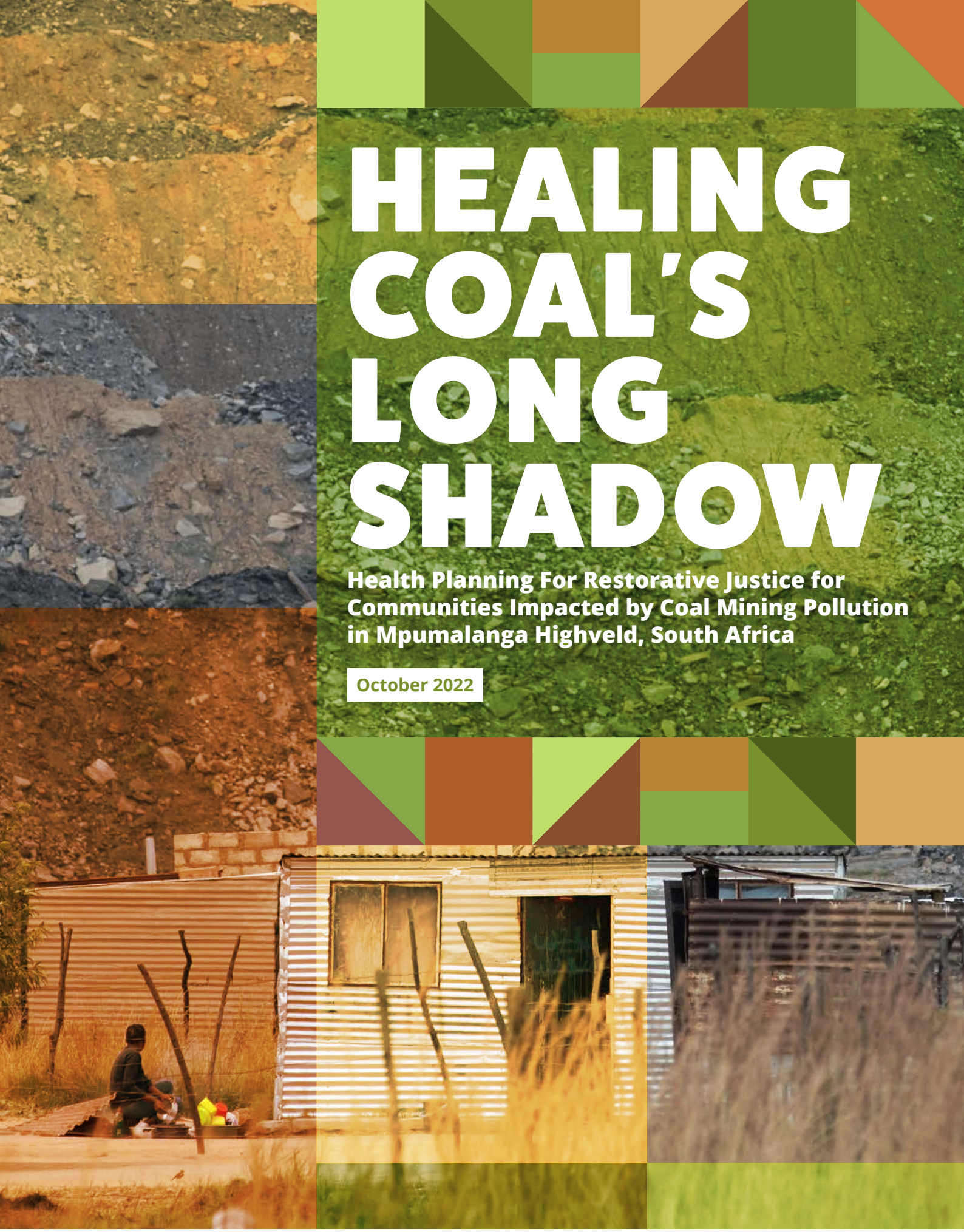

HEALING COAL'S LONG SHADOW

Health Planning For Restorative Justice for Communities Impacted by Coal Mining Pollution in Mpumalanga Highveld, South Africa

October 2022

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HEALING COAL'S LONG SHADOW

Health Planning For Restorative Justice For Communities Affected By Coal Mining Related Pollution In The Mpumalanga Highveld, South Africa

FINAL REPORT: CAROLINA AND ERMELO

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October 2022

CONTENTS

INTRODUCTION

People living in the Mpumalanga Highveld, the heart of the energy belt in South Africa, have long endured the negative health effects of decades of exposure to environmental pollution related to coal energy and mining activity. With the increasing demands to transition to cleaner forms of energy and a national commitment to the Paris Agreement of the Conference of Parties in 2015, this energy belt is likely to evolve. However, this evolutionary process needs to address the adverse health legacy of the residents in these communities. Based on this understanding, the overall aim of the project was to develop a health plan that provides restorative justice to people whose health has been affected by decades of pollution from coal mining activities on the Mpumalanga Highveld.

Restorative justice encompasses a growing social movement to institutionalise peaceful approaches to harm, problem-solving and violations of legal and human rights (Boyes-Watson, 2021). This extends to addressing long-term historical dynamics to foster socio-economic empowerment of vulnerable stakeholders (Mohamed & Montmasson-Clair, 2022). Restorative justice for mining communities is the reconciliation between communities and mining entities facilitated by stakeholders to acknowledge and compensate for all identified harm caused by mining activities. In this case, the plan for restorative justice for the communities of Mpumalanga Highveld will honour their rights to a healthy environment and wellbeing which have been violated for years by coal mining activities. The plan was developed based on data collected from primary (interviews & FGDs) and secondary sources (literature & document review).

METHODS

The document review aimed at synthesizing available literature on policies, plans and documents applicable to coal mining related pollution, possibly associated health effects and health services delivery in the Mpumalanga Highveld. Documents in the form of policies, reports and journal articles were searched for using Google and Google Scholar, Department of Health websites and other governmental and non-governmental websites, as well as environmental websites and historic articles in the media. Six Individual and two focused group discussion interviews were held to explore the health challenges related to the coal-related pollution within the Ermelo and Carolina communities in the Mpumalanga highveld. These interviews aided in identification of recommendations that are expected to help in addressing the identified health related needs of the coal mining-affected communities.

SYNTHESIS OF THE DOCUMENT REVIEW, INTERVIEWS, AND FOCUSED GROUP DISCUSSIONS

Geographical setting and environmental pollutants

Mpumalanga is a province which constitutes 6.5% of South Africa's population and lies in eastern South Africa, bordered by Eswatini and Mozambique. The area is rich in coal reserves, which produce about 80% of the country's coal and is home to South Africa's major coal-fired power stations. Gert Sibande and Nkangala districts form the Mpumalanga Highveld have a population of around 2 421 186 and house 12 coal-fired power stations (See figure 1), and six coal mines (FES, 2021). The area is known for elevated levels of the criteria pollutants (particulate matter, SO2 (sulphur dioxide), NO (nitrogen oxide) and heavy metals such as mercury (Hg) and lead (Pb) (Figure 1) (Millar et al, 2022; Zerizghi et al, 2022).

The concentrations of these particulate pollutants exceed the National Ambient Air Quality Standards of South Africa and the Air Quality Guidelines of the World Health Organisation (WHO) (Hallowes & Munnik, 2017; Holland & Spadaro, 2019; Shikwambana et al, 2020). Additionally, there is acid mine drainage (AMD) with a high concentration of iron (Fe), aluminium (Al), mercury (Hg), manganese (Mn), sulphate (S), and other contaminants which further affect ground water and freshwater bodies (dams, rivers) including the soil and aquatic life (Kakaza, 2020; Chanda-Kapata, 2020; Esterhuyse & Buschke, 2021). Additionally, they pollute the surface and ground water resources, and agricultural lands in the vicinity, thus disrupting the growth and reproduction of aquatic and terrestrial organisms which are extended consequences of the existence of these substances at above normal levels in these communities (Mcdaid, 2014; Munawer, 2018; Kolo et al., 2018; Cock, 2019).

MPUMALANGA BY NUMBERS

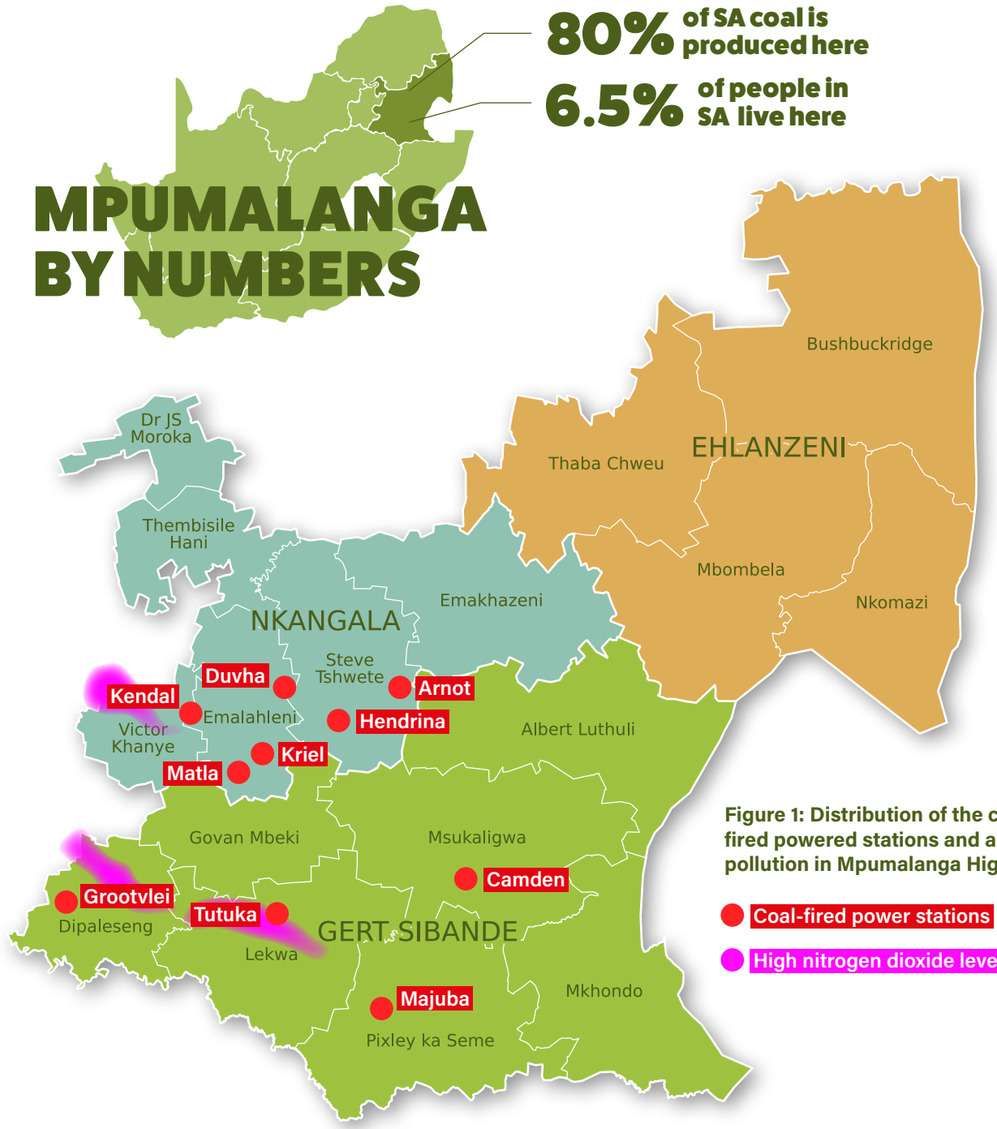


Figure 1: Distribution of the coal fired powered stations and air pollution in Mpumalanga Highveld.

- Coal-fired power stations
- High nitrogen dioxide levels

MPUMALANGA HIGHVELD (NKANGALA & GERT SIBANDE)

2 421 186 people

12 coal-fired power stations

6 coal mines

1 020 doctors

15 district hospitals

Health effects of coal mining-related activities in Carolina and Ermelo

Communities in the Mpumalanga highveld have been exposed to long-term effects of coal mining activities, with severe health effects in children and adults. There were multiple coal mining pollutant-related direct and indirect health effects identified. The health effects themselves derive from direct and indirect contamination of the environment. Direct contamination of both coal mining and utilisation of coal as an energy source results in air pollution from particulates and SO2 [Lockhood et al, 2009; Macdaid, 2014) and indirectly to water and soil contamination (CER Report, 2019). Because of this, direct health effects include diarrheal and skin diseases from water pollution, respiratory disorders from breathing polluted air, cardiovascular disorders, as well as lung cancers, among others. Indirect health effects could arise from eating contaminated food items grown in these communities, or fish harvested from the water bodies (Laisani & Jegede, 2019) and these could range from acute outcomes or longer-term cancers, neurocognitive or reproductive negative outcomes.

Similarly, documents from non-governmental and government environmental organisations articulate the health challenges emanating from toxic pollutants from coal mining activities in the Mpumalanga Highveld. Several reports identified disorders that are likely to be generically associated with coal mining activities such as respiratory, cardiovascular, neurological, gastrointestinal related, skin allergies, maternal complications, kidney diseases coupled with HIV/AIDS and tuberculosis (Macdaid, 2014; Hallowes & Munnik, 2016, 2017; Holland, 2017; Cobenefits study, 2019; Gray et al, 2019; Holland & Spadaro, 2019; Department of Environment, Forestry and Fisheries, 2019; Kakaza, 2020; Chanda-Kapata, 2020, Denoon-Stevens & du Toit, 2021).

Importantly, the informants from the FGDs were able to note the contribution of coal mining activities to the ongoing climate changes leading to temperature increases, droughts, and floods. This is true generically and Mpumalanga province has been experiencing the effects of temperature increase and drought for over a decade, with 2015 and 2017 being the worst (Gbetibouo et al, 2010, Elum et al, 2017; Schreiner et al, 2018; Ebhuoma et al, 2020). These climate change variables do have lasting negative impacts on the health of individuals including heat related illnesses, malnutrition, and premature deaths (Rocque et al, 2021, WHO, 2021). All these effects disproportionately affect children and particularly the vulnerable adult sub-populations such as those with chronic diseases, the elderly and pregnant women.

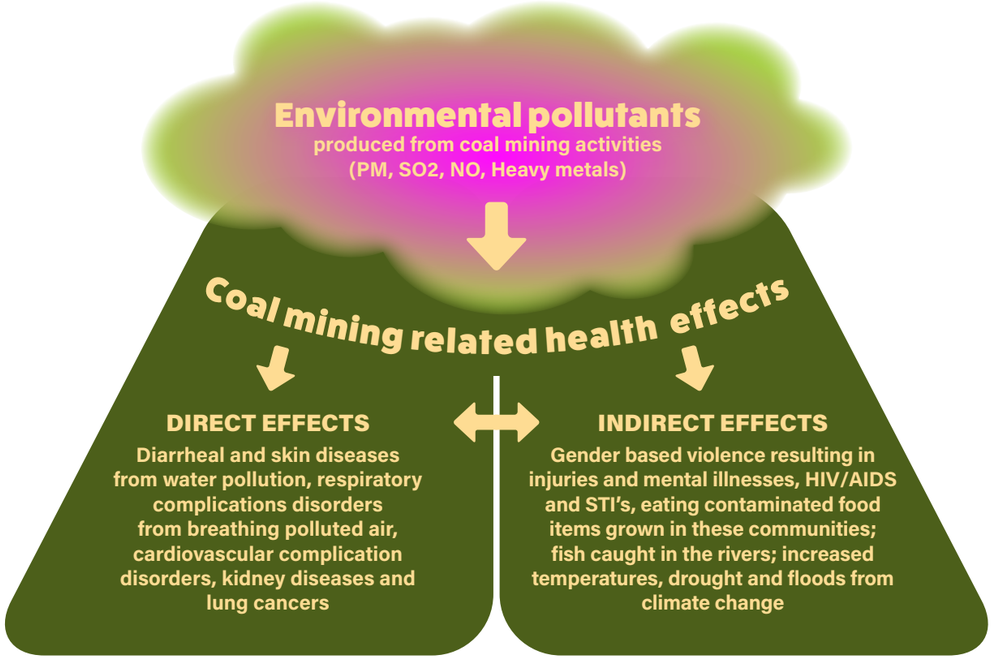


Figure 2: Diagram showing the direct and indirect effects of coal mining related activities

With regards to the indirect effects of coal mining related activities, it was established that high income mine workers have a propensity to sexually exploit the women and young girls in the Mpumalanga Highveld communities. This is possible as most mining workers are migrants who live temporarily in mining communities with their families elsewhere in South Africa and beyond (Widana, 2019). Additionally, sexual exploitation of teenage girls has consequences for teenage pregnancies and for further increasing the risks of maternal and neonatal complications on delivery as well as post-delivery (Grønvik & Fossgard Sandøy, 2018; Eliner et al, 2022).

Sometimes, the exploited women and teenagers face gender-based violence in the form of physical, emotional, and financial dependency, thus resulting in injuries and depression as reported by the community activists and affected community members. Moreover, the employed mine workers and truck drivers who come to the area facilitate the spread of HIV/AIDS and other STIs. Financial dependency poses a threat to economic security and independence, leading to economic violence and thus potentially preventing the victim from leaving abusive relationships with consequences for mental health issues (Alkan et al, 2021).

The health documents specific to Mpumalanga indicated non-communicable diseases (NCDs) (34.5%), HIV/TB (24%), maternal, perinatal, and nutritional complication (21%) as well as injuries (11.5%) as the major causes of disease burden and mortality in the Mpumalanga highveld (Mpumalanga Gert Sibande District Profile, 2010/2011; Mpumalanga health annual report, 2016/2017; DHB, 2019/2 020). Despite the Mpumalanga highveld producing 80% of coal generated power in South Africa, there is no empirical evidence to date, on the burden of disease contributed to by environmental pollutants from the coal mining and energy generation activities. Yet, many of the reported diseases such as diarrheal and skin diseases, respiratory disorders, cardiovascular disorders, lung cancers and HIV/AIDS could be associated with coal mining activities based on evidence from literature (Mcdaid, 2014; Denoon-Stevens & du Toit, 2021).

Available health services

Despite the ongoing coal mining activities which emit toxic pollutants in excess of the required air quality standards that are likely to contribute to detrimental health effects to the surrounding communities (Macdaid, 2014, Leonard et al., 2020), the distribution of health services in Mpumalanga highveld seems to be disproportionate. There are 123 clinics, 44

community health centres, five satellite clinics, 53 mobile clinics, 15 district hospitals, one regional hospital, one tertiary hospital, three specialised TB hospitals for a population of 2 421 186 (Mpumalanga health strategic plan, 2020-2025). The community health centres, satellite clinics and mobile clinics represents health posts involved in community service activities (Mpumalanga Health annual report, 2018-2019). These are, however, limited ambulatory and curative services to serve the catchment population (WHO, 1994). Based on the ratio of healthcare posts to the population of Mpumalanga highveld (Mpumalanga Strategic Plan, 2020 – 2025), one health post in Mpumalanga highveld is serving an approximate population of 23 737. This deviates excessively from international benchmarks and shows inaccessibility of health services to the disadvantaged communities.

As reported by participants, in Carolina and Ermelo, two towns in the Highveld, the existing healthcare services within the communities were government, private and NGO-operated practices. For Ermelo, they reported 11 formal and informal settlements being served by two clinics, two hospitals and two tuberculosis (TB) hospitals. Emergency maternity and vaccination services are offered at primary care levels. Carolina has 24 settlements which are serviced by two clinics and one hospital. Privately operated practices included dental and eye services. NGOs offered wellness programme on HIV/AIDS and counselling services. Moreover, 86% of the population is uninsured, and hence dependent on the already overburdened public health sector for service delivery (Mpumalanga health annual report, 2018-2019) and this is expected to increase with the current elevated levels of unemployment (Naidoo, 2021) spurred by the Covid-19 pandemic.

Challenges associated with the existing healthcare services

The role of primary healthcare services in South Africa is to give first level treatment to individuals, families, and populations within communities (Dookie & Sigh, 2012). Limited functional services are a challenge among the available health care services as expressed in the FGDs and individual interviews. Participants indicated that there are very few clinics (four clinics in total) operating within a sizable population. The limited primary care services treat minor ailments, such as coughs and minor flu symptoms. Services tend to be clinic-based and focused on acute conditions and healthcare workers often lack the training to deal with the specific needs of older people (Kelly et al, 2019). The available clinics are always full and there is no guarantee of being served on the day, leading to additional lost days, and for those employed, lost income.

While there are three functional district hospitals within the communities included in this review (Mpumalanga annual report, 2018-2019), after hours attendance is not a solution in the absence of a referral letter. There was also inconvenience of opening hours (Burger and Christian, 2020) as participants complained of limited operating hours impacting those seeking emergency care after hours, such as those with respiratory distress, as they would not get help. Although there are 25 Gert Sibande and 27 Nkangala documented mobile clinics that cover 1116 and 461 points respectively (Mpumalanga Annual Report, 2018-2019), participants highlighted the absence of these in reality. Fortunately, the two specialised TB hospitals (Mpumalanga Health Strategic Plan, 2020-2025) are located in Ermelo thus giving adequate coverage to those suffering from tuberculosis.

Secondly, a shortage of resources in terms of human, medication, and transportation was highlighted by the participants. Despite the efforts made by the Department of Health (DoH) to make health services available to everyone, healthcare worker shortages, poor leadership (little or no supervision) and improper resource allocation remains an obstacle to the provision of quality health care (Kelly et al, 2019). For instance, there are 5 619 professional nurses (126.3 per 100 000 population), 1020 medical doctors, 320 pharmacists (7.2 per 100 000 population) and 107 dental practitioners (2.4 per 100 000 population) which is below the recommended 147.5, 33.1, 11.89 and 2.55 per 100 000 population respectively for Mpumalanga region (Mpumalanga Strategic Plan, 2020 – 2025). This is in stark contrast to the recommended standards and below the WHO standards of one physician per 10 000 population, five nursing and midwifery personnel per 10 000 population: one dentistry personnel per 10 000 population and one pharmaceutical personnel per 10 000 population (Sabo et al, 2014). Healthcare professionals prefer to work in urban areas compared to small towns surrounded by farms, as there is no additional incentive to work in these communities under the same salary grade/scale; thus contributing to reduced functioning of the available healthcare services within coal mining areas. According to the World Health Organization (WHO) and the Organisation for Economic Co-operation and Development (OECD), there is critical shortage of health care professionals in rural than in urban areas, thus creating a challenge to the attainment of the Sustainable Development Goal 3 (universal health coverage) (WHO, 2018)

While the National Department of Health (2009) considers 5 km to be the maximum allowable distance to a primary health care facility, this was not the case in the study areas as most participants had to use two taxis to reach the healthcare centres and therefore used more travel time coupled with associated costs due to the huge distances involved. A shortage of ambulances to ferry individuals to available healthcare services and poor roads also contributes to other forms of transport not wanting to transport patients. Burger and Christian (2020) reveal reduced availability of transport services for the vulnerable subgroups such as the poor, the rural population and black South Africans, thus affirming the findings of this study. Consequently, the limited ambulance services result in increased costs being borne by patients as they are forced to hire expensive transport in emergency situations to access the nearest health services.

Thirdly, direct health costs are hidden. Even if you get served at the available healthcare services, it is difficult to get all the medication, especially at primary health care facilities within the communities. The shortage of medication, especially in primary health care facilities, compels patients to use available family resources, particularly social grant income to buy medication to ensure stable health. Although, by design, the cost of health care for public health facilities should be affordable (Maseko & Barris, 2018), this is not the case for the communities under review. Those who get referred to the district or regional hospitals, were expected to pay a consultation fee upon arrival. Although the communities highlighted such costs associated with medication and transport, other studies estimate the health costs of coal mining and energy generated activities in South Africa, at US$2,37 billion (Macdaid, 2014; Holland, 2017; Cobenefits study, 2019). These are calculated using emission levels, concentration response functions from international studies and cost of living calculations in South Africa. Unfortunately, for the communities in Mpumalanga the actual costs are yet to be determined. For communities already marginalised, these additional costs for health care increase their vulnerability and poverty.

Lastly, unfavourable staff attitudes towards communities were highlighted from the interviews held. Community members felt it was a waste of time to go to clinics since they are always served with rudeness, aggression and sometimes even referred to bigger hospitals. Staff members within primary healthcare services were alleged to be not very keen on serving the community. A study done by Kelly et al (2019) reveals disinterest, value judgements, rudeness, and aggression of healthcare professionals in primary healthcare clinics as a major challenge, thus affirming the findings of the current study. In cases where they get salaries, they were said to disappear for a week or two from work with no one to monitor them.

Healthcare Policies

The healthcare programmes within Mpumalanga Highveld, managed by the Provincial Department of Health, includes Primary Health Care (PHC), Maternal, Child and Women's Health and Nutrition (MCWH&N), HIV and AIDS, Sexual Transmitted Infections and Tuberculosis (HAST), Disease Prevention and Control on Diabetes Mellitus, Hypertension, and mental health (Mpumalanga health annual report, 2016/2017). While the environmental health organisations have been campaigning for the available healthcare system to take cognisance of the health challenges of communities and ensure that healthcare policies and programmes support the communities affected by air pollution within Mpumalanga Highveld, there has not been sufficient attention paid to this. The available health policies at national level (South African health policies and guidelines, 2022) focuses on youth and adolescents, palliative care, Covid 19, cancer and TB. The Department of Health policies do not seem to focus on air pollution-related ill-health but adopt a general PHC approach to treatment and care of healthcare conditions presenting to its facilities.

For example, there is no expectation that clinics in close proximity to the large polluters have specialised care for those with respiratory disorders, likely to become seriously ill in conditions of high pollutant emissions. Nor are there any additional services provided to females exposed to pollution during their pregnancy, despite evidence strongly suggesting adverse outcomes under these conditions. Members of the community and clinics are expected to respond in a laissez faire manner to situations when they arise. These are likely to be regular health flashpoints in the communities, but because they are not recorded as such, and no policies determine the necessity for such events being recorded. These health service resource constraints and policy gaps provide evidence for the urgent need of a health plan that addresses the current health needs and provides restorative justice to people whose health has been adversely affected by decades of pollution in the Highveld.

MISSION, VISION, AND VALUES OF THE HEALTH PLAN

The mission of the health plan is to identify, develop, and promote health solutions that maximize community protection, minimize harmful exposures, and prevent disease. The vision of the health plan is to identify risk factors, treat, restore, and sustain the health and well-being of the communities that have been exposed to coal mining related activities. The plan will also prevent the occurrence of new disease in this community. The values that will guide in accomplishing the mission of the health plan for the communities of Mpumalanga Highveld are Batho Pele principles of communication, collaboration, evidence-based, and active participation.

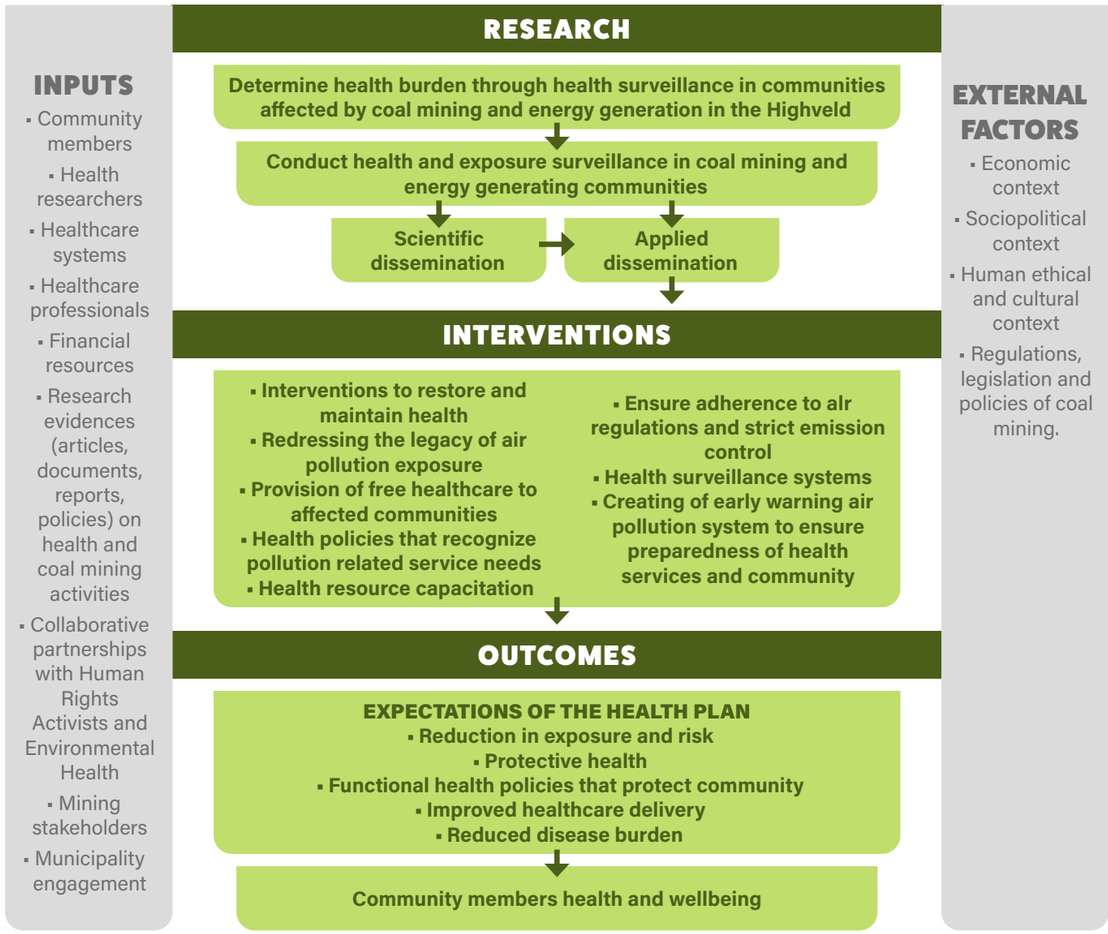
PURPOSE OF THE SUGGESTED HEALTH PLAN

The purpose of the health plan is to understand, address, and generate a blueprint or roadmap that, if implemented, will lead to the improvement and restoration of the health service needs and well-being of community members who have been exposed to the adverse effects of coal mining and energy generation activities. The plan must recognise that not only have the health of these communities been directly adversely affected by these activities, but the indirect consequences also increase vulnerability and poverty, further increasing the risk for adverse health. Therefore, the plan must include strengthening PHC services, but also providing specialised emergency care at a PHC level at selected clinics for acute outcomes of exposure to air pollution, as well as chronic care for those pollutant related NCDs. This plan is expected to be achieved through community engagement, research integration, implementing interventions and evaluation with the required stakeholder involvement at each stage.

> **“Not only have the health of these communities been directly adversely affected by these activities, but the indirect consequences also increase vulnerability and poverty, further increasing the risk for adverse health.**

COMPONENTS OF THE PROPOSED HEALTH CARE PLAN

Figure 3: Proposed health plan



Health research and surveillance in communities and healthcare systems

Determine health burden through health surveillance in communities affected by coal mining and energy generation in the Highveld

As detailed above, the coalfields and energy belt of Mpumalanga has experienced and continues to experience the highest levels of pollution in South Africa (Figure 4a and 4b). Despite calls for the reduction in emissions, and suggestions that repeated loadshedding may reduce the emissions, the figures clearly indicate that while levels of pollution dropped during the peak of the pandemic lockdown, they rapidly increased post lockdown. The burden of disease associated with these exposures is poorly understood. The District Health Information System (DHIS) collects a range of information on various health outcome indicators, allowing Districts to determine the prevalence of certain health outcomes, as detailed in Section 2.2 above. However, these indicators do not include either the acute or chronic outcomes associated with environmental pollution.

This implies that the burden of ill-health associated with the adverse environment experienced by these communities is unknown. In addition, vulnerable population groups, such as pregnant females, babies, and growing children and the elderly, are likely to be disproportionately affected – but this too, is unknown. The consequence of the absence of information is that appropriate health services cannot be channelled towards the needs of the pollutant-related ill-health as they are unknown. To address this shortcoming, the DHIS, as a surveillance tool, needs to be improved and should capture and trace acute outcomes that are likely to be associated with air pollution, such as acute respiratory symptoms (wheezing requiring emergency room visit and nebulisation; severe shortness of breath or respiratory distress), acute cardiovascular symptoms (myocardial infarctions, angina attacks, elevated blood pressure), neurological (strokes) and acute upper airways, mucosal irritation (sinusitis, sore throats, red and watery eyes). Additionally, chronic outcomes must be documented as well. These include lung disorders (chronic obstructive lung disease; lung cancers); cardiovascular and neurocognitive disorders.

A key component of the health surveillance system, particularly in understanding the impacts of the environment, is the establishment of a population-based Cancer Registry (PBCR). Using established tools for surveillance, each community member diagnosed with cancer is systematically interviewed to better understand the risks that are likely to have resulted in this health outcome. The development of these components of health surveillance (an improved DHIS and a new PBCR) will provide the policy makers, treasury, and the Department of Health a better understanding of the service needs, including type (emergency vs routine; PHC vs tertiary; etc), outcome oriented (for example, respiratory vs neurological vs reproductive etc), location (urban vs semi-urban vs rural) and other planning aspects of health services so as to plan / implement remedial interventions as required.

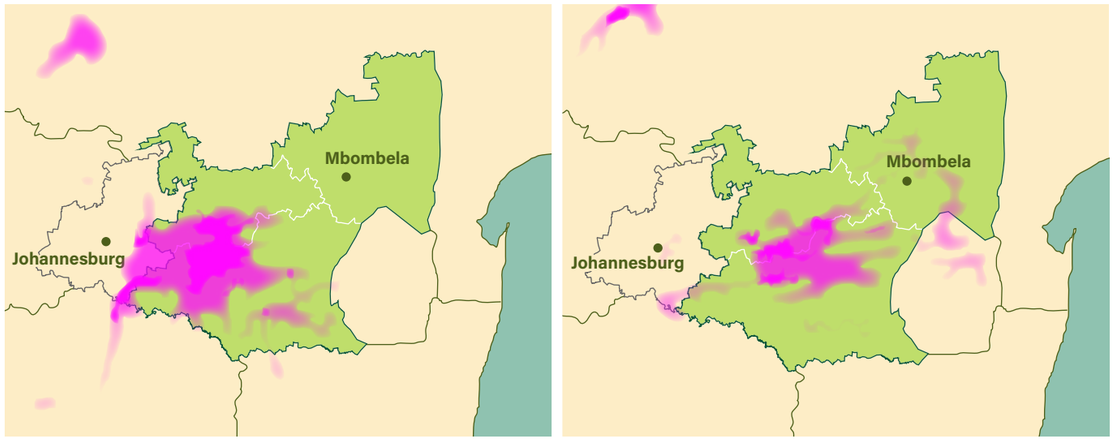


Figure 4a and 4b: compares pollution levels in the current period (October 2022) to that during the pandemic lockdown in April 2020 – figures from the NASA Sentinel-5 Satellite.

Conduct health and exposure research within communities

Although the health-related effects of coal mining have been identified as respiratory complications, lung cancers, cardiovascular diseases and gastrointestinal complications, a cause-effect relationship in an individual patient is always challenging. Additionally, indirect coal mining health effects like HIV/AIDS, gender-based violence, climatic change health effects and drowning were also highlighted from the community perspectives but are not well documented in literature. Therefore, health, exposure and other risk factor research focusing on the physical, biological, and psychosocial problems including both acute and chronic outcomes within the coal mining and energy generating communities is still paramount. This research must explore the multiple pathways and intersecting risk factors that result in adverse outcomes, and how ill-health itself contributes to increasing poverty, which further increases the health risk.

Due to the complexity of health problem related to coal mining and the multitude of intervening variables, measuring health and well-being outcomes takes longer to observe and measuring health and well-being outcomes is a lengthy process (CDC, 2021). Thus, with adequate and appropriate planning, as well as adequate financial resources, multidisciplinary engagement that ensures participation of the required professionals (health researchers, healthcare professionals, environmental health specialists) with the intention to produce evidence-based information that will contribute to the well-being of individuals within coal mining communities is paramount. In crafting health community lead solutions, Llamas et al. (2017), recommend epidemiological profiling of communities for "HIV/STIs, malaria, water, sanitation and hygiene (WASH), health care, occupational injuries, and health promotion" and this can even extend to health care effects associated with coal mining and energy generation activities.

The value of this multidisciplinary research provides the opportunity to identify areas of intervention that will have the maximum benefits for the affected communities. These could be either service interventions, risk factor reduction interventions or other public health programmes that will contribute to the reduction of the burden of ill-health.

Scientific Information and dissemination

Most of the information on health-related effects of coal mining and energy generating activities in Mpumalanga highveld, was found on government and NGOs websites with limited evidence emanating from academic and peer review journals. Within the government documents, the exact information of health effects and their related interventions due to coal mining activities was scarce. Hence the need to consider scientific and applied dissemination in this health plan. The distribution of scientific outputs to the public is crucial to enhance knowledge and advance the state of the science as well as closing the gaps in literature. Scientific outputs of the state of health and wellbeing of communities within coal mining areas should be disseminated through conference presentations, publications, and reports to sensitise

and make the public aware of the detrimental health effects of coal mining activities. Once the information on health-related effects of coal mining activities is made available, applied dissemination of research findings should be instituted. This requires strategic collaboration with stakeholders within the context of the community settings. Applied dissemination will facilitate the collaborative action of all involved stakeholders to implement the required interventions based on the findings of the study.

Interventions to restore and maintain wellbeing of communities exposed to coal mining and energy generating activities

Redressing the legacy of air pollution exposure: Restorative Justice for the affected community and individuals

Undeniably, communities in Mpumalanga highveld have been exposed for over 120 years to health effects of coal mining activities. Restorative justice to people whose health has been affected by coal mining activities remains an issue. Compensation of the affected communities and individuals by the mining companies and government is necessary. The form of compensation applicable to the respective communities needs to be determined through engagement with the exposed communities. This is not necessarily financial. Environmental reclamation and rejuvenation is essential, as the abandoned mining pits have become community hazards in the form of flooded lakes, in which children are at risk of drowning; dust tailings continue to generate pollution past the dates of closure of the mines and marginal mines become sources of income for informal miners. Infrastructure redress and infrastructure development, such as improved network of tarred roads, compared to coal-laden dirt tracks, the creation of parks, green zones and sports facilities, are means of addressing this legacy.

Helwege (2015) recommended that more investment and capability enablement of organisations that are mandated with looking after the environment and bringing unity among the natives and immigrants is necessary. Similar sentiments were echoed by Esdaile and Chalker (2018), that the war against the harmful effects from mining activities need not only be the responsibility of researchers, geologists, and public health and environmental advocates, but also "funding agencies and journal editors" to redirect their funding and knowledge thereto. In an extended definition of sustainable development, Shah (2008) suggests the need to not only consider the physical needs of communities, the ideal "values, relationships, freedom to think, act, and participate". It is thus important for policy makers to have possible and practical solutions to community problems, closely guiding communities to actively respond in time, participate and constructively engage mining entities on arising health risks. Furthermore, the policies should support mining entities to run safe operations and still be fully accountable, to maintain the relationships and values of communities they operate in.

Provision of free healthcare to affected communities

By design, the cost of health care for public health facilities should be affordable (Maseko and Harris, 2018). Given that the communities exposed to coal mining and energy generation have had to bear their own burden of disease, due to their historical and ongoing exposures, the provision of free healthcare is at the basis of restorative justice for these communities. The major mining corporations and the energy industry is required, through their corporate social responsibility (CSR), to contribute to this programme of free health care consciously and sustainably. For the "loss of livelihoods, health effects and other social consequences of mining activities," (Betancur-Corredor et al., 2018). Orelibe et al, (2019) recommend private-public partnerships with multinational companies, to reinvest part of proceeds in communities to strengthen healthcare services, which in the South African case, can enable free treatment in communities around coal mining areas.

> **"Compensation of the affected communities and individuals by the mining companies and government is necessary.**

Health resource capacitation

Participants in the focus group discussions alluded to the need for more hospital equipment to cater for those with asthmatic and other respiratory complications, more training of health care professionals to mitigate staff shortages and increased operating hours for primary care health care services. The construction of more clinics (at least one in each settlement area) would be a function of the mining company's responsibility in its mining license and agreements with the Department of Mineral Resources and Energy (DMRE). Partnerships would be required for revitalising the community mobile clinic initiatives. Amid adding the clinics, decarbonising the system plans should be a priority to indirectly fight the effect of climatic change as the current healthcare system uses mostly coal and gas to power hospitals, health care-related travel and transport of health care products (Health Care Without Harm, 2022).

Resource capacitation in terms of staff, especially specialists, is a major issue for mining communities, not only in the health care sector, but even in mining activity, for engineers and artisans. As indicated by Hallowes and Munik (2022), a programme with qualified healthcare professionals tailored to health challenges of residents in the highly polluted Mpumalanga Highveld should be designed and implemented in consultation with local communities. In addressing human resources needs, issues of recruitment and retention come to the fore. Recruitment and retention of skills is well documented in literature as a challenge in both developing and developed countries such as Australia. Specialists find the migration to mining communities unattractive as they must forego their social life with family. According to Humphreys et al. (2017), high turnover of skilled health professionals undermines sustainable outcomes that could be implemented in this underserved communities.

Health Policy for affected communities

This study revealed the health and socio-enviro-economic challenges facing communities in the mining province of Mpumalanga in South Africa. These challenges can be direct or indirect, confirming that the problems associated with mining activities and their impact on the health of surrounding communities are a global phenomenon (Shu et al, 2020).

So, while mining entities should conduct business activities responsibly, where they falter, the government and lobby groups should participate to ensure adherence to air regulations and strict emission control as stipulated within the National Environmental Management Act 107 of 1998, so that justice prevails.

In the Latin American region, forceful demonstrations against the lack of policy change against the reckless mining activities were organised. However, these did not achieve major policy change (Helwege, 2015). In the context of SA, a series of demonstrations has resulted in a judgement on deadly air (2022) which agreed to the provision of the right to safe and healthy environment for the population of Mpumalanga Highveld. This is an exceptionally good starting point as it will inform other policies, especially for health-related challenges emanating from coal mining activities.

Ensure adherence to air regulations and strict emission control

The existence of regulations that guide air and emission control of environmental pollutants is positive (NEMA, 1998, The Air Quality Act 39, 2004), however a lack of adherence to and enforcement of these regulations undermines their value. The National Environmental Management Act 107 of 1998 is the main regulatory framework which establishes principles for decision-making and procedures for co-ordinating environmental functions (NEMA, 1998). The Air Quality Act (2004) regulates air quality, provides measures for the prevention of pollution and ecological degradation including monitoring and control of national norms and standards. Additionally, adherence to the minimum emission standards (MES) (2010) will protect the health of the population.

While the role of Environmental Health Practitioners (EHPs) includes environmental pollution control (Health Professions Act, 1974), their Scope of Practice does not explicitly mention climate change and health-related adaptation action (Shezi et al, 2019). Despite this, the EHPs can function as an enforcing agent as they are positioned to create awareness and enhance communities' ability to adapt to climate change health impacts (Shezi et al, 2019). The Mining Inspectorate from the Department of Mineral Resources and Energy (DMRE) and Factory Inspectorate from Department of Employment and Labour (DEL) are crucial in facilitating adherence of air regulations and strict emission control.

Enforcement of strict laws that govern the decommissioning of some coal-fired power stations is crucial, as indicated by Halowes and Munik (2022). There is a need for strengthening the regulation of the mining charter where mining entities are mandated with taking an active role in the community development, which has also been incorporated in Environmental, Social, and Governance (ESG) targets by business entities. Nyirenda et al., (2020) appraise the successful provision of healthcare services to communities in Botswana by Debswana because of its governance structure which gives 50% ownership shares to government, claiming that CSR activities have negligible impact on community development.

Health Surveillance

Health surveillance through the District Health Information Software (DHIS) and the establishment of Population Based Cancer Registries (PBCR) are important interventions, particularly with a focus on health effects associated with coal mining and energy generation activities. Such focused surveillance aids in early detection of diseases and will provide the relevant healthcare systems and other stakeholders the ability to initiate control and prevention measures for chronic diseases such as cancers, asthmas, tuberculosis, and chronic obstructive pulmonary diseases.

Data Integration for Early Warning System

The data on human exposure to air pollution from the National Ambient Air Quality Monitoring Network (NAAQMN) (Gwaze & Mashele, 2018) can be used to create early warning systems for the community and to provide feedback to the Health Management. The networks provide valuable information which enables the determination of compliance with ambient air quality standards. This information can be used by healthcare services to appropriately plan for increase in numbers of emergency health visits during peaks of air pollution.

Expectations of the health plan

Adherence to air regulations and strict emission control can reduce the exposure and risk of coal related pollutants among the surrounding communities. The suggested community policies that protect the community should protect their rights. Recapacitating the healthcare system will improve healthcare service delivery and reduce disease burden. The overall expected outcome is improved health and well-being of the communities and reduced /sustained reduction in the negative impacts on health of the communities living in coal mining areas.

CONCLUSION

The health plan is expected to address the health needs of the coal mining-affected communities in the Mpumalanga highveld in South Africa. This plan was developed based on the triangulation of the data collected from the primary (FGDs and individual interviews) and secondary sources (literature review and document review). The components of the suggested healthcare plan are centred around research, implementing tailored interventions related to coal mining activities and evaluating expected outcomes. For the success of the health plan, engagement of different stakeholders varies from the coal-affected communities, health professionals and National Department of Health, environmental health professionals, environmental rights activists and involved mining companies. The plan will aid in describing the nature and scale of coal pollution related health problems and could be used to point to the costs of pollution. It will be done within the larger context of dealing with climate change impacts, building resilience through dealing with people's health challenges on the Highveld, and decarbonising the health system.

> **"The plan will aid in describing the nature and scale of coal pollution related health problems and could be used to point to the costs of pollution.**

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NOTES


LIFE AFTER COAL
IMPILO NGAPHANDLE
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