Underground workers who received aluminum dust prophylaxis and its personal impact

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DRHJ/RDRS 2021, 4, pp. 172-184

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Abstract

Background: From 1943 to 1980, some gold and uranium mines across the globe mandated that their workers inhale aluminum dust daily, also known as the McIntyre powder treatment or aluminum prophylaxis, to help prevent silicosis of the lungs. Daily, underground workers were exposed the aluminum dust prior to the start of the work day. The purpose of this study was to determine how being exposed to the aluminum dust impacted exposed workers on a personal level. **Methods:** A qualitative descriptive study design was used to explore the perceived personal level impact of exposure to McIntyre Powder treatment in Northeastern Ontario. Semi-structured interviews were conducted with 16 exposed male underground miners from Timmins, Elliot Lake and Sudbury, in Ontario, Canada. Snowball sampling was used for study recruitment and data were analyzed thematically and steered by cognitive dissonance theory by guiding perspective to interpreting the results of this research. **Results:** From the 16 interviews, the majority of participants were recruited from the McIntyre Powder Project and newspapers (n=5, n=5) respectively. Other recruitment consisted of the pilot interview (n=1) from the Sudbury OHCOW intake clinic, the researcher's personal Facebook page (n=2), a poster from inside a dollar store (n=1), and snow ball sampling (n=2). All participants in this study were male. Participants age ranged from 60 to 88 years old, with an average of 67 years old. The participants interviewed lived in Sudbury, Elliot Lake, and Timmins (n=7, n=5, n=5) respectively. The four main themes derived from the participant's interviewed who were exposed to McIntyre powder daily included: 1) compulsory exposure, 2) hesitancy to complain, 3) feelings of betrayal by union, employers and the Canadian government, 4) concern about health impact and dying. **Conclusion:** Exposed workers perceived that their long-term health was impacted on a personal level. The results will contribute to the literature about workplace aluminum dust exposures and to better inform workers and companies about exposure impact and management of aluminum dust.

Keywords: McIntyre powder, aluminum powder, aluminum dust, aluminum, underground workers.

Résumé

Contexte: De 1943 à 1980, certaines mines d'or et d'uranium du monde entier ont imposé à leurs travailleurs d'inhaler quotidiennement de la poussière d'aluminium, également connue sous le nom de traitement à la poudre McIntyre ou prophylaxie de l'aluminium, pour aider à prévenir la silicose des poumons. Chaque jour, les travailleurs souterrains étaient exposés à la poussière d'aluminium avant le début de la journée de travail. Le but de cette étude était de déterminer comment l'exposition à la poussière d'aluminium avait un impact au niveau personnel sur les travailleurs exposés. **Méthodes:** Un plan d'étude descriptif qualitatif a été utilisé pour explorer l'impact perçu au niveau personnel de l'exposition au traitement de la poudre McIntyre dans le nord-est de l'Ontario. Des entretiens semi-structurés ont été menés avec 16 hommes mineurs souterrains exposés dans les régions de Timmins, Elliot Lake et Sudbury, en Ontario, au Canada. L'échantillonnage par méthode boule de neige a été utilisé pour le recrutement à l'étude et les données ont été analysées thématiquement et orientées par la théorie de la dissonance cognitive en guidant la perspective pour interpréter les résultats de cette recherche. **Résultats:** Sur les 16 entretiens, la majorité des participants ont été recrutés respectivement dans le cadre du McIntyre Powder Project et des journaux (n=5, n=5). Les autres recrutements ont consisté en l'entretien pilote (n=1) de la clinique d'accueil OHCOW de Sudbury, la page Facebook personnelle du chercheur (n=2), une affiche à l'intérieur d'un magasin à un dollar (n=1) et un échantillonnage de boules de neige (n=2). Tous les participants à cette étude étaient des hommes. L'âge des participants variait de 60 à 88 ans, avec une moyenne de 67 ans. Les participants interrogés vivaient respectivement à Sudbury, Elliot Lake et Timmins (n=7, n=5, n=5). Les quatre principaux thèmes qui se dégagent des entrevues des participants qui ont été exposés quotidiennement à la poudre McIntyre sont les suivants 1) exposition obligatoire, 2) hésitation à se plaindre, 3) sentiment de trahison de la part du syndicat, des employeurs et du gouvernement canadien, 4) inquiétude quant à l'impact sur la santé et la mort. **Conclusion:** Les travailleurs exposés ont perçu que leur santé à long terme était affectée au niveau personnel. Les résultats contribueront à enrichir la littérature sur l'exposition à la poussière d'aluminium sur le lieu de travail et à mieux informer les travailleurs et les entreprises sur l'impact de l'exposition et la gestion de la poussière d'aluminium.

Mots-clés: Poudre de McIntyre, poudre d'aluminium, poussière d'aluminium, aluminium, travailleurs souterrains.

Introduction and Background

From 1943 to 1980, some gold and uranium mines across the globe mandated that their workers inhale aluminum dust daily, also known as the McIntyre powder treatment or aluminum prophylaxis, to help prevent silicosis of the lungs (Findlay, McKeown, & Kelley, 2016; Newkirk,

1972). The McIntyre Research Foundation was led by Dr. W.D. Robson and an engineer J.J. Denny who created the aluminum dust in Timmins, Ontario, Canada (Newkirk, 1972). The aluminum dust was made of 85% aluminum oxide and 15% aluminum (Newkirk, 1972). Daily, underground workers were exposed the aluminum dust prior to the start of the work day (Newkirk, 1972). During the treatment, workers were confined to a sealed tight tunnel or change room for approximately 15 to 30 minutes. The purpose of this study was to determine how being exposed to the aluminum dust impacted exposed workers on a personal level.

Aluminum dust exposure was introduced because it was thought to engulf the silica dust particles before reaching the bronchial tree, leading to expulsion of the silica particles (Crombie, Blasidell, & MacPherson, 1944). Others have suggested that the aluminum dust compounds coated the silica particles inside the lungs inhibiting the development of silicosis (Peters et al., 2013; Sorenson, Campbell, Tepper, & Lingg, 1974).

From 1939 to 1943, Crombie, Blaisdell, and MacPherson (1944) conducted a human experiment by exposing participants to the aluminum dust in Timmins, Ontario, Canada. The researchers did not utilize a control group to compare results. They subjectively measured shortness of breath, fatigue, cough and sputum, and chest pain without using any standardized testing. From the 32 participants that completed the study, 19 participants showed definite and slight improvements. However, 15 participants showed no improvements. The researchers stated that the aluminum powder was harmless towards humans and concluded that the aluminum powder was an effective method to prevent silicosis of the lungs. This study was one of the main reasons the McIntyre foundation started the aluminum dust treatment for underground workers exposed to silica dust particles.

Rationale and Possible Health Effects

There is a noticeable gap in research about the McIntyre Powder treatment and its related health outcomes. Only a small amount of research has found a possible weak association between Aluminum Powder treatment and Alzheimer's, cardiovascular, and cognitive impairments of underground workers (Peters, Reid, Fritsch, de Klerk, & Musk, 2013; Rifat, Eastwood, McLaghlan, & Corey, 1990). The research described here will provide in-depth information regarding workers who were obligated to be exposed to McIntyre powder and how it has impacted them at the time and to this day. The existing gaps in research creates a challenge for recognition of illness from exposure and compensation of workers and their families. The practical implications of this research will help guide future needs of exposed workers and identify areas of improvement for government, unions and employers.

Perceived Health Impact of Work in Mining

While there is a limited amount of research specific to aluminum dust exposure, there are several examples of research conducted on the perceived impact by miners exposed to environmental contaminants. For instance, Markstrom and Charley (2003) conducted a qualitative literature review about the history of the Navajo Native Americans and uranium mining and discussed the psychological impact on underground workers in Southwestern in the

States of America who were exposed to technological or human-caused disasters (Markstrom & Charley, 2013). Navajo uranium miners worked in hazardous conditions with little safety measures. Workers were exposed to radioactive dust, sulfuric acids, sodium chlorate, and solvents involved in extracting material. The main themes identified were: “human losses and bereavement, feelings of betrayal, fear about current and future effects, prolonged duration of psychological effects, anxiety and depression, and psychological impacts and exacerbating conditions of poverty and minority status” (p.28).

Markstrom and Charley (2003) identified that bereavement related to trauma does not allow individuals to properly go through the grieving process. Furthermore, the Navajo workers commonly felt betrayed or cheated by their employers. Also, they identified feelings of anxiety from uncertainty of possible health effects. The researchers identified that stress and anxiety were high amongst Navajo workers particularly as they did not have any control over change in their work environment. Researchers also identified some themes that could be useful in assisting in making recommendations to help better support individuals in the future, such as having mental health resources specifically for those who worked in hazardous environments with little safety measures (Markstrom & Charley, 2013).

Malin and Petrzeka (2010) also conducted a case study on a small isolated community in Monticello in Utah, United States (Malin & Petrzeka, 2010) to determine the community’s knowledge about environmental contamination. Data were collected through interview excerpts, government documents and newspaper articles. Issues of health impact were raised by participants and identified themes included: the history of the social context, contested illness, deception and powerlessness. Social context of gained employment was also discussed. Members were happy to have been gainfully employed and did not think having a uranium mine in their community would cause any dangers to the workers and other community members. Interviewees stated that they participated in the research because “they were tired of seeing so much suffering around them and felt they deserved more honesty from the responsible party” (p.1193) and they “feel that the government needs to acknowledge their illnesses and accept responsibility” from the damages due to the contamination from the mill (Malin & Petrzeka, 2010, p.1193).

Additionally, the health survey demonstrated astronomically high numbers of incidences of cancers and respiratory diseases within the community (Malin & Petrzeka, 2010). Members requested that cancer screening and treatment facility be made readily available within the community and a federal trust fund be made available to pay for medical expenses. One member stated “the government is going to pay the bill, because it was negligent and it was their mess” (p.1194). The community demonstrated frustration regarding the lack of support from the government. The government continued to decline claims due to the lack of research proving causation of environmentally associated diseases (Malin & Petrzeka, 2010). Members of the community found a government document stating that they were habitants of a “low-use segment of the population” (p.1195) and scientists were told to wait till the wind was in that direction before they tested bombs. Other government documents demonstrated that they were aware of

the potential health risks, yet nothing was ever communicated to the community members. (Malin & Petrzela, 2010).

In 1992, Dawson and Madsen (1995) conducted a case study with 68 American Indian uranium workers and 13 widowers to determine the perceived effects of uranium milling and mining living in Shiprock, New Mexico and Tonalea, Arizona. Participants had worked at least one year in the uranium mining and milling industry. Hazardous workplace exposure included radioactive materials, silica, vanadium, acids and alkalis. Data were collected by in-depth interviews either at a chapter house or at the participants' home. Approximately 65% were uranium millers, and 35% were both millers and miners. Dust and fumes were found to be the top workplace exposure hazards. Most workers mentioned that their employers did not inform them of workplace hazards regarding radiation. The most common reported physical health problems were respiratory problems (74.1%) and cancers (8.6%). Anxiety (34.6%) and depression (28.4%) were the most frequently reported emotional problems. Participants identified experiencing anxiety from the lack of understanding from health care providers. Workers would seek medical attention and the health care providers were not sure if the issue was related to their workplace exposure. The researchers suggested that emotional health problems were also present with those who reported physical health problems when they thought it was related to their occupational hazard exposures. Medical screening, full health examinations, and health professionals being better aware of the potential health issues were also recommended (Dawson & Madsen, 1995). Clearly, working in the mining sector is a hazardous occupation. This research sought to contribute to this body of literature by examining the perceived personal impact the exposure treatment has had on the miners.

Research Objective

This study aimed to explore the perceived personal level impact of McIntyre Powder treatment exposure (1943-1980) on some underground gold and uranium workers in Northeastern Ontario.

Theoretical Framework

Cognitive dissonance theoretical framework was used to give a guiding perspective to interpreting the results of this research. Cognitive dissonance originated from cognitive consistency. In 1957, Leon Festinger theorized that individuals are motivated to find balance in their cognition when they are in a state of psychological imbalance (Harmon-Jones & Harmon-Jones, 2012). The state of dissonance can be described when there are conflicting attitudes, beliefs or behaviours (Harmon-Jones & Harmon-Jones, 2012). Leon Festinger theorizes that one may find balance by altering cognitions by changing one's attitude or behaviour, or by rationalizing the behaviour by changing the cognition, or by adding cognition. The most common way to reduce dissonance is through attitude change. One of the downfalls of cognitive dissonance is that it cannot be measured, it is purely subjective (Harmon-Jones & Harmon-Jones, 2012).

Methods

For this study, a qualitative descriptive design was used to explore the perceived personal level impact of exposure to McIntyre Powder treatment in Northeastern Ontario. Semi-structured interviews were conducted with 16 exposed male underground miners from Timmins, Elliot Lake and Sudbury, in Ontario, Canada. Snowball sampling was used for study recruitment and data were analyzed thematically (Braun and Clarke, 2006) and steered by cognitive dissonance theory by guiding perspective to interpreting the results of this research (Harmon-Jones & Harmon-Jones, 2012).

Recruitment

To decrease sampling bias, research participants were recruited using several methods. Firstly, recruitment posters and letters were mailed out from the Sudbury Ontario Health Clinics for Ontario Workers (OHCOW). From the 2016 OHCOW client list, every 10th client of the 270 possible participants were mailed a poster and letter by one of OHCOW's service coordinators. Secondly, the lead researcher posted the study recruitment poster on their Facebook page. Thirdly, the recruitment poster was posted on the McIntyre Powder Project website and Facebook page (Martel, 2013). Fourthly, ten recruitment posters were posted in general grocery stores, community bulletin boards and dollar stores in Sudbury, Elliot Lake, and Timmins. Lastly, the lead researcher contacted various newspapers (i.e., the Elliot Lake Standard, Timmins Daily Press, the Sudbury Star, Northern Life and the Northern Ontario Business Newspaper) and they all offered to publish an article to assist with recruitment for this study.

Sample Inclusion

All participants required a minimum of one-year continuous daily exposure to the aluminum dust treatment and for a duration of 15 to 30 minutes, which excluded any contract and transient workers. Due to previous literature identifying a possible connection between McIntyre powder and cognitive deficits, participants had to be able to provide free and informed consent (Peters et al., 2003). The target population had to currently reside in Sudbury, Elliot Lake or Timmins Ontario, Canada.

Setting

Sixteen individual interviews were conducted in person or by telephone. Participants interviewed in person were given the option to meet at a local union hall, library or their own home, and all participants chose to have the interviews conducted at their residences. Interview duration averaged approximately 45 minutes. To thank participants for their time, participants were given a five-dollar gift card for a popular local coffee shop. These gift cards were donated by the Sudbury OHCOW clinic. A pilot interview was conducted on February 5th, 2018 with a participant who volunteered at a Sudbury intake clinic on October 3rd, 2016. Subsequent interviews were conducted between February and April 2018.

Data Analysis

Detailed thematic analysis was utilized to analyze the data in this research, which consisted of six steps (Braun & Clarke, 2006). During the first step, the researcher became familiar with the data by reading and re-reading the transcriptions and began looking for

meaning in the data when transcribing all data verbatim (Braun & Clarke, 2006). Once all transcriptions were completed, the next step involved generating initial codes (Braun & Clarke, 2012). Initial codes consisted of: how workers described and felt about McIntyre Powder (MP), had no choice, hesitant to complain and helplessness, not enough information regarding MP, young and inexperienced, concern about future health impact, trust in company, health issues, death, and no consent. The researcher coded all data line by line, which consisted of open coding and used inductive analysis by not using pre-identified codes (Braun & Clarke, 2006; Khandkar, 2009). During the third step, the primary and secondary researcher searched for and identified broader themes and extracts related to the research question (Braun & Clarke, 2012). In step 5, the main themes were defined and the essence of each theme were captured (Braun & Clarke, 2006). In the last step, the researchers grouped the themes and extracts for final analysis, which allowed researchers to answer the research question with the data (Braun & Clarke, 2006).

Results

Participant Characteristics

From the 16 interviews, the majority of participants were recruited from the McIntyre Powder Project and Newspapers (n=5, n=5) respectively. Other recruitment consisted of the pilot interview (n=1) from the Sudbury OHCOW intake clinic, the researcher's personal Facebook page (n=2), a poster from inside a dollar store (n=1), and snow ball sampling (n=2). All participants in this study were male. Participants age ranged from 60 to 88 years old, with an average of 67 years old. The participants interviewed lived in Sudbury, Elliot Lake, and Timmins (n=7, n=5, n=5) respectively. Workers' daily exposure duration to the aluminum dust averaged seven years, and ranged from 2 to 27 years.

The four main themes derived from the participant's interviewed who were exposed to McIntyre powder daily included: 1) compulsory exposure, 2) hesitancy to complain, 3) feelings of betrayal by union, employers and the Canadian government, 4) concern about health impact and dying.

Compulsory Exposure

A predominant theme noted by participants was that the exposed workers did not consent to the aluminum dust treatment. Workers did not provide their employers with any type of written or verbal consent for treatment. They were not given the opportunity to make an informed decision to consent to treatment. They believed they had no choice in the matter, one exposed worker stated: "...we just had to do it -- well then, they (the employer) didn't ask me, ..., want to go in there and get gassed before every shift, -- no they didn't ask me that," Elliot Lake Underground Worker #9. Another underground worker stated: "My God there's so much stuff out nowadays they warn you for this and that and then, but there was nothing, to breathe that for 10 minutes for god sake forced to do it," Timmins Underground Worker #13. Another worker explained:

It was done without our permission and without our knowledge. It was a medical treatment that was invasive and they shouldn't have done it without, that's still 77,

that's still fairly modern. That's not like in the 1800s, right it's still at the modern age where they should have let people know. You know they just went ahead and done, and I don't think that was right, Elliot Lake Underground Worker #10.

From the above quotes, it demonstrates that the exposed workers were obligated to being exposed to the daily aluminum dust treatment; consent (i.e. verbal or written) was not provided for the treatment, and workers felt they had no choice in the matter.

Hesitancy to Complain

Workers who were exposed to the McIntyre Powder did not complain about the aluminum dust treatment because they were afraid of losing their jobs. Their hesitancy to complain was increased as they were the primary source of financial support for their families at the time and thus their families' stability was dependent on their employment. They did not feel respected enough as workers to be able to speak with supervisors and discuss concerns about being exposed to the McIntyre powder on a daily basis. A few examples illustrate this point:

It wasn't voluntary, it was mandatory. So, I mean you could look back now, and say well I would have done this, or I would of done that but at the time no. You did what they told you because they in Elliot Lake mining, mining companies where they ruled everything in this city town then. You work for the mines or you didn't work really, and if you didn't do what the mine tells you, you have no job, Elliot Lake Underground Worker #14.

Another underground worker stated: "Well you know the only thing I can say with the mining companies and stuff like that they're self-serving and they're going to do whatever they want and the little guys mean nothing," Elliot Lake Underground Worker #15. To further explain workers' hesitancy to complain, another worker stated:

...you go down on the first day, we were wondering what's going on and this is, ...this is what we had to do and I guess as (the) new man. The old guys they all knew they were doing it for years. But it was as a new man you just, you were happy to have a job and you just did whatever you were told to do," Elliot Lake Underground Worker #15.

The above quotes illustrate that exposed underground workers were hesitant to complain on several factors. They were hesitant to complain due to following direction from authority members from the mining companies, normalization with coworkers and financial obligations.

Feelings of Betrayal from Union, Employers and Canadian Government

Participants felt betrayed, tricked, and deceived by mining companies, the government and their union for allowing the companies to have exposed them to a treatment that had little evidence of any health benefit. They felt that they were used as guinea pigs as part of an experiment to determine if the aluminum dust could actually help prevent lung silicosis. They expressed feelings of betrayal in various ways. One participant stated:

There's the element of trust that you're being taken care of. Then many years after it's almost like a violation you know like a break and enter kind of thing where something has happened that you oh I don't know just makes you feel, -- betrayed, or whatever. Elliot Lake Underground Worker #9.

Another worker illustrated feelings of betrayal:

I feel they fooled us...Yeah. They lied. -- They did not know, it was gonna be good for us they don't know they just believed it because somebody just made it and sold those little things. That, McIntyre dust or whatever they call that. I remember that, those little cans. Elliot Lake Underground Worker #8.

One deceived exposed worker stated:

Well today, in today's standards, I feel that I was deceived -- Back then you didn't say much right well like I said maybe it's okay that's why they're doing it, they're protecting us right. -- But today, you know, I don't think they could, the law says you can't do anything medical to a person without their knowledge. But back then, well that's 40 years ago right. So, different laws different standards. Elliot Lake Underground Worker #10.

The above quotes demonstrated how the workers felt deceived by their employers, government and unions.

Concern About Health Impact and Dying

Another theme identified was that participants were concerned about their own health impact and dying. Some participants feared that even though they were currently healthy, they were unsure about future health implications from exposure. They were concerned with the fear of the unknown health consequences and the possibility of early death. One participant stated: "My friends, -- they're in worse shape than me [...] Yeah they're all dead," Elliot Lake Underground Worker #9. Other examples of these concerns include: "And especially there's so many people that were exposed to it probably longer than I have and they're not here no more and they didn't even get to see their retirement or nothing. That's what really bugs me now," Timmins Underground Worker #13. Another concerned worker stated: "It's kinda scary. I know now and I'm not in that great of shape but, I'm afraid to get Alzheimer's or Parkinson disease, you know, it's scary," Elliot Lake Underground Worker #15.

From the participants' experience described above, it is apparent that exposed workers are currently concerned about their future health implications from being previously exposed the aluminum dust treatment.

In summary, the main results found that at the time of exposure, exposed workers felt they were mandated to being exposed to the McIntyre powder treatment and were hesitant to complain to authority figures. At the time of the interviews, exposed workers felt betrayed by

their union, employers, and Canadian government. Today, exposed workers are concerned about future health implications associated with being exposed to the aluminum dust treatment.

Discussion

Theoretical Framework

Cognitive dissonance theory helped explain the main findings in this research. Cognitive dissonance can impact individuals in the workplace and can have several negative effects (Prvulovic, 2015). Some workers may have been exposed to certain situations that are in direct conflict with their beliefs and personal values and still chose to execute tasks that are in direct internal conflict (Prvulovic, 2015). Internal justification methods can include positional obedience, normalization, and emotional trading. Positional obedience occurs when a worker justifies their action because it came from a person of authority in the workplace. Normalization occurs when workers follow suit because other workers are doing it (Prvulovic, 2015). Emotional trading occurs when workers foresee future reward for their behaviour even though it compromises their beliefs and personal value (Prvulovic, 2015). Negative impacts from cognitive dissonance in the workplace can include, increased absenteeism, withdrawal and disengagement, significant reduction in performance, negative and inappropriate behaviour, high staff turnover, workplace stress claims, and adverse health effects, such as depression, fatigue, and anxiety (Prvulovic, 2015).

In relation to cognitive dissonance theory, participants explained that they felt being exposed daily to the McIntyre powder was mandatory. Some participants explained that direction to undergo McIntyre powder treatment came from mining authority personnel who they trusted at the time. Furthermore, some workers went along with it because other workers were doing it, and they believed that their health would benefit from it in the future. Furthermore, participants were concerned about having been exposed to McIntyre powder and its effect on their future health and they were concerned with developing illnesses and experiencing a premature dying. These concerns may cause chronic stress leading to additional adverse health effects for exposed workers. As such, our findings confirm the workers were hesitant to complain due to internal justification, such as positional obedience, normalization, and emotional trading as previously reported by Prvulovic (2015).

Main Themes

Workers exposed to McIntyre powder felt that the treatment was compulsory. They did not remember consenting to the aluminum dust prophylaxis treatment and were hesitant to complain about the treatment at the time out of fear for losing their job. Interviewed workers explained that they felt they had no choice of the aluminum prophylaxis - it was a condition of their employment. In that era, men were the prominent financial supporters for their families, which generally increased their hesitancy to complain about the perceived conditions of their employment. Several interviewed workers explained that they felt they had no other options for employment, and they felt obligated to financially support their family regardless of hardships. In relating these findings to cognitive dissonance theory, workers found balance by rationalizing

their daily behaviour of aluminum treatment by changing their thinking. Workers internalized their thoughts about not wanting to be exposed to the McIntyre powder, by rationalizing that they needed their jobs to support their family.

Feelings of betrayal by unions, employers, and the Canadian government and concern about health impact and dying suggest exposed workers were not in a state of dissonance. The negative feeling of betrayal produced a negative relationship between workers and the government, mining corporations, and the unions. Furthermore, exposed workers' concerns about health impact and dying resulted in unstable cognitive state. To find balance, exposed workers need to add cognition, which may be done by receiving compensation, a formal apology, and receiving efficient health care by knowledgeable and understandable health care providers.

Workers also were concerned about their health and that of their coworkers, as well as the possibility of dying early. Exposed workers learned that being exposed to the aluminum powder did not have any protective effect, and that it may have had a negative impacted their health. They felt that they were the only survivors of all their co-workers. In terms of theoretical aspects, exposed workers who are concerned about future health impact are in a state of cognitive dissonance which may contribute to negative health effects and well-being.

Similar Findings

To our knowledge, no other qualitative research has been conducted on exposure to a harmful element that was originally meant to protect workers. However, qualitative research with workers from the Navajo mining industry, similarly found that underground workers felt betrayed by their employers and had feelings of anxiety regarding the uncertainty of possible health effects from working under ground (Markstrom & Charley, 2003). Likewise, Malin and Ptrlzelka (2010) studied a community in Monticello where residents were exposed to an environmental uranium contamination from a mill felt they were deceived and powerless, and also concerned with the uncertainty of future health impacts. Dawson and Madsen (1995) interviewed American Indian uranium workers and widowers and also found that workers were concerned with their coworkers' illnesses and deaths. Thus, individuals have been concerned in other settings about the potential health implications from being exposed to harmful elements in the workplace.

Strength and Limitations

The main goal of this study was to explore the perceived impact of McIntyre powder exposure on workers who were exposed. Due to the lack of research on McIntyre exposed workers, this qualitative research study may help reduce a knowledge gap by providing more information on how being exposed has impacted workers. This study is the first qualitative study that has been conducted with individuals exposed to the McIntyre powder. This research has brought new insight on this matter and will continue to guide future research about McIntyre powder. Another strength to this study was that exposed workers showed great interest in participating in this research. There were over 40 workers that showed interest. However, not all met the sample inclusion criteria and did not participate for that reason.

Limitations of this study included sampling bias, there was no master list of all workers who were exposed the McIntyre powder. To minimize this factor, participants were recruited by several methods and convenience and snowball sampling was utilized. The possibility of recall bias is also present in this study as participants were asked to recall events that happened over 30 years ago. In addition, selection bias may have occurred given who ultimately participated in the study. The results from this study provide only perspectives from those who participated and reside in Northeastern Ontario. Furthermore, to reduce coder bias, data were coded by two researchers and reviewed by peers. To decrease researcher bias, the researcher kept a reflexivity journal following each interview.

Conclusion and Recommendations

Exposed workers to the aluminum dust treatment perceived that their long-term health was impacted on a personal level. There is some research on McIntyre powder exposure that has identified a possible association with neurological disorders, cardiovascular diseases and cognitive impairments (Peters, Reid, Fritschi, de Klerk, & Musk, 2013; Rifat, Eastwood, McLaghlan, & Corey, 1990). However, to our knowledge this the first qualitative study to examine the perceived impact of the treatment on the exposed individuals. The main findings from this research identified that exposed workers felt they were obligated to receive the aluminum powder daily at work, were hesitant to complain about undergoing daily treatment, felt betrayed by their union, employers, and the Canadian government, and are currently concerned about future health implications and the possibility of dying at an earlier age. These results may be used to inform workers, companies, unions, governments, and health care professionals about workers who were exposed to McIntyre powder, as well as its potential health concerns. Even though McIntyre powder is currently not in use, workers continue to be exposed to hazardous chemicals and elements in the mining environment. A thorough review of these elements is necessary to protect our workers from unnecessary harmful exposures. Furthermore, continued research is required to minimize barriers for workers to feel more comfortable in raising concerns in the workplace. Also, to assist exposed workers in minimizing their feelings of betrayal from their union, employers and government, a formal apology should be provided, and information sessions should be offered to address concerns about future health implications.

Implications for Practice

McIntyre powder was used globally and is not only a Northeastern Ontario concern. These findings can be used in clinical practice and for educating clinicians who are primary care providers for exposed workers. Results can also be used to plan educational interventions about McIntyre power exposure for medical professionals. Occupational health research must continue to focus on the potential health impacts for these exposed workers. Further qualitative research could include interviewing workers about compensation experiences, spouses or partners of exposed workers, health care workers, compensation and regulatory government workers, and employers who used the aluminum dust.

Conflict of Interest: None

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