutes) for each effort	No. of Respondents (total, not by mine site)	Total Average Response Time per Respondent
Mine Workers	**Visit 1 (Week 1)** • Survey pre-test (15)	150	2 hours

	• Wear Helmet-CAM while doing job (60) • Formative assessment behavior interview (45)		
	Visit 2 (Week 2, 3, or 4) • Wear Helmet-CAM while doing job (30) • Mid-assessment behavior interview (30)	150	1 hour
	Visit 3 (Week 6) • Survey post-test (15) • Wear Helmet-CAM while doing job (60) • Post-assessment behavior interview (45)	150	2 hours
TOTAL TIME for Workers:		**5 hours over a six-week period**	
Mine Site Leaders/ Managers	**Visit 1 (Week 1)** • Initial HSMS assessment interview or focus group (60)	30	1 hour
	Visit 2 (Week 2, 3, or 4) • Mid-assessment HSMS interview or focus group (30)	30	30 minutes
	Visit 3 (Week 6) • Post-assessment HSMS interview or focus group (45)	30	45 minutes
TOTAL TIME for Leaders:		**2.25 hours over an ~1 year period**	

NIOSH researchers may read the survey to mine workers if they want to participate but do not want to read the survey (e.g., if they do not have their reading glasses with them). Then, the researcher will fill in the answers for the participant as requested. The other data will be collected via focus groups or interviews and researchers will record information from participants using hand written notes.

Upon returning to the office, members of the research team will enter the information from the survey into a password protected computer database using the Statistical Package for the Social Sciences (SPSS), a word processor program, and a database spreadsheet. If respondents complete the web-based survey this data will be directly imported into SPSS with the paper-pencil information that was entered. Our branch has an Insight 20 scanner that we purchased from Scantron that has the ability to download the survey data directly into the computer to avoid the possibility of human error.

Qualitative data (interviews and focus groups) will be collected via note taking. This data will not be used for statistical analysis. Upon returning from the data collection, the NIOSH researcher taking notes will transcribe the notes to Microsoft Word and save the files with a de-identified password. Each team member will be responsible for typing their individual notes and summarizing major points during the interviews/focus groups.

<u>Statistical Analysis</u>

The only quantitative data analysis includes workers' pre and post-surveys. In order to answer whether or not the MLI communication model significantly changed mine workers' (1) perception of organizational values and (2) level of proactivity from the beginning of the intervention to the end of the intervention, a paired-samples t-test or repeated measures ANOVA will be used. These tests are commonly used to determine if an intervention or training affected some other variable, in this case, mine workers' proactivity. A paired-samples t-test is used to determine whether there is a significant difference between the average values of the same measurement made under two different conditions (Pallant, 2010). However, the sample may be too small to perform statistical analysis with any level of confident power. In this case, statistical analysis will not be performed.

Note on sample size for quantitative analysis: It is possible to increase the sample size at each mine, during our first visit, but we also want to be cognizant that we have a burden on each worker not just one time but another time when we return to the mine. We are also saying that the sample size may be small because we need to have the same workers wear the Helmet-CAM on our follow-up visits. Despite trying to coordinate a return date with the mine where the same people will be working, we foresee some challenges with this (e.g. people being on vacation, out sick, or in a new job role). We are trying to be a little more on cautious side in the protocol but of course hope we have a large enough sample, which we believe we will.

Other Analysis

1. Dust Exposure Data from Helmet-CAM is discussed while interviewing and going over the footage content with participating workers but is not recorded. Although we discuss with workers what their max dust exposure readings are, rather than focusing on the number, we focus on the conditions/behaviors that caused the elevated exposure and what actions can be taken to reduce future elevations. Dust exposure data is not recorded because on follow-up visits workers may not wear the Helmet-CAM for the same length of time nor work in the exact same area doing the exact same thing; therefore, comparing exposure data cumulatively is not possible. Rather, noting an exposure level while doing a task, such as changing screens one day, and noting the difference in exposure level if a worker vacuums the screen before changing it, is the purpose of the Helmet-CAM assessment technology – identifying things the worker and manager can do to reduce silica dust exposure.

2. Qualitative summary notes will be consolidated into two finalized sets of integrating notes (one set of worker data on worker perceptions and behaviors and one set of leadership data on workgroup leadership). Then, results will be summarized and coded using theories of health behavior and health and safety management systems as categorizing mechanisms. The rules of qualitative data coding (Boyatzis, 1998; Patton, 2002; Charmaz, 2006) will be applied during the analysis phase to ensure validity of results. This includes engaging in initial and focused coding and then constant comparison of the results. In addition, some of the responses provided during the interviews that are more close-ended or number counts will be coded using qualitative content analysis methods. Content analysis is a flexible method for analyzing text data in order "to provide knowledge and understanding of the phenomenon under study" (Downe-Wamboldt, 1992, p. 314).

Specifically, any perspectives that workers provide about communication with their mine site leadership will be analyzed and coded to allow researchers to see patterns in supervisors' leadership communication behaviors and to note whether or not mine workers appreciated these interactions in terms of facilitating

safer work perceptions and behaviors. The purpose of this analysis is to simply provide tailored information about HSMS implementation to different levels of leadership at the organization. This content will **not** be used to make any generalizations about leadership practices from an industry perspective.

3. Because we are collecting both quantitative and qualitative information at different time points, this study is longitudinal and therefore, process tracing can be used as a means of gaining insight into causal mechanisms during the intervention (Gerring, 2007; Harding et al., 2002; Mahoney, 1999). Using process tracing as an analysis technique will help address the challenge of how to meaningfully assemble all of the disparate information we receive throughout the intervention into coherent information that establishes causality (Tashakkori & Teddlie, 2010). Process tracing involves establishing causal chains throughout an analysis that contributes to a final outcome within a case (e.g. Max Dust 1 → Max Dust 2 → Max Dust 3 or Proactivity 1 → Proactivity 2). Because a series of time points and observations with workers and leaders can be analyzed concurrently in a way that build upon each other, this project will have strong narrative explanations that support the targeted behavioral outcomes over time (Tashakkori & Teddlie, 2010). In addition, by collecting data on more than one level (worker and leader) we can explain how and why these different factors came together to yield a targeted outcome (i.e. proactive health/safety behavior or sound HSMS implementation practices).

Therefore, data will be analyzed independently and then together during three time points, shortly after data collection. At the end of the project, the data results from each of the three time points will be viewed "organically" to help "mix the methods" in an effort to trace data and determine factors at the worker and leadership levels that caused changes in workers' pre and post-test survey including their noted behavior changes over time, and their maximum dust points (Tashakkori & Teddlie, 2010, p. 731). This process will involve analysis of the data by a research team of approximately four people.

3. Methods to Maximize Response Rates and Deal with Nonresponse

CDC does not claim that the workers selected for this study are statistically representative of the entire population of U.S. underground and surface miners. It should not be assumed that the findings of this exploratory study are generalizable to other groups of miners. Based on previous research studies completed with mine workers, it is anticipated that at least 85% of individuals selected to participate in the evaluations will participate. The instruments will be administered in group sessions, which should help to ensure a higher response rate. In addition, extensive prior experiences with this mixed methodology at mine organizations suggest that the response rates will achieve the expected levels. For example, in a safety culture assessment that NIOSH OMSHR completed, the response rate was typically in 80th or 90th percentile for those who were selected to participate in a survey and interview [Kosmoski et al., in progress]. Due to normal absences from work, a few miners may be unavailable on the particular days that the data collection activities are conducted.

4. Tests of Procedures or Methods to be Undertaken

A majority of the questions have been pilot tested at previous mine sites under smaller IRB project protocols, to ensure they make sense to the mining population and can inform the questions guiding this study. Data collection materials were developed based on formative/pilot research that was conducted with both mineworkers and mine management in separately approved protocols in which nine workers were interviewed (HSRB 14-OMSHR-05XP "Exploring the Use of Dust Control Technologies on Bagging Operators' Perception of Risk and Health Protective Behaviors" approved on 06/18/2014) and nine members of management participated in one focus group (HSRB 14-OMSHR-07XP "Understanding How Mine Leadership Uses the Helmet-CAM to Improve Mine Site Health and Safety" approved on 09/15/2014). These tests of procedures occurred in order to create the most accurate, resonant intervention for the current study. Therefore feedback provided during interviews with workers and management informed the current study design and data collection materials. In addition, members of management provided feedback about the utility and practicality of the overall intervention framework, expressing interest in future participation.

The pilot tests of procedures informed the qualitative data collection instruments for both groups and the overall intervention design. In terms of being able to evaluate the intervention for effectiveness, researchers had to create a pre and post-test survey to monitor the workers' perception of the safety climate before and after the intervention. The survey items were created based on a thorough literature review of using occupational health and safety, applied psychology, public health communication, as well as past practice utilized by NIOSH researchers when developing psychometrically supported surveys for mine workers. OMSHR researchers used existing scales and/or adapted scales to be consistent with mine terminology. Each item within the current study is studied using a 6-point (strongly agree to strongly disagree), Likert response scale format. To make the items relevant in the mining context, information was gained by reviewing previous NIOSH research and data in which mine workers completed survey questionnaires. This process helped ensure correct terminology and reading level. Even though all scales used to complete the survey were deemed valid, OMSHR researchers will revalidate each scale upon initiating data collection to ensure that the survey is measuring what we intend to measure.

5. Individuals Consulted on Statistical Aspects and Individuals Collecting and/or Analyzing Data

The persons who will collect and/or analyze the data are listed below. Should the project require further guidance on scientific issues regarding data, other internal resources are available through teams within the project staff's branch.

1Project Staff:

These are the primary individuals who are leading study design, data collection, and analysis efforts.

Designed the data collection, will lead data collection and qualitative analysis:

- Emily J. Haas, Ph.D., Behavioral Research Scientist, NIOSH Pittsburgh Research Laboratory, 412-386-4627, EJHaas@cdc.gov

Will assist with data collection, and will lead statistical analysis (if statistical analysis is applicable):

- Kyle Stanyar, Ph.D., Associate Service Fellow, NIOSH Pittsburgh Research Laboratory, 412-386-6415, ygm1@cdc.gov

Will assist with data collection and qualitative analysis:

- Blaine Connor, Ph.D., Associate Service Fellow, NIOSH Pittsburgh Research Laboratory, 412-386-5226, ysi4@cdc.gov
- Dana Willmer, Ph.D., Human Factors Branch Chief, NIOSH Pittsburgh Research Laboratory, 412-386-6648, dpr4@cdc.gov