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Challenges and Adaptation Strategies for Workers with ADHD in the Mining Industry

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Abstract:

The article discusses the specifics of working in the mining industry and the associated challenges for individuals with ADHD. Underground work requires high levels of concentration, psychological resilience, and strict adherence to safety procedures. Individuals with ADHD may struggle with sustained attention, work organization, and rule compliance, which can increase the risk of accidents. At the same time, their ability to respond quickly to changes and adapt to a dynamic environment can be an advantage.

The article presents the results of a survey conducted among 67 working men diagnosed with ADHD. The findings indicate that 73% of respondents perceive ADHD as an obstacle at work, while 58% recognize an increased risk of accidents. Additionally, these individuals reported difficulties with multitasking and following procedures.

Based on these findings, the article proposes strategies to support the adaptation of individuals with ADHD to mining work, such as adjusting the work environment, providing training to increase supervisors' awareness, and offering individualized psychological and organizational support. The article highlights the necessity of implementing appropriate support mechanisms to improve the safety and efficiency of neurodivergent workers in the mining industry.

Keywords: mining, ADHD, workplace safety, workplace adaptation, workplace inclusivity, employee support

1. Introduction

The mining industry remains one of the most demanding professional sectors, presenting numerous physical and psychological challenges. Despite technological advancements, modern mining continues to involve harsh conditions, high stress levels, intense work pace, and strict requirements for precision, organization, and sustained attention. This environment demands a high degree of psychological and physical resilience, procedural discipline, and the ability to respond swiftly to change and potential hazards.

At the same time, growing attention is being given to neurodiversity in the workplace, including individuals with Attention Deficit Hyperactivity Disorder (ADHD) - a neurodevelopmental condition that affects attention regulation, impulsivity control, and energy levels. People with ADHD often struggle with prolonged focus, task organization, and adherence to rigid structures, which may appear incompatible with the strict demands of the mining sector. However, their natural ability to react quickly, high energy levels, and preference for dynamic environments can offer distinct advantages in roles requiring flexibility and rapid decision-making.

This study aimed to assess the impact of ADHD on the functioning of employees in the mining sector and to identify adaptive strategies and forms of support that could enhance their effectiveness in this specific work context. The article explores both the difficulties and potential strengths that neurodivergent individuals may experience in mining. It outlines support strategies, highlights the employer's role, and discusses structural changes that could facilitate adaptation and improve work conditions.

To gather empirical data, a survey was conducted employees diagnosed with ADHD. This article addresses a significant research gap: while existing ADHD research typically focuses on education, office work, and creative fields, limited attention has been paid to how neuroatypical individuals' function in high-risk, physically demanding occupations [1, 2]. By examining both the challenges and adaptive potential of individuals with ADHD in mining, this study contributes meaningfully to the field of neurodiversity research within industrial settings.

2. Characteristics of work in mining

Mining is an industrial sector encompassing all activities related to the extraction of raw materials (minerals) to the surface, as well as their preparation in the beneficiation process for further use. Depending on the extraction method, mining is categorized into open-pit mining (which involves removing overburden layers and exploiting surface-level deposits), underground mining (where the deposit is extracted from deep underground and brought to the surface via shafts or adits), and borehole mining (where the deposit is extracted through specially prepared and equipped drilling wells) [3].

Work in underground mining involves a range of tasks related to resource extraction and is typically divided into three stages. The first stage includes access work, consisting of the excavation of shafts that provide entry to the deposits. The second stage involves preparatory works, such as driving horizontal tunnels at various levels of the mine. Shafts and roadways are additionally reinforced with steel structures to ensure the safety of working miners. The third stage involves coal extraction using specialized machinery and equipment (such as longwall shearers and plows). The extracted coal is then transported by conveyors or mining trolleys to a transfer point, from where it is delivered to the surface [4].

Miners working in underground coal mines using underground extraction methods operate various tools and machines, including drills, hammers, pickaxes, longwall shearers, plows, cutting units, and conveyors. Depending on their qualifications, their responsibilities may include loading excavated

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material, assembling and dismantling supports, operating mining machinery and equipment, managing pumps and compressors, performing on-site repairs of mining and electrical equipment, overseeing transportation and ventilation systems, operating lifts, setting explosive charges, conducting detonations, drilling holes, and backfilling chambers [5]. This work requires not only proficiency in operating machines and equipment but also strict adherence to safety procedures and effective teamwork skills. Adverse workplace environmental factors present significant challenges and involve exposure to:

- physical factors - excessive noise from mechanical equipment, inadequate lighting, local vibrations, high humidity, and a hot microclimate;
- chemical and dust factors - reduced oxygen levels combined with elevated carbon dioxide concentrations, mining dust (a mixture of coal dust with silica and trace metals) with fibro-genic effects, as well as mine waters and oils containing sensitizing substances (e.g., chromium);
- biological factors - parasites, fungi;
- ergonomic and psychosocial factors - shift work, including night shifts, an increased risk of accidents, strenuous physical labor (often monotonous and performed in a forced body posture) [5].

Miners are particularly at risk of developing numerous occupational diseases due to harsh underground working conditions and constant exposure to harmful factors. According to the latest available data from the Higher Mining Authority, one of the most serious threats is pneumoconiosis, which accounts for over 90% of all occupational diseases in mining. Other common conditions include permanent hearing loss and vibration syndrome [6].

To minimize these risks, both individual and collective protective measures are implemented, such as hearing protectors, safety goggles or protective glasses, masks or half-masks against dust, anti-vibration gloves, and monitoring systems for gas and dust concentrations [7].

Mining jobs, especially those in positions such as shotfirers or machine operators, require meeting specific psychophysical criteria. Workers must have valid medical and psychological certificates confirming the absence of mental disorders or significant psychological impairments [8]. Additionally, machine operators in mines should demonstrate above-average reaction times and visuomotor coordination [9]. Regular psychophysical examinations are essential to ensuring both safety and operational efficiency in mining.

3. Characteristics of ADHD and the specifics of working in mining

Attention Deficit Hyperactivity Disorder (ADHD) is a common neurodevelopmental disorder that begins in childhood and has a high heritability rate [10]. The first symptoms of hyperactivity typically appear between the ages of 3 and 6. It is estimated that ADHD affects 5-10% of children [11]. A significant proportion of patients remain undiagnosed during childhood or adolescence, as diagnosing the disorder can be complex, particularly when it coexists with other psychiatric, neurological, or neurodevelopmental conditions. Recent studies indicate that approximately 85% of children with ADHD continue to exhibit symptoms into adulthood, while only about 10% fully outgrow the disorder Non-genetic factors also contribute to ADHD development, including stress and perinatal complications (such as fetal hypoxia), low birth weight, central nervous system damage, maternal smoking, alcohol consumption, medication use, or psychoactive substance exposure during pregnancy. Additionally, early emotional deprivation and exposure to environmental toxins (e.g., lead, pesticides, polychlorinated biphenyls) in fetal or early childhood stages have been linked to increased ADHD risk [12].

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The DSM-V (Diagnostic and Statistical Manual of Mental Disorders) categorizes ADHD into three subtypes: predominantly inattentive type, predominantly hyperactive-impulsive type, and combined type [13]. ADHD is more commonly diagnosed in boys, while in women, the inattentive subtype is more prevalent [9]. To diagnose ADHD, symptoms must persist for at least six months, negatively impact daily functioning, be observable in multiple settings, significantly deviate from developmental norms, appear before the age of 12, and not be attributable to another medical or psychological condition [14].

In adults, ADHD symptoms are often milder than in childhood due to the development of coping mechanisms and/or masking behaviors. This adaptation can complicate diagnosis, as some individuals may no longer meet the full diagnostic criteria. Untreated ADHD can have serious consequences across multiple areas of life, including low self-esteem, impaired social skills, anxiety disorders, depression, occupational difficulties, substance abuse leading to addiction, increased risk of legal issues, and greater vulnerability to physical health problems, such as accidents and injuries. Treatment options for ADHD include psychoeducation, cognitive-behavioral therapy (CBT), and pharmacotherapy. Table 1 presents a classification of ADHD subtypes along with examples of typical symptoms associated with each category.

Table 1. Division of ADHD with typical symptoms

Source: Own elaboration based on [5, 15]

ADHD		
Predominantly inattentive subtype	**Predominantly hyperactive-impulsive subtype**	**Combined subtype**
losing tools and equipment	sudden changes in activity and attentiveness	combination of all the mentioned symptoms
forgetting procedures	speaking without thinking	
getting distracted	need for constant movement	
difficulty following instructions	risky behaviors	
procrastination	impatience	
variable efficiency	lack of caution when operating machinery	

Individuals with ADHD exhibit various traits that can impact their functioning in the mining environment. These traits can be both advantages and challenges.

Strengths:

1. Quick response to stimuli: In crisis situations, individuals with ADHD often act quickly and effectively.
2. Creativity: ADHD is often associated with unconventional problem-solving approaches, which can be valuable in jobs requiring innovative solutions.
3. Dynamic environment: Individuals with ADHD have a natural tendency toward high activity levels, which can be beneficial for tasks requiring intense physical effort.
4. Physical work: Tasks involving movement can help maintain focus and reduce feelings of restlessness.
5. Structured work schedule: A shift work schedule can provide a routine that facilitates daily functioning.

Challenges:

1. Difficulty with concentration: Problems with prolonged focus can make it harder to perform monotonous or precision-demanding tasks.
2. Impulsivity: This may lead to decision-making without fully considering the consequences, which can be particularly risky in mining.
3. Organizational challenges: Managing tools, machinery, documentation, or tasks may pose challenges.
4. Focus on safety requirements: Working in a mine requires strict adherence to safety rules, which may be challenging for individuals struggling with impulsivity.
5. High-stress levels: Sudden crisis situations may lead to sensory and emotional overload.

Despite the growing interest in neurodiversity in the workplace, the issue of ADHD in the context of underground mining remains largely unexplored. Understanding the challenges and strengths of workers with ADHD can contribute significantly to better workplace adaptations, as well as to increased safety and efficiency in this sector of the economy.

4. Risk and potential hazards

Work in underground mines involves numerous hazards, with exposure to industrial dust being among the most serious. Inhalation of suspended particulate matter can lead to respiratory diseases such as pneumoconiosis, asthma, and, in the long term, respiratory failure. Additionally, miners are at increased risk of developing lung cancer [16].

Working in a mine means constant exposure to elevated noise levels, which negatively affects hearing, leading to its gradual impairment. The deeper the shaft, the higher the temperature at the worksite, which further complicates working conditions - especially the use of protective masks, which forces workers to choose between the risk of inhaling dust and the discomfort of heat [17].

The mine is also a place where mechanical injuries, such as fractures or sprains, frequently occur. A commonly overlooked hazard is occupational stress - the continuous pressure related to responsibility for oneself and others, awareness of danger, and the need to meet operational standards may lead to cardiovascular problems, including heart attacks. While these are not direct consequences of working underground, a higher incidence of heart disease has been observed among miners [4].

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According to data from the past ten years, an average of 20 miners dies annually in mining accidents [18]. Despite the overall downward trend, the mining sector remains one of the industries with a high occupational risk. The elevated level of threats associated with underground work results from various factors that can be classified according to their nature and source. A breakdown of hazards present in mining operations is presented in Table 2.

Table 2. Classification of hazards in mining operations [3, 19]

No.	Type of Hazard	Example
1.	Natural hazards	rock bursts, methane hazards, gas and rock outbursts, coal dust explosions, climatic hazards, water hazards, landslide hazard, eruption hazard, hydrogen sulfide hazard, exposure to radioactive substances
2.	Technical hazards	entrapment, dragging in, crushing, electric shock, burn from electric arc
3.	Mining hazards	rock falls, roof collapse
4.	Physical hazards	noise, dust, mechanical vibrations generated by machines and equipment
5.	Chemical hazards	blasting and technological gases, chemical compounds used for bonding and sealing mine workings
6.	Biological hazards	microclimatic conditions, bacteria, viruses, fungi, molds, contaminated watercourses
7.	Psychophysical hazards	forced body posture (static and dynamic load), stress
8.	Hazards resulting from human factors	disregard for safety regulations, routine, lack of caution, inadequate training

An analysis of human factors in the context of mining accidents makes it possible to identify key areas requiring intervention. Research conducted by Es'haghi et al. showed that insufficient supervision and inadequate training are the main causes of unsafe behaviors among mine workers [20].

Similarly, Mirzaei Aliabadi et al. indicated that organizational errors, worker mistakes resulting from insufficient skills, and environmental factors significantly influence unsafe behaviors and the occurrence of accidents [21].

The National Institute for Occupational Safety and Health (NIOSH) emphasizes the importance of human-centered design to reduce risk and accident rates in mining. This approach includes analyzing interactions between individuals and the work environment, operational processes, and organizational management. Identifying and addressing gaps allows for the development of intervention strategies to improve workplace safety and health. Taking into account factors such as age, experience, or worker skills can help reduce the number of accidents [22].

In parallel, in the context of ensuring a safe working environment, increasing attention is being paid to the needs of neurodivergent workers. A lack of appropriate support for such workers can lead to safety-threatening situations, such as inattention during machine and equipment operation, delayed responses to warning signals (e.g., gas alarms), omission of steps in routine procedures, difficulty concentrating under demanding conditions, and problems with communication and teamwork in situations requiring precise coordination.

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Additionally, working in a mine presents a range of specific challenges and conditions that can particularly affect employees with ADHD:

- environmental conditions - limited space, high noise levels, humidity ranging from 70% to 100%, fluctuating temperatures (often exceeding 30°C in many areas) and hazards such as gas explosions or tunnel collapses [23] can cause sensory overstimulation and impair concentration;
- need for sustained concentrations - mining work demands precision and strict adherence to procedures. For individuals with ADHD, who may struggle with sustained attention, this can be a significant challenge;
- team dependence - many underground tasks require close collaboration and effective communication. Workers with ADHD may need additional support in in structuring team-based tasks;
- crisis situations - while individuals with ADHD may excel in dynamic environments, impulsivity can lead to risk-taking decisions in emergency situations.

5. Research methodology

To collect data, a survey study was conducted. The survey was developed in an electronic format using the Google Forms platform and consisted of 19 single-choice closed-ended questions and one semi-open-ended question. The survey link was distributed via social media platforms (Facebook) and online messaging applications (Messenger) in thematic groups for working individuals with ADHD. A total of 200 participants took part in the study. The data collection period lasted six weeks.

6. Results

Considering the latest data from the end of November 2024, employment in the coal mining sector in Poland amounted to 74,379 people [24]. The share of women employed in this sector is approximately 10% (primarily working on the surface); therefore, only the group of men was included in further analyses.

The survey study was conducted on a group of 67 employed men diagnosed with ADHD. The collected data were analyzed using Microsoft Excel. Selected results of the analysis are presented below in graphical form (Fig. 1-7).

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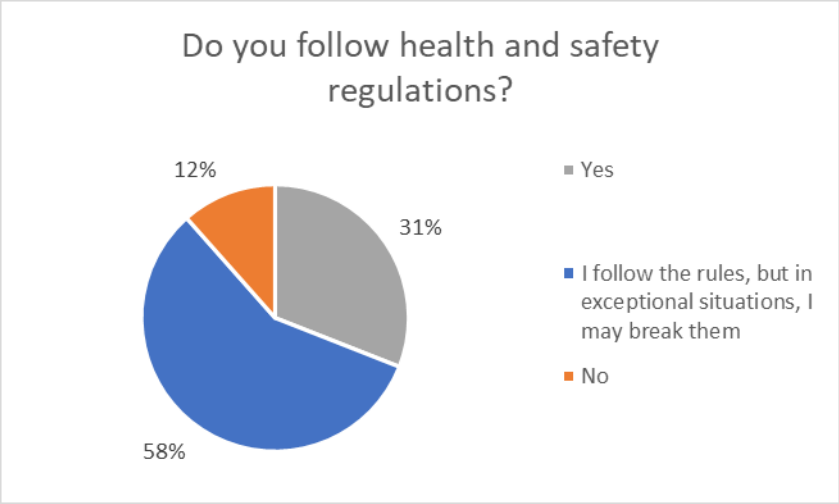

Fig. 1. The chart presenting the responses to the question: Do you follow health and safety regulations?

More than half of the respondents (58%) report that they adhere to regulations, although they occasionally break them. A total of 31% strictly follow occupational health and safety (OHS) rules, while 12% do not comply with them. In underground mining, adherence to OHS procedures is crucial for safety, as any deviation can lead to serious accidents, such as rockfalls, methane explosions, or machinery-related incidents. The fact that a certain group of workers admits to violating regulations may pose a significant risk to the entire crew.

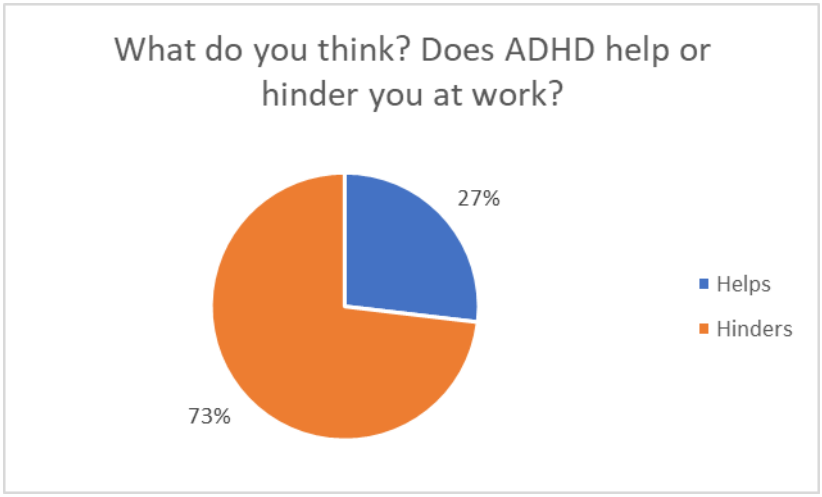

Fig. 2. The chart presenting the responses to the question: What do you think? Does ADHD help or hinder you at work?

The majority of respondents (73%) believe that ADHD hinders their work, which may indicate difficulties in concentration and task execution in the demanding mining environment. In contrast, 27% believe that ADHD benefits them, which may suggest better adaptation to dynamic situations.

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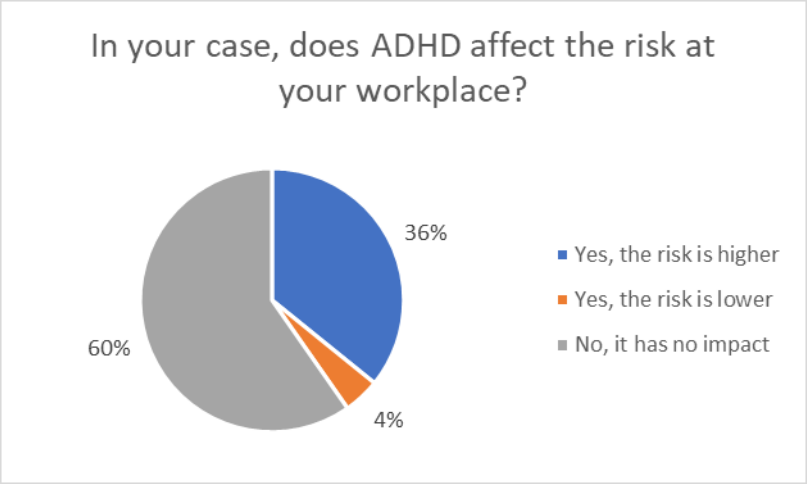

Fig. 3. The chart presenting the responses to the question: In your case, does ADHD affect the risk at your workplace?

36% of respondents believe that ADHD increases risk in their work, 4% believe it reduces risk, and 60% see no impact. In mining, increased risk may translate into a higher likelihood of errors and accidents, posing a significant hazard.

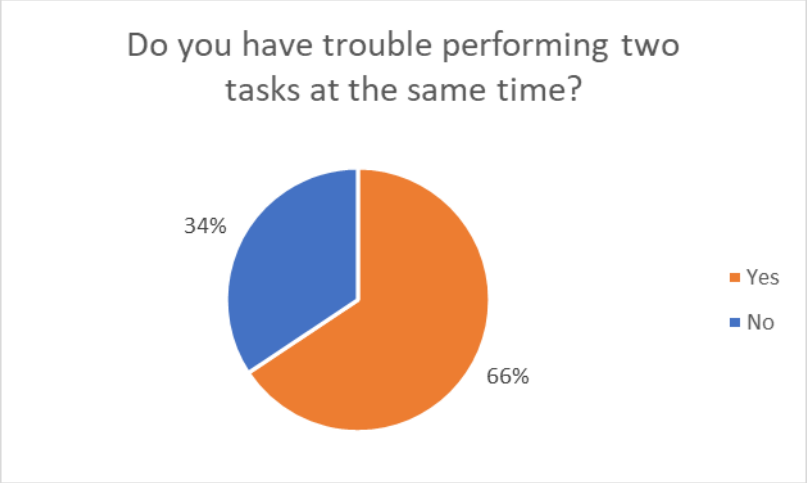

Fig. 4. The chart presenting the responses to the question: Do you have trouble performing two tasks at the same time?

66% of respondents report difficulties with multitasking, which in a mining environment may hinder the simultaneous monitoring of equipment and surroundings, increasing the risk of errors.

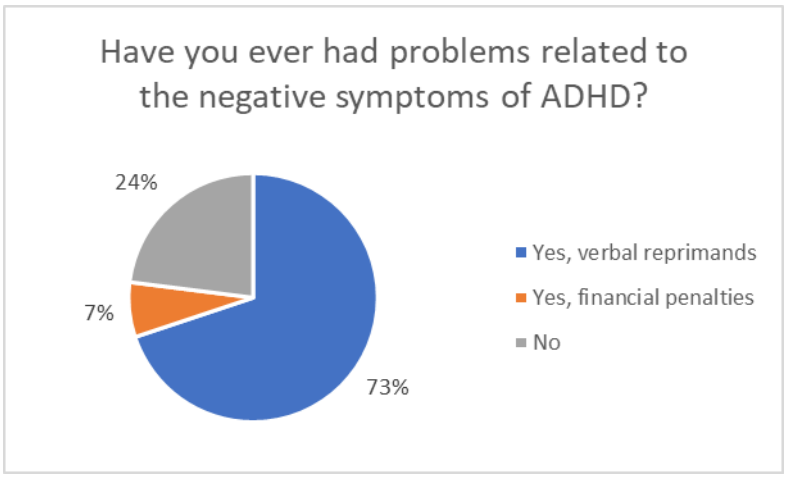

Fig. 5. The chart presenting the responses to the question: Have you ever had problems related to the negative symptoms of ADHD?

73% of respondents admitted to receiving verbal reprimands, 7% experienced financial penalties, while 24% had no issues. In the context of mining work, this may indicate difficulties in adhering to rules and professional requirements.

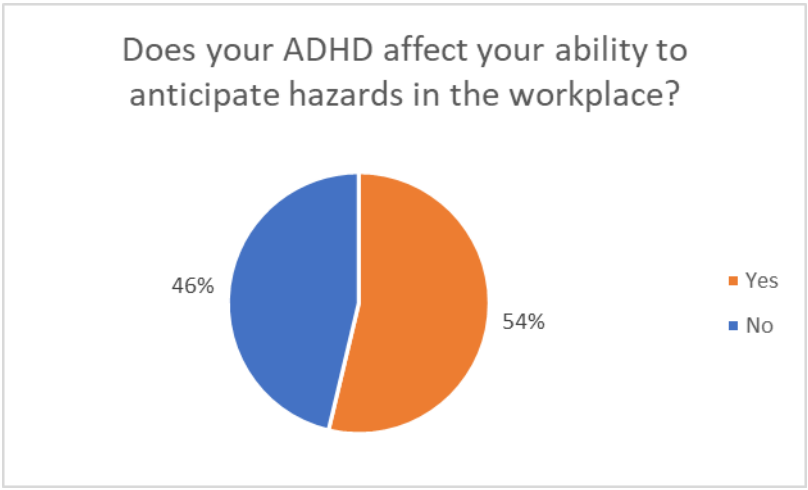

Fig. 6. The chart presenting the responses to the question: Does your ADHD affect your ability to anticipate hazards in the workplace?

54% of respondents believe that ADHD affects their ability to anticipate hazards, which can be particularly dangerous in an underground mine. This finding suggests an increased risk of accidents due to difficulties in concentration and situational assessment.

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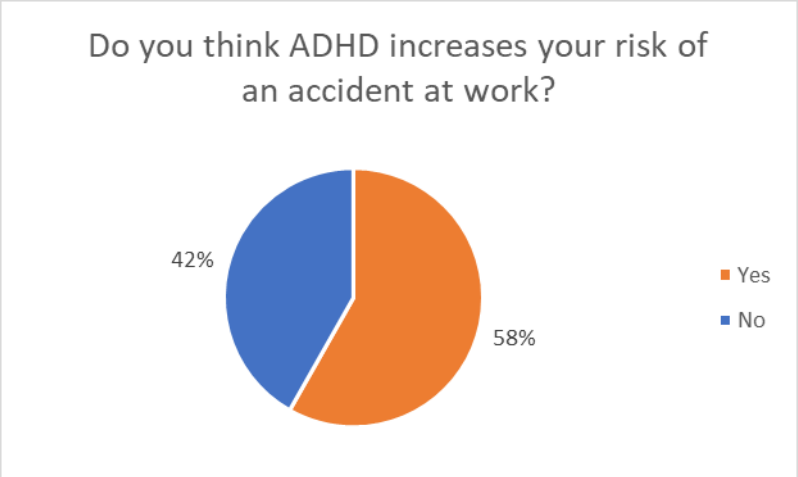

Fig. 7. The chart presenting the responses to the question: Do you think ADHD increases your risk of an accident at work?

The majority of respondents (58%) believe that ADHD increases the risk of workplace accidents. For underground miners, this is particularly significant, as the profession requires high levels of concentration, adherence to procedures, and rapid response to threats. Individuals with ADHD may be more prone to inattention, which can further increase the risk of accidents in a high-risk environment such as a mine.

7. Support for people with ADHD in the workplace

Considering the results of the survey, in which 73% of respondents identified ADHD as a factor that hinders work, and 58% stated that it increases the risk of accidents, the implementation of effective support strategies is essential. Appropriate workplace adjustments can significantly improve the comfort and efficiency of neurodivergent employees while reducing risks associated with their specific challenges.

Below, a comprehensive set of measures aimed at enhancing workplace safety for neurodivergent individuals is presented. The recommendations cover various areas, including education and awareness-raising, modifications to the work environment and organization, as well as psychological and technological support. Each of these elements is crucial for creating a safe and inclusive work environment tailored to the needs of individuals with ADHD.

1. Training and awareness-raising

   Organizing training sessions for supervisors and colleagues on ADHD and its impact on workplace functioning. Introducing workshops on stress management techniques and time organization.

2. Psychological support and mentoring

   Providing access to a psychologist. Implementing a mentoring system in which experienced employees assist individuals with ADHD in adapting to professional requirements.

3. Measures to improve concentration and work organization

   Reducing stimuli that interfere with concentration (e.g., appropriate lighting, noise reduction, designated rest areas). Utilizing assistive technologies, such as task management applications.

4. Workstation adaptation

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Allowing short, regular breaks to support concentration. Introducing clear procedures and their visualization (e.g., graphical representation of norms and rules).

5. Role of the employer

   Educating management staff, including mining supervisors, sectional and shift foremen, and direct superiors, about ADHD and methods to support employees.

6. Individual approach to assessing employee performance

   Considering employees' strengths and weaknesses when assigning tasks and responsibilities.

Neurodiversity in the workplace is increasingly being recognized in modern enterprises, highlighting the need for solutions that support employees with diverse cognitive profiles. From a practical standpoint, however, implementing significant changes can be challenging and, in some cases, even impossible due to the demanding conditions of underground work. Nevertheless, it is crucial to undertake as many preventive measures as possible, as they not only enhance employees' efficiency and well-being but also contribute to the overall work culture and safety in the mining sector.

8. Limitations and Directions for Future Research

One of the key limitations of the conducted study was the small number of respondents -67 men participated in the survey, which limits the possibility of generalizing the results to the entire population of workers in the mining sector. Furthermore, the study did not utilize the Likert scale, which affected the precision of the collected data and hindered in-depth statistical analysis. Another significant limitation was the industry-specific scope of the study – it focused exclusively on employees of hard coal mines.

Future research should aim to develop more robust preventive strategies and raise awareness about the role of human factors, including neurodivergence, in occupational safety. In particular, incorporating Likert-scale-based assessments would allow for a more nuanced understanding of the experiences and challenges faced by individuals with ADHD in high-risk work environments. Experimental studies are also recommended to evaluate the effectiveness of various support strategies -such as mentoring, individualized training, organizational modifications, or technical adaptations of workstations. A comparative analysis between a support-receiving group and a control group would provide more reliable insights into the impact of these interventions on safety, performance, and work satisfaction. It is also recommended to conduct longitudinal studies that track changes in the occupational functioning of individuals with ADHD over time – both before and after the implementation of selected intervention strategies. Such analyses will make it possible to identify the lasting effects of support as well as potential risks resulting from its absence in a high-stress and high-risk environment such as a mine.

Considering the above research directions may contribute not only to improving the quality of work and safety for individuals with ADHD but also to the implementation of more inclusive and informed management practices in the extractive sector and other branches of heavy industry.

9. Conclusions

Mining is a high-risk sector that requires not only excellent physical fitness, but also sustained concentration, discipline, and strict compliance with safety procedures. Attention Deficit Hyperactivity Disorder (ADHD), on the other hand, is associated with challenges in task organization, impulsivity, and fluctuating attention levels, all of which may introduce additional risks in this demanding industry.

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Individuals with ADHD may encounter numerous challenges in underground work, such as issues with task monotony, long-term focus, and compliance with established safety regulations. On the other hand, their ability to react swiftly to changes, high energy levels, and creativity can serve as advantages in dynamic and difficult to predict working conditions.

The research findings indicate that 73% of respondents perceive ADHD as negatively affecting their job performance, and 36% believe it increases the risk of workplace accidents. Furthermore, 66% reported challenges with multitasking - a critical skill in mining, where simultaneous monitoring of multiple processes is often required. Additionally, 54% acknowledged that ADHD impairs their ability to anticipate hazards, which may contribute to a higher likelihood of procedural errors, mechanical injuries, and difficulties in effective teamwork.

The study results confirm the necessity of implementing the proposed strategies to support the adaptation of individuals with ADHD to the mining work environment. Such support should encompass both organizational and individual-level measures. Additionally, it is important to raise awareness among employers and colleagues about ADHD and to implement tools that facilitate better task management and concentration. Equally crucial is the increased accessibility of ADHD diagnosis for adults, especially for those who suspect any neurodiversity. Early diagnosis and appropriate support can significantly improve professional performance and daily life.

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