# Draft_Rapid Appraisal Health Impact Assessment for the Proposed Platinum Pride Crematorium in Cape Town

## Rapid Appraisal Health Impact Assessment

## SES01

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|---|---|
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| **Report Name:** | Rapid Appraisal Health Impact Assessment Report |
| **Report Version:** | Draft_01 |
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I, Vumile Ribeiro as duly authorised representative of Niara Environmental Consultants (Pty) Ltd., hereby confirm my independence (as well as that of Niara Environmental Consultants (Pty) Ltd) and declare that neither I nor Niara Environmental Consultants (Pty) Ltd. have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of Ikamva Green Holdings T/A Platinum Pride, other than fair

remuneration for work performed, specifically in connection with the Environmental Licensing Process at the proposed Platinum Pride Crematorium.

## Specialist Declaration of Independence

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I Vumile Ribeiro, as duly authorised representative of Niara Environmental Consultants (Pty) Ltd., hereby confirm my independence and declare that I:

- I act as the independent specialist in this application.
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant.
- I declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, regulations, and all other applicable legislation.
- I have no, and will not engage in, conflicting interests in the undertaking of the activity.
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- all the furnished by me in this form are true and correct.
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

| | |
|---|---|
| **Signature of the Specialist:** | **V. Ribeiro** |
| **Designation:** | Environmental Health Consultant |
| **Qualifications:** | Post Graduate Degree (Hons): BSoc Sci Environmental Analysis and Management |
| **Name of company:** | Niara Environmental Consultants (Pty) Ltd |
| **Experience (years):** | 15 |
| **Date:** | July 2022 |

## Executive Summary

The use of Health Impact Assessments (HIAs) is a relatively new process in South Africa that is designed to ensure that often-overlooked or unanticipated health impacts are considered in proposed policies, programs, projects or plans. HIAs offer practical recommendations to minimise negative health risks and maximize health benefits, while addressing differential health impacts on vulnerable groups of people.

### Methodology

A HIA is a practical, multi-disciplinary process, combining a range of qualitative and quantitative evidence in a decision-making framework. A HIA seeks to identify and estimate the lasting or significant changes of different actions on the health status of a defined population. The methodology of this HIA was based on the Good Practice Note (GPN) for HIAs as supported by the International Finance Corporation (IFC). The IFC has published a set of Performance Standards (PS) for large Projects that will require international funding. PS4 which deals specifically with Community Health, Safety and Security, recognises that Project activities result in both positive and negative impacts to communities. The GPN has been developed specifically to provide guidance on community health for this Standard.

This approach will be supported by a systematic and consistent approach to collecting and analysing baseline health data through the Environmental Health Areas (EHA) framework. Twelve different EHAs are described, which provide a linkage between mine-related activities and potential positive or negative community-level impacts. This incorporates a variety of biomedical and key social determinants of health. Through this integrated analysis, environmental and social conditions that contain significant health components are identified instead of focusing primarily on disease-specific conditions.

Specific Potentially Affected Communities (PACs) and health impacts related to different activities of the proposed Crematorium Project will be described.

### Activities

The specific activities of the HIA[1] included:

- A desktop literature review outlining the host country and its community health profile;

[1] It should be noted that the HIA is specific to the health impacts on communities and does not address any aspect of health and safety applicable to the workforce at the mine.

- Collecting additional secondary information that was not available in the public domain that is available in published and grey data[2];
- Understanding the mine design, present and planned work activities, and location of PACs;
- Considering the potential human health impacts that the proposed mine development will have on the health of the respective communities;
- Determining the existing health needs of the community based on health strategies, infrastructure, programs, service priorities, delivery plans and challenges; and
- Developing evidence-based recommendations to avoid/mitigate negative and enhance positive impacts resulting from the proposed Crematorium development.

It is the specialist's opinion that due process has been followed. Where impacts have been assumed to be potentially significant, various mitigation measures to manage and monitor the impacts of the proposed mine development has been proposed. Adequate mitigation measures have been provided and are expected to reduce the significance of almost all negative impacts although not always to acceptable levels, while positive impacts will on average be significantly enhanced to maximise benefits to surrounding communities. The recommended mitigation measures must be implemented to minimise the impacts and ensuring compliance with current legislative requirements.

## Key Findings and Recommendations

[2] Grey literature is a type of information or research output produced by organisations, outside of commercial or academic publishing and distribution channels. Common grey literature publication types include reports (annual, research, technical, project, etc.), working papers, government documents, and evaluations. Organisations that produce grey literature include government departments and agencies, civil society or non-governmental organisations, academic centres and departments, and private companies and consultants.

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## 1. Introduction

Risks to health posed by emissions of hazardous air pollutants from crematories are emerging concerns. The presence of silver–mercury amalgams in bodies results in airborne emissions of mercury; and the combustion of essentially any material results in emissions of polychlorinated dibenzodioxins and furans (PCDD/Fs; “dioxins”) (Green, 2013).

Sharples Environmental Services cc (hereafter, SES) on behalf of Ikamva Green Holdings, trading as Platinum Pride appointed Naira Environmental Consultants (Pty) Ltd to undertake a Rapid Appraisal Health Impact Assessment (HIA) for the proposed Platinum Pride Crematorium Project.

This document presents the results of the Baseline Health Impact Assessment (HIA) for the above-mentioned Project. The objective of the overall Study (both scoping and impact assessment phases) is to assess the human health impacts associated with the proposed Crematorium Project on the population of concern, with particular reference to vulnerable people, through the evaluation of various determinants of health, including those identified in the various specialist studies. To ensure that environmental health becomes part of the Environmental Impact Assessment (EIA) decision making process, health will need to be integrated into the present process in a structured and systematic manner. This will ensure that human health issues, resulting from a listed activity, are addressed before the start of an activity.

This HIA Report is structured into various sections. Section 14 which determines which health effects, or indicators, ought to be considered. It takes into consideration all the relevant background information (in this case, environmental and health information) including laws, demographics of the affected population, health status, project details, etc., providing a complete characterisation of the current situation around the Project.

## 2. Terms of Reference

As the site is within 500m of a habitable dwelling (Milnerton Fire Station), The Department of Environmental Affairs and Development Planning (DEA&DP) have requested we get input in the form of a Health Impact Assessment.

The terms of reference (otherwise objectives) for this EIA level HIA are:

A HIA will be conducted as a specialist study for the compilation of the Environmental Impact Assessment (EIA) in support of their Environmental Authorisation. This study baseline component of the study evaluated the different types of evidence from readily available information, in order to assess the health impacts associated with the Project on the population of concern. In so doing, the project aimed to adhere to the relevant provisions contained in the Equator Principles (IFC, 2006). These provisions had been derived from the principles themselves and the International Finance Corporation (IFC)'s Performance Standards and Environmental Health and Safety (EHS) Guidelines.

Health is gaining prominence in public policies in accordance with its importance as a core value for population wellbeing and thus, as a driving force for sustainable human and social development. The assessment and management of community health is part of risk management and social responsibility of an operator.

The Terms of Reference for the HIA comprised the following:

- A desktop review in order to outline the country and community health profile and to determine any data gaps;
- A field visit by an experienced member of the Niara's community health specialist team to:
  - Gather additional information that was not available in the public domain during the desktop review. This includes collection of information from health facilities, from the national health information management system, as well as from unpublished reports and documents;
  - Identify relevant stakeholders/informants and collect primary participatory data in the form of informal randomly selected discussions with members the different potentially affected communities. These individuals included both men and women, as well as different age groups, in these discussions. Separate interviews with any vulnerable groups (e.g. women and/ elderly) were not conducted due to the National Lockdown Regulations and internal safety protocol. Discussions will cover individual perceptions of health impacts, community lifestyles, and any traditional and local knowledge;
  - Review the standards of the local health facilities and functionality of the health management information system; and
  - Gain first-hand knowledge of the Project setting and location of communities in relation to planned project activities.
- Review of other specialist studies conducted as part of the EIA to identify bio-physical or socio-economic impacts that may have health implications. Examples of such impacts include:
  - Groundwater, since contamination of groundwater resources could affect the health of communities that rely on such resources; and

- Project-induced in-migration (which would be assessed in the social impact assessment), since overcrowding to increase the prevalence of various infectious diseases.

- An impact assessment process which involved:
  - Considering the potential future health impacts that the proposed project will have on the health of the respective communities;
  - Determining the existing health needs of the community based on health strategies, infrastructure programs, service priorities, delivery plans and challenges;
  - Based on the existing evidence, rating the likelihood and consequence of different health impacts to outline their significance and prioritisation for mitigation; and
  - Considering recommendations for mitigation/management of priority impacts. Recommend measures to avoid/mitigate negative and enhance positive impacts resulting from the project at the relevant project stage.

## 3. Aims and Objectives

The over-riding objective of a HIA is to maximise health gain and reduce health inequalities. Another predominant aim of the HIA is to provide decision-makers with a set of recommendations on health issues associated with the Project, so that health objectives may be considered at the same level as socio-economic and environmental objectives.

The objectives are:

- To predict the likely impacts the project may have on the health of surrounding communities; and
- To formulate mitigation measures to avoid or ameliorate negative community health impacts and to enhance positive ones.

This will be achieved through:

- Evaluating various determinants of health, including those identified in the various specialist studies;
- Reviewing and assessing comments as received during the stakeholder engagement process; and
- Desktop and literature reviews -this baseline assessment.

## 4. Details and Expertise of Specialist

Vumile Ribeiro is currently the Director of Environmental Management Services at Niara Environmental Consultants (Pty) Ltd. Vumile has 15 years of professional experience in Environmental Assessment and Management. Her roles include the executive management responsibilities of Niara Environmental Consultants, project management, client and business development, marketing and quality assurance as well as corporate

compliance. Having worked for a multi-disciplinary advisory firms and environmental consultancies, Vumile has a competent understanding of the work effort and cross collaboration required for a successful multidisciplinary organisation. Vumile has been involved in a number of Environmental Impact Assessments and has a particular interest in health impacts assessments, water resource management, mining, energy and stakeholder engagement. Vumile has considerable experience across a range of developmental and environmental sciences and has worked in South Africa, Mozambique, Sierra Leone and Liberia and is familiar with Regulatory Environmental Legislation in other parts of Africa.

Vumile is very well versed in the IFC Environmental and Social Performance Standards (including IFC PS 2012) and the associated Equator Principles, which have informed the approach and standard for a number of ESIA processes that she has been involved in. Vumile is skilled at organising and driving effective project teams at a scale relevant to the project's requirements. She has technical experience and is able to quickly identify the most pertinent issues of a particular project whilst focussing on driving project success by rigorously implementing project management tools.

Vumile has experience ranging over several aspects of social research, including the planning and execution of social surveys, participatory rural appraisal, sustainable livelihoods assessments, data management and statistical analysis, capturing and management of spatial data, stakeholder identification and community facilitation. She has acted as project manager and/or task leader on a number of social impact studies in Africa. Social impact studies included both mining development and linear projects.

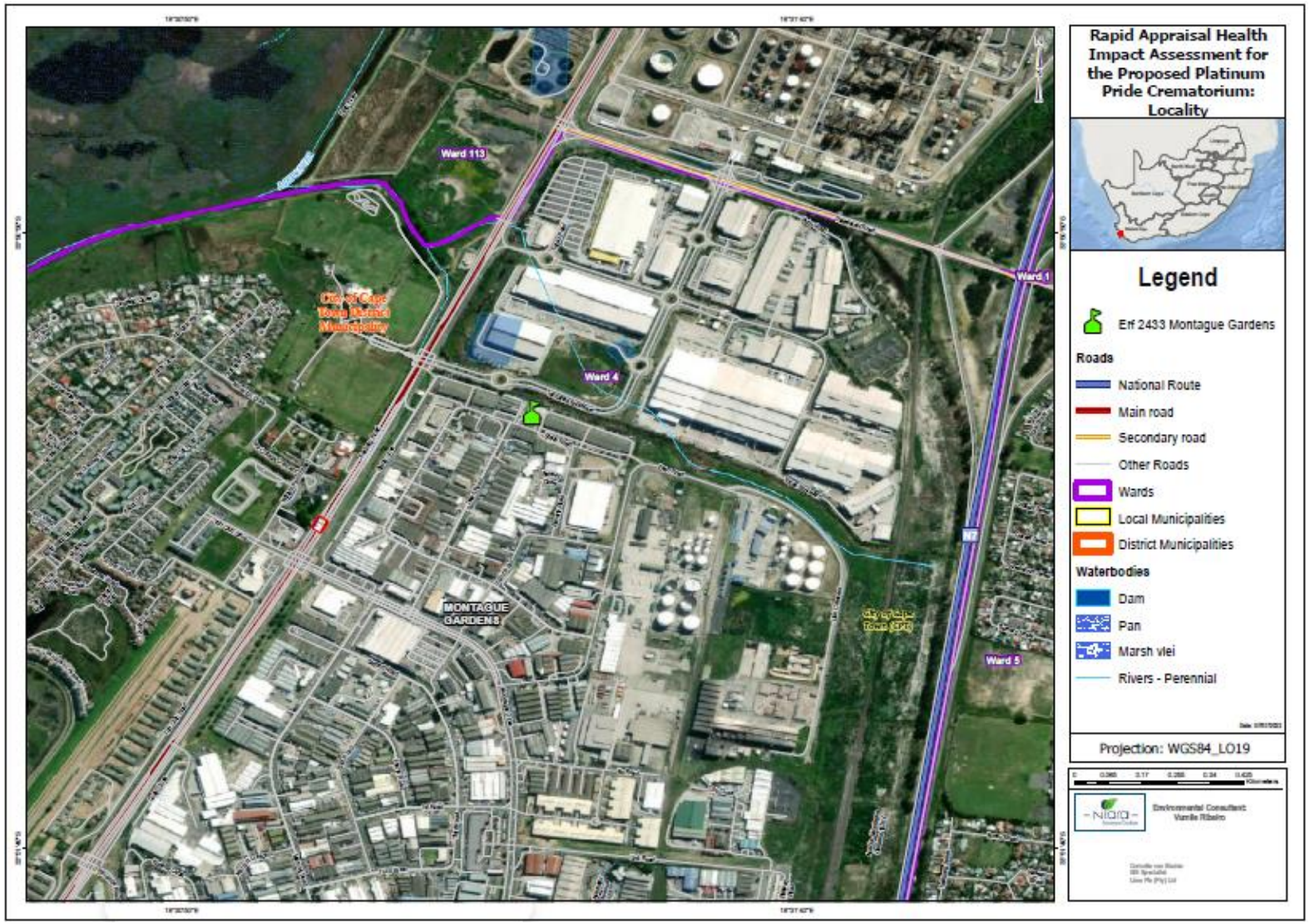

Rapid Appraisal Health Impact Assessment for the Proposed Platinum Pride Crematorium: Locality
Legend
Erf 2433 Montague Gardens
Roads
National Route
Main road
Secondary road
Other Roads
Wards
Local Municipalities
District Municipalities
Waterbodies
Dam
Pan
Marsh vlei
Rivers - Perennial
Projection: WGS84_LO19
Ward 113
Ward 4
Ward 1
Ward 5
MONTAGUE GARDENS

**Figure 4-1: Local Setting**

## 5. Project Description

The proposed development site is situated in Montague Gardens Industrial Area, Ward 4, on ERF 2433. The site is approximately 2 506.7m2 in size, and is zoned as General Industrial Zone I, which does accommodate crematorium facilities. The site contains existing infrastructure, is fenced and has been transformed significantly, resulting in the majority of the site containing concrete or tar surfaces. A small area to the rear (north) of the site, has not been transformed into a hardened surface. This area is approximately 481m$^2$, and is predominantly sandy with sporadic vegetation, including alien invasive tree species. This area is disturbed and contains building waste and stormwater infrastructure. The site is currently being utilized by Crous Chemicals cc., an organization that manufactures numerous chemical products for a variety of industries.

The establishment of a crematorium at the site is to take place in two phases:

- Phase 1 will consist of the installation of two cremators that operate 24 hours per day. Each cremator has a maximum cremation capacity of 24 cadavers per day. Thus, in total, the site will have the capacity to cremate 48 cadavers per day.
- Phase 2 will consist of the installation of an additional four cremators, also operating 24 hours per day. After the completion of phase 2, the site will have the capacity to cremate 144 cadavers per day.

The proposed scope of works includes the renovations of the existing warehouse facility as follows:

- Installation of 6 x BA2 cremators (manufactured by Engineered Thermal Systems) and associated infrastructure
- LPG tanks (fuel source for cremators), stored on site in excess of 80m3, but less than 500m3
- 6 x Chimney stacks approximately 0.35m in diameter, and approximately 6m's above the nearest building
- 3 x reefer coolers and one cool room
- Each reefer can take 60 units, in total with three reefers and one cool room, for stockpiling purposes, where necessary
- Associated infrastructure and services
- Safety Plans:
    - Compilation of a fire plan and equipment, safety measures;
- Modifications to the inside of the building includes
    - Resurfacing including flooring
    - New offices
    - Sterilization of the interior
    - Servicing of roll-up doors
- Modifications outside include:

- New ABR sheets will be utilized on the outside
- Painting
- Appropriate signage

## 6. South African Legislation Pertaining to Health

### 6.1 Constitution of the Republic of South Africa (Act 108 of 1996)

The over-arching legislation is the Constitution of South Africa (Act 108 of 1996) (the Constitution), in particular Section 24, which places people and their needs at the forefront of environmental management. The Constitution provides a right to "an environment that is not harmful to [human] health or well-being" and to have the environment protected, for the benefit of present and future generations, through reasonable legislative measures. These measures include the prevention of pollution and ecological degradation, the promotion of conservation, the securing of ecologically sustainable development and the utilisation of natural resources while promoting justifiable economic and social development.

### 6.2 The National Health Act (Act 61 of 2003)

The National Health Act, 2003 (Act No. 61 of 2003) (NHA) provides a framework for a structured uniform health system in South Africa, considering the obligations with regard to health services imposed on the national, provincial and local governments by the Constitution and other laws. Any activity that gives rise to offensive/injurious conditions or is dangerous to health (e.g., accumulation of refuse) may have a negative impact on health and thus warrants being assessed in the EHIA (DOH, 2010). The Director General (DG) should issue and promote adherence to, norms and standards on health matters, including conditions that constitute a health hazard and facilitate the provision of indoor and outdoor environmental pollution control services. The Act also provides for environmental health investigations in Section 88.

### 6.3 National Ambient Air Quality Standards

The Department of Environmental Affairs (DEA) issued ambient air quality guidelines for several criteria pollutants, including particulates, sulfur dioxide, oxides of nitrogen, lead, ozone and carbon monoxide. The National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) adopted these guidelines as National Ambient Air Quality Standards (NAAQS). On 2 June 2006, the Minister of Environmental Affairs and Tourism announced his intention of setting new ambient air quality standards in terms of Section 9(1)(a) and (b) of the NEM: AQA. The proposed new standards were published for public comment in the Government Gazette of 9 June 2006. Since then, updated draft National standards with allowable frequencies of exceedance and compliance timeframes have been proposed.

The prevailing legislation in the Republic of South Africa with regards to air quality is the NEM: AQA. The NEM: AQA serves to repeal the Atmospheric Pollution Prevention Act (Act no. 45 of 1965) (APPA).

The purpose of NEM: AQA is to set norms and standards that relate to:

- Institutional frameworks, roles and responsibilities;
- Air quality management planning;
- Air quality monitoring and information management;
- Air quality management measures; and
- General compliance and enforcement.

Guidelines provide a basis for protecting public health from adverse effects of air pollution and for eliminating, or reducing to a minimum, those contaminants of air that are known or likely to be hazardous to human health and well-being (WHO, 2000). Once the guidelines are adopted as standards, they become legally enforceable. These standards prescribe the allowable ambient concentrations of pollutants which are not to be exceeded during a specified time period in a defined area. If the air quality guidelines/standards are exceeded, the ambient air quality is poor and the potential for health effects is greatest.

Air quality legislation comprises primary standards which protect human health and secondary standards which protect property, vegetation, climate and aesthetic values. The development of new industries that increase air pollution through the emission of gases in the atmosphere should be managed. The Air Quality Impact Assessment Report was not available at the time of compilation of this Report. This section of the Report will be updated upon availability of the Report. Findings of this study will be considered and cited in this Report once made available to Niara.

### 6.4 National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended

The National Environmental Management Act (NEMA) provides the legislative framework for Integrated Environmental Management (IEM) in South Africa. Section 24 provides that all activities that may significantly affect the environment and require authorisation by law must be assessed prior to approval. NEMA also provides for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of the State and to provide for matters connected therewith. Section 2 of NEMA establishes a set of principles that apply to the activities of all organs of state that may significantly affect the environment.

These include the following:

- Development must be sustainable;

- Pollution must be avoided or minimised and remedied;
- Waste must be avoided or minimised, reused or recycled;
- Negative impacts must be minimised; and
- Responsibility for the environmental health and safety consequences of a policy, project, product or service exists throughout its life cycle.

These principles are taken into consideration when a government department exercises its powers, for example during the granting of permits and the enforcement of existing legislation or conditions of approval.

Section 28(1) of NEMA states that "every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring". If such pollution cannot be prevented, then appropriate measures must be taken to minimise or rectify such pollution. These measures may include:

- Assessing the impact on the environment;
- Informing and educating employees about the environmental risks of their work and ways of minimising these risks;
- Ceasing, modifying or controlling actions which cause pollution/degradation;
- Containing pollutants or preventing movement of pollutants;
- Eliminating the source of pollution; and
- Remedying the impacts of the pollution.

The authorities may direct an industry to rectify or remedy a potential or actual pollution problem. If such a directive is not complied with, the authorities may undertake the work and recover the costs from the responsible industry.

## 6.5 Other Relevant Legislation

Acts and Regulations pertaining to health and environmental, and health in particular, are indicated in Table 6-1

**Table 6-1: Acts and Regulations relevant to Health and Environmental Health**

| National legislation | Relevance to HIA |
|---|---|
| Atmospheric Pollution Prevention Act (Act 45 of 1965) | Hazardous substances associated with air pollution affect human health. This Act has identified some of the activities for which authorization for emissions is required from the DEA (DOH, 2010). |
| National Water Act (Act 36 of | The quality of water in domestic water sources impacts on human health. |

| National legislation | Relevance to HIA |
|---|---|
| 1998) | The Act provides for the protection of water quality for the benefit of human health and aquatic ecosystems through the concept of the reserve determination process (DOH, 2010). |
| Water Services Act (No. 108 of 1998) | Water services (water supply services and sanitation services) may impact on human health. Water service providers have an important role to play in this regard. Proposed activities may involve industrial use of water, which is covered under Section 7 of this Act (DOH, 2010) |

## 6.6 International Management Standards

There are a number of international guidelines or best practice guidelines that refer to community health in development or industrial Projects. The World Bank Group's standards and norms, in particular those developed by its private sector arm, the International Finance Corporation (IFC), are generally considered as the benchmark. The IFC has published a set of Performance Standards for large projects that will require international funding. Performance Standard 4 (PS4): Community Health, Safety and Security, recognises that Project activities result in both positive and negative impacts to communities (IFC, 2012). The objectives of this PS4 are:

- To avoid or minimise risks to and impacts on the health and safety of the local community during the Project life cycle from both routine and non-routine circumstances; and
- To ensure that the safeguarding of personnel and property is carried out in a legitimate manner that avoids or minimises risks to the community's safety and security.

IFC Performance Standard 4 "Community Health, Safety and Security" states that:

*"The client will evaluate the risks and impacts to the health and safety of the Affected Communities during Project life-cycle and will establish preventive and control measures consistent with Good International Industry Practice (GIIP), such as in the World Bank Group Environmental, Health and Safety Guidelines (EHS Guidelines) or other internationally recognised sources. The client will identify risks and impacts and propose mitigation measures that are commensurate with their nature and magnitude. These measures will favour the prevention or avoidance of risks and impacts over minimization."*

In addition to being considered the benchmark standards for major projects, the IFC's Performance Standards are applicable to projects seeking financing from either the IFC or other Equator Principles funding institutions.

Key requirements include:

- Evaluation of the risks and impacts of the affected community during the design, construction, operation and decommissioning of the Project;
- Where the Project poses risks to the health, safety and security of communities, an Action Plan will be disclosed on an on-going basis to enable the community to understand the risks and adverse impacts;
- The design, construction, operation and decommissioning of the Project will be in accordance with good international industry practice. Particular consideration will be given to potential exposure to natural hazards;
- Adverse impacts on soil and groundwater as a result of the proposed Crematorium Project will also be avoided;
- The transmission of communicable diseases from temporary or permanent labour will be minimised;
- Risks and impacts from Project activities will be assessed and communicated in a culturally-appropriate manner. Emergency community situations shall be addressed; and
- Where employees or contractors are retained to provide security, the risks to those inside and outside the Project site will be assessed.

## 7 Health Impact Assessment Framework and Methodology

It is important that a distinction is made between HIA and Health Risk Assessment (HRA). HRA is concerned with the identification of hazards and risks to the workforce which relate to occupational health and safety and engineering design. Generally, HRA is “within the fence” while HIA is “outside the fence” but there are distinct overlaps with HIA often taking a central position as workplace activities can affect community health and existing community health needs or disease burdens can affect workplace health. HIA is used to evaluate the public health consequences of proposed decisions in non-health sectors (CDC), while HRA is about “quantitative, analytic process to estimate the nature and risk of adverse human health effects associated with exposure to specific chemical contaminants or other hazards in the environment, now or in the future (CDC). Results from HRA can be used within a HIA to predict human health effects of specific exposures. It is thus important that these assessments should not be placed into individual elements but integrated to support an overall strategic plan for the Project. Workplace health is specifically out of scope of the HIA; however, it is important to understand which activities in the workplace can impact community health. This is important as the project activities can impart direct external influences on community health and the workforce also originates from the community and thus workplace activities and potential exposures must not be transferred back to the community at the end of shifts.

## 7.1 Environmental Health Areas

A World Bank analysis demonstrated that an almost 50% improvement in major health outcomes could be achieved by improvements in four sectors: (i) housing and urban development; (ii) water, food and sanitation; (iii) transportation; and (iv) communication. Building upon this sectoral analysis and incorporating a broad perspective on "environmental health" led to the development of a defined set of environmental health areas which have been adopted in the IFC Notes for PS4 the 2005 IPIECA (International Petroleum Industry Environmental Conservation Association) HIA guidelines and the IFC HIA GPN.

The IFC methodology uses twelve (12) Environmental Health Areas (EHAs) to support the systematic analysis of health considerations. These are summarized in Table 7-2. The set of EHAs provides a linkage between project-related activities and potential positive or negative community-level impacts and incorporate a variety of biomedical and key social determinants of health. In this integrated analysis, cross-cutting environmental and social conditions that contain significant health components are identified instead of a HIA focusing primarily on disease-specific considerations – as is frequently done in many biomedical analyses of potential project-related public health impacts. The EHA framework is based on an analysis performed and published by the World Bank.

## 7.2 Potentially Affected Communities

To identify and quantify potential health impacts an accurate population profile is required and it is important to distinguish between differences in exposure and susceptibility. Thus, besides a demographic profile of the at-risk population and the identification of the most vulnerable groups, it is crucial to understand how the development, construction and operational activities are likely to impact at both a household and community level. Impacts caused by resettlement, shifts in the social structures or influx triggered increases in population density are considered within the overall assessment.

The key aspects when considering the potential influence of the project to the Potentially Affected Communities (PACs) is the exposure pathway of the potential health determinant. The following key elements need to be considered:

- Whether there is a hazard;
- Who or what may be exposed to this hazard (pathway and rate of exposure to estimate the concentration/extent to which human receptors of concern may be exposed);
- The mode (air, water, food, vector, social determinants etc.) and route (inhalation, ingestion etc.) of exposure;
- The risk of exposure based on a likelihood and consequence analysis (magnitude, duration and length); and
- How sensitive or vulnerable the receptor is to the potential hazard or impact.

As part of the analysis, the relevant overall population is stratified into PACs. A PAC is a defined community within a clear geographical boundary where project-related health impacts may reasonably be expected to occur. PACs are inherently prospective and simply represent best professional judgments. PACs are likely to change over the course of project implementation; and there may be changes in the project design, and thus its longer-term implications are not fully known. This implies that the definition of PACs may need further adaptation as the project moves ahead; therefore, the specification of a PAC should be viewed as time-dependent as it will evolve over the project cycle. Findings of social and economic assessments, resettlement plans and migration management plans need to be carefully updated as this allows linkage between the PACs and key demographic determinants such as age structure and population numbers.

Mitigation strategies may also require specific considerations for the different PACs. On the one hand, not all the EHAs may be of concern for mitigation for the individual PACs. On the other hand, a separate risk analysis for a PAC may be indicated due to a particular susceptibility to a specific health impact. However, at this stage of the impact assessment only limited risk analysis will be carried out for different PACs based on the existing designs.

### 7.3 Introduction and Definition

A HIA is a practical, multi-disciplinary process, combining a range of qualitative and quantitative evidence in a decision-making framework. A HIA seeks to identify and estimate the lasting or significant changes of different actions on the health status of a defined population (Winkler *et al*., 2010). A HIA may be defined as "*a combination of procedures, methods and tools by which a Project may be judged as to its potential effects on the health of a population, and the distribution of those effects within the population*". The objective of a HIA is to deliver evidence-based recommendations to maximize potential positive health benefits and prevent or mitigate any detrimental health impacts that a Project may have on the potentially affected communities (PAC) (WHO/ECHP, 1999).

The WHO defines health as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. This is influenced through complex interaction of social, economic, genetic, and environmental factors (WHO, 2010c).

The ultimate deliverable of a HIA is a Community Health Management Plan (CHMP) (Winkler *et al*., 2011). This plan would be based on evidence and stakeholder input, prioritised according to impacts and needs and having clear indicators to monitor and evaluate impacts and programs. The CHMP will also facilitate the development of social development programs linked to health.

The holistic model of health used in the HIA process acknowledges that the health status of a population is affected by factors known as health determinants (e.g. education, income level, health services, etc.). All of these

are closely interlinked and differentials in their distribution lead to health inequalities. These include both biophysical and social determinants of health as well and not just purely health outcomes. The methodology allows HIA practitioners to consider how a Project affects these determinants of health, as well as health outcomes.

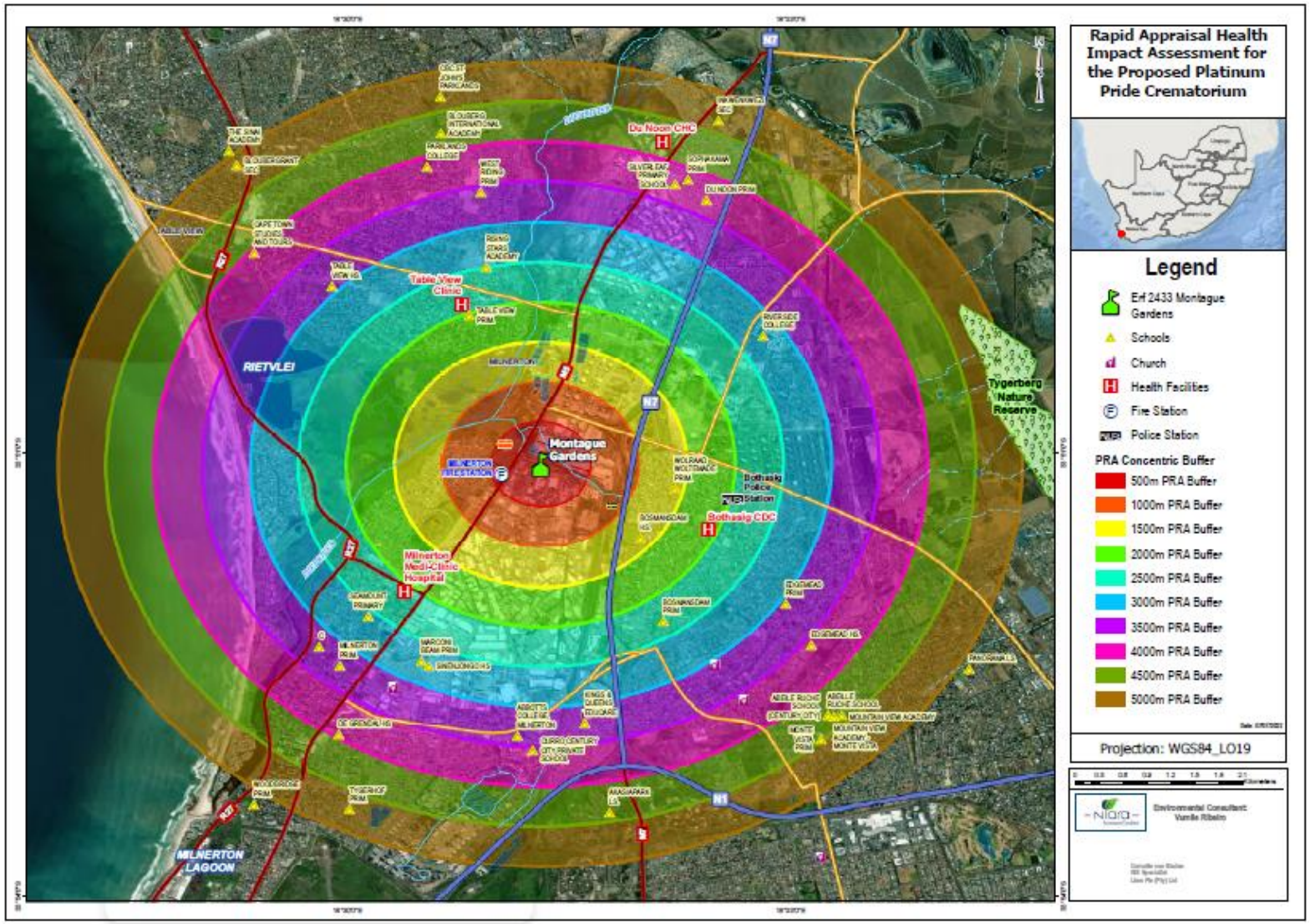

Rapid Appraisal Health Impact Assessment for the Proposed Platinum Pride Crematorium
Legend
Erf 2433 Montague Gardens
Schools
Church
Health Facilities
Fire Station
Police Station
PRA Concentric Buffer
500m PRA Buffer
1000m PRA Buffer
1500m PRA Buffer
2000m PRA Buffer
2500m PRA Buffer
3000m PRA Buffer
3500m PRA Buffer
4000m PRA Buffer
4500m PRA Buffer
5000m PRA Buffer
Projection: WGS84_LO19
Environmental Consultant: Vanilla Ribeiro
Montague Gardens
Table View Clinic
Du Noon CHC
Bothasig CDC
Milnerton Medi-Clinic Hospital
RIETVLEI
MILNERTON LAGOON
Tygerberg Nature Reserve

**Figure 7-1: Identified Potentially Affected Communities**

## 7.4 Determinants of Health

The driving concept behind HIA is that individual and community health is not simply determined by health services or biological factors (e.g., age). It is also shaped by wider social, economic and environmental influences and factors. These health determinants are the factors that lead to health outcomes and include:

- Physical environment factors (e.g., air quality, water quality, hazards)
- Built environment factors (e.g., buildings, public spaces, roads, bike lanes)
- Livelihood factors (e.g., income, employment)
- Social and community factors (e.g., social support, family structure, access to services)
- Lifestyle factors (e.g., diet, exercise, alcohol and tobacco use)

On the other hand, there are health-related outcomes. These health outcomes refer to the health status of both individuals and groups within a population or community, and can include both positive and negative outcomes. The health determinants—as impacted by an activity—contribute to health outcomes in various ways, either directly or indirectly. Health outcomes can include things like morbidity rates (injuries), mortalities, asthma, diabetes, cardiovascular disease, and other diseases. Both determinants of health as well as health outcomes will be assessed in this Report. This Report does however use a broader definition of health outcomes that includes the behaviours and contributing factors that contribute to an individual or community's health status. For example, while physical activity is not exactly a health outcome, it does have a notable effect on health outcomes and is therefore considered a health-related outcome.

The process diagram (Figure 7-2) illustrates the general relationship between an activity, the impacts activities can have on health determinants, and the resulting influences and changes to health-related outcomes. These determinants of health encompass all 12 EHAs.

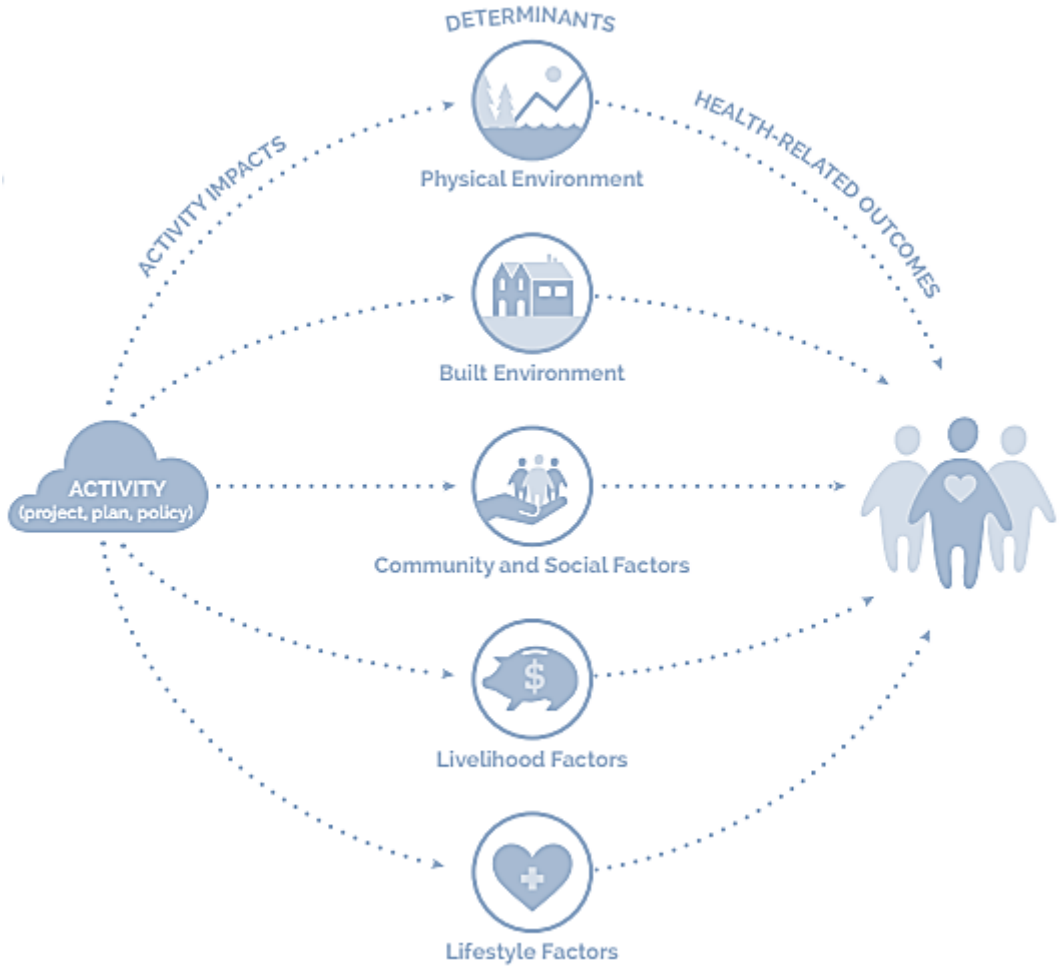



**Figure 7-2: Activity impacts, health determinants and health-related outcomes**

## 7.5 Overview of the HIA Process

A standardised approach was considered for the HIA to ensure that evidence-based recommendations supported the impact assessment. To ensure compliance with the IFC performance standards, and especially PS4, the methodology outlined in the Good Practice Note for HIA from the IFC, was adopted (IFC, 2009). The main elements of this are illustrated in Figure 7-3. These are also discussed briefly below so that the context of the HIA is understood.

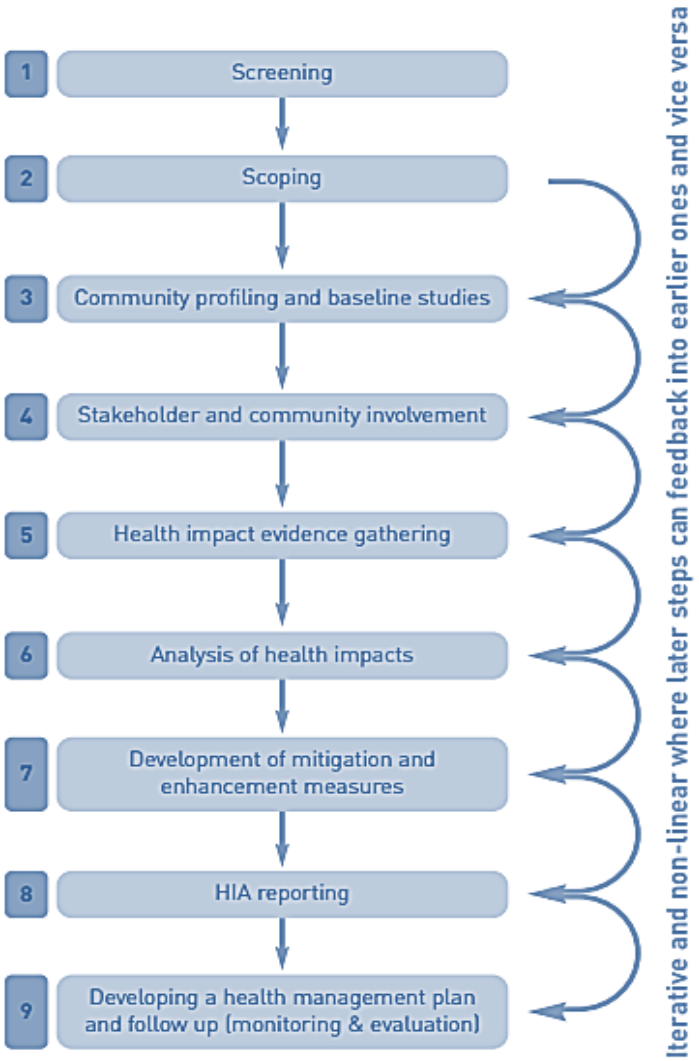



**Figure 7-3: HIA Procedure**

The framework that is commonly used for a HIA follows a 6-step process (IFC, 2009):

- Screening (preliminary evaluation to determine the necessity of a HIA);
- Scoping (identifying the range of potential Project-related health impacts and defining the terms of reference for the HIA, based on published literature, local data and broad stakeholder consultation and how these may be influenced by the Project);
- Risk assessment (qualitative and quantitative appraisal of the potential health impacts in relation to defined communities and the Project development, including stakeholder participation);
- Appraisal and mitigation (development of a CHMP) based on the findings of the risk assessment);
- Implementation and monitoring (realisation of the CHMP including monitoring activities that allow for adaptation); and
- Evaluation and verification of performance and effectiveness (key step to analyse the HIA process as a whole).

This HIA aims to influence design and inform the construction, operation and decommissioning phases of the Project. As HIAs are dynamic iterative processes they do require flexibility in their methodologies and tools, so that they can be fit for purpose for different Projects.

Figure 7-4 shows a decision-flow diagram outlining the decision steps, and the key questions to consider, from screening to a rapid in-house HIA and onto a more formal rapid or in-depth HIA.

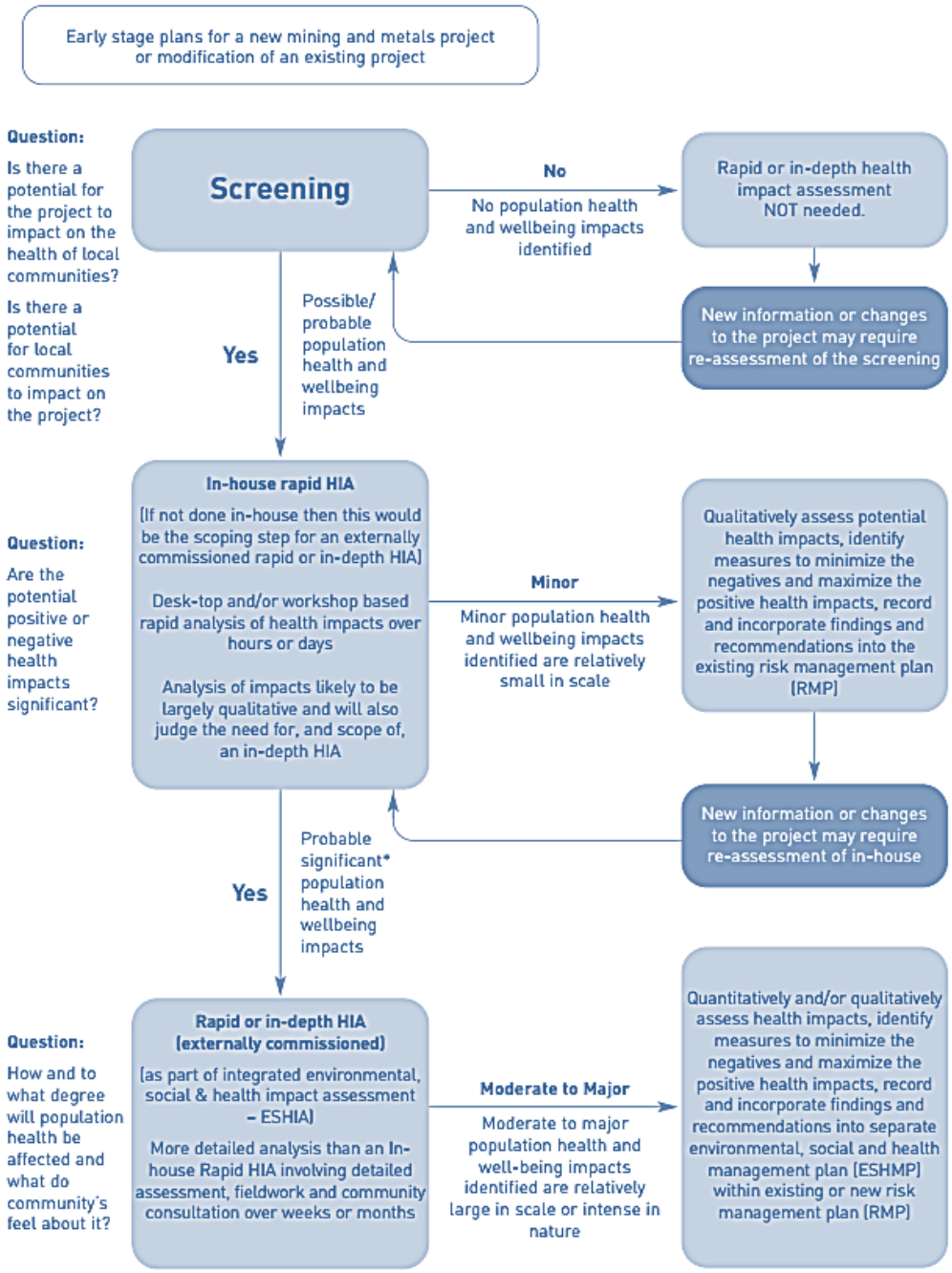



**Figure 7-4: Decision tree for Health Impact Assessment**

## 7.6 Benefits of HIA

Assessment and management of community health, safety and well-being impacts is increasingly considered part of the risk management and social responsibility of applicants. A range of industrial sectors e.g. oil and gas, chemical manufacturing and transportation are increasingly looking to embed HIA within their organizational and project management structures. For new projects and modifications, or acquisitions of existing projects, HIA can:

- Identify and maximize the positive community health and well-being impacts and opportunities that a proposed project can bring.
- Identify, avoid and minimize, through changes to the project design and implementation, the unintended negative community health and well-being impacts that can arise.
- Identify existing community health problems, which could amplify the impact of a proposed project and affect its viability.
- Identify country-specific health regulations which may affect the proposed Crematorium Project.
- Provide a process through which the project can work in partnership with local health, social care, and welfare services to jointly alleviate these health problems.
- Form one part of a broader community and local stakeholder involvement and engagement process that can build trust, draw out any community concerns and generate a dialogue about the best ways that the project can benefit local communities.
- Help to make explicit the potential trade-offs between community health and well-being and other economic, environmental and social objectives of the proposed Crematorium Project.
- Provide an equitable, transparent and evidence-based approach to planning and funding community health infrastructure and development activities to protect and enhance sustainable local livelihoods.
- Help to negotiate jointly those aspects of community health and well-being which are the responsibility of the project and those aspects which are the responsibility of local government and local public services.
- Help to manage project sustainability and obtain a long-term licence to operate.

A proactive approach to preventing ill health and maximizing health and well-being benefits can improve the financial performance of a project and parent company. Key bottom-line benefits include:

- Speedier achievement of a project's licence to operate
- Lower planning and associated legal and consultancy costs
- Access to international funding
- Lower risk of disruptive protest or sabotage
- Lower risk of damage to a project and parent company's reputation
- Lower risk of future community-led liability and litigation

- Reduced absenteeism and health care costs for employees from local communities
- Improved general employee morale.

## 7.7 Determining the scale of the HIA

The level or scale of a HIA depends on the complexity of the Project, the magnitude of expected impacts, as well as the Project phase during which the HIA is undertaken. Various levels of HIA are defined in Table 7-1 below (IFC, 2012).

When gathering new field data for the HIA, the Project will require different levels of effort and needs. The key descriptive terms for these cases— "comprehensive" and "rapid appraisal"—indicate the different depths of analysis and consultation required, and whether the performance of the HIA involves collecting new field data.

In Figure 7-5, the 'potential health impact' axis considers health issues in the Project location, such as:

- Hazardous materials exposure—how the mine will operate, and what the exposures to physical, biological, and chemical agents will be;
- Endemic disease profile;
- HIV/AIDS, tuberculosis, schistosomiasis, etc.;
- Health systems and infrastructure—poor or non-existent health infrastructures; and
- Stakeholder concerns—critical community issues, such as water quality or access, increased road traffic and accidents.

The 'social sensitivity' axis in Figure 7-5 covers a broad range of issues, many of which are typically addressed within the social analysis of the potentially affected communities (for example, conflict, resettlement, political factors, vulnerable communities, human rights, and equity concerns). The vulnerable status includes factors such as gender, ethnicity, culture, sickness, physical or mental disability, poverty or economic disadvantage, and dependence on unique natural resources (IFC, 2012).

Since the Project is a relatively big and an influx of new residents (however few) is expected, a Comprehensive HIA was deemed necessary, as opposed to Rapid Appraisal or Desktop HIA. An essential element of the comprehensive HIA is the need for some type of new data collection in potentially affected communities, and for helping to predict changes in health determinants, the associated risks, and health outcomes.

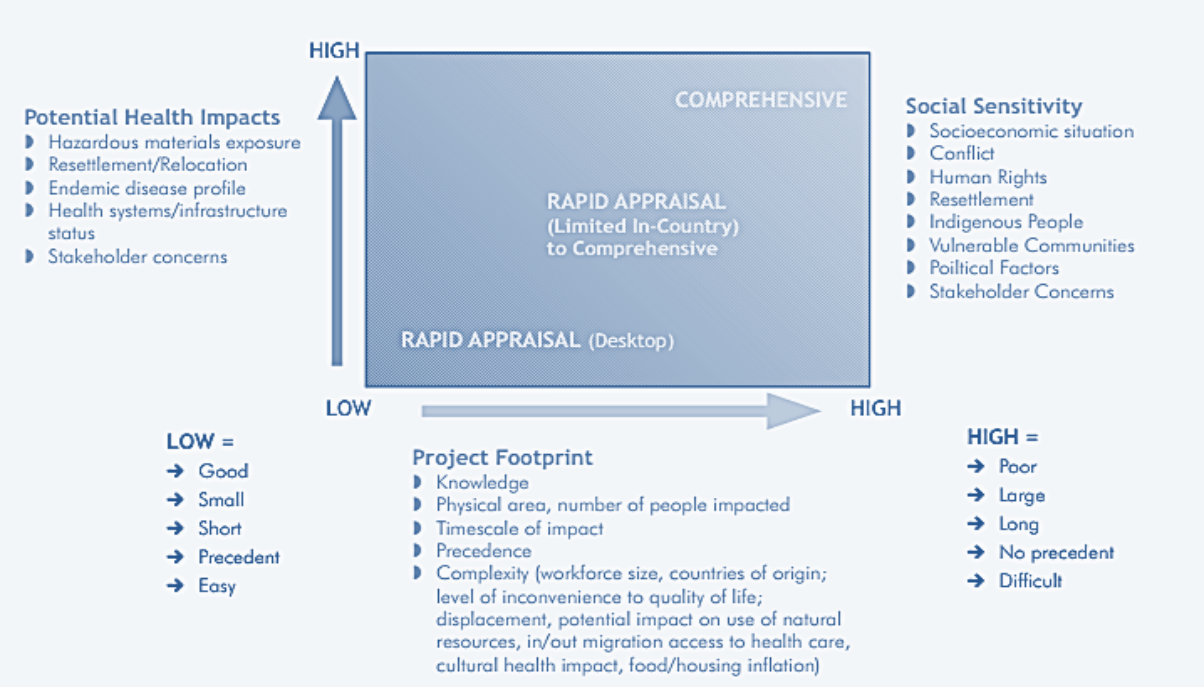



**Figure 7-5: Selecting a HIA Type**

A Limited In-Country HIA uses information that is readily accessible in the public domain. Data sources may include peer-reviewed scientific literature and "grey literature," that is, health department data. Although no specific new data collection is required, workshops or discussions with key internal and external stakeholders can provide useful health-related information. Limited in-country HIAs are appropriate for many expansion scenarios where new data collection is not crucial (IFC, 2009). The activities undertaken in the limited in-country HIA are highlighted in Table 7-1 and formed the basis for this study.

**Table 7-1: Levels of HIA (IFC, 2009)**

| Level of HIA | Characteristics |
|---|---|
| Desktop HIA | • Provides a broad overview of possible health impacts;<br>• Analysis of existing and accessible data; and<br>• No new Project specific survey data collection. |
| Scoping/Rapid Appraisal HIA | • Provides more detailed information of possible health impacts;<br>• Analysis of existing data;<br>• Stakeholder and key informant analysis; and<br>• No new Project-specific survey data collection. |

| Level of HIA | Characteristics |
|---|---|
| Comprehensive HIA | • Provides a comprehensive assessment of potential health impacts;<br>• Robust definition of impacts;<br>• New Project specific survey data collection; and<br>• Participatory approaches involving stakeholders and key informants. |

## 7.8 Stakeholder Analysis

Stakeholders are vitally important throughout the entire HIA process. The experience and expertise of a wide range of stakeholders and key decision makers are necessary as it aids in identifying potential concerns and hazards surrounding human health. Public participation ensures that community concerns are noted and addressed. Stakeholders whom have been identified for the proposed Crematorium include some of the following:

- Community representatives
- Potentially Affected Communities
- NGOs
- Representatives from various authorities ranging from local to national government

## 7.9 Baseline Data Collection

The data collection activities of the HIA included a desktop literature review, participatory data collection (stakeholder input – questionnaire and a Focus Group Discussion) and direct observation. This method allows for the triangulation of data and provides a robust description of data as shown in Figure 7-6 (Winkler *et al*., 2011).

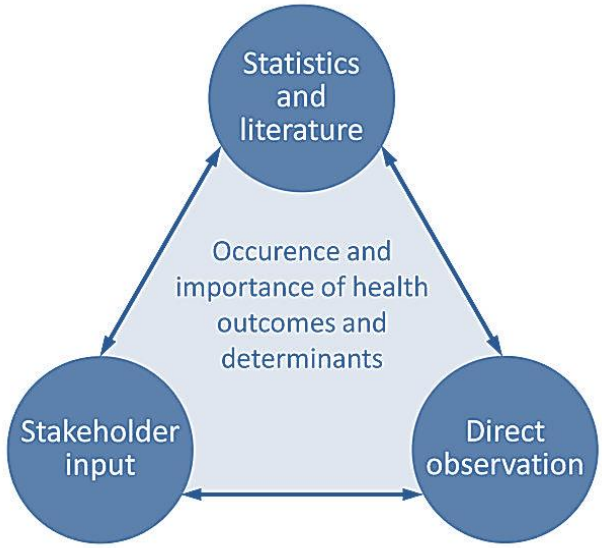



**Figure 7-6: Triangulation of Data (Winkler *et al*., 2011)**

### 7.9.1 Desktop Work

This involved a literature review of health-related data in the public domain as well as a review of existing Project documentation and related secondary data. The literature review was completed before the field visit so that data gaps could be identified and questioning routes for Key Informant Interviews (KII) and questionnaires could be developed. Priority was given to topics that contributed the most towards the burden of disease in South Africa and the proposed Crematorium Project site and also to health-related incidents related to emissions from crematoriums in general.

The desktop work included an extensive literature review to inform the health profiling of the region and where possible the population in the proposed Crematorium Project site. The desktop work described the broad health status of the population, based on a systematic review of the 12 EHAs.

The outcomes of the literature review are presented in this Report and have been combined with the information that was acquired during the field visit and subsequent Project documentation review.

## 7.10 Potential Impact Categorisation: Environmental Health Areas (EHAs) Framework

Potential community health impacts were identified on the basis of: (i) the available health data from the literature review; (ii) the information generated through stakeholder consultation; (iii) the knowledge of the Project context and developments; (iv) input from other specialist studies that inform the elements of the EIA; and (v) experience of previous HIAs in similar settings (Winkler *et al*., 2010).

The identified potential impacts were then categorised in terms of 12 Environmental Health Areas (EHAs) – a set of health-related factors and considerations defined by IFC methodology. These are summarised in Table 7-2. The set of EHAs provides a linkage between Project-related activities and potential positive or negative community-level impacts, and incorporates a variety of biomedical and key social determinants of health. In this integrated analysis, cross-cutting environmental and social conditions that contain significant health components are identified instead of a HIA focusing primarily on disease-specific considerations – as is frequently done in many biomedical analyses of potential Project-related public health impacts. The EHA framework is based on an analysis performed and published by the World Bank (IFC, 2009).

**Table 7-2: Environmental Health Areas**

| Environmental Health Areas (EHAs) | |
|---|---|
| 1. | **Vector-related diseases** – Mosquito, fly, tick and lice-related diseases (e.g., malaria, dengue, yellow fever, lymphatic filariasis, rift valley fever, etc.). |
| 2. | **Acute respiratory infections and respiratory effects from housing** – Transmission of communicable diseases (e.g., acute respiratory infections, pneumonia, tuberculosis, meningitis, plague, leprosy, etc.) and respiratory infections. |
| 3. | **Veterinary medicine and zoonotic issues** – Diseases affecting animals (e.g., bovine tuberculosis, swinepox, avian influenza) or that can be transmitted from animal to human (e.g., rabies, brucellosis, Rift Valley fever, Lassa fever, leptospirosis, etc.). |
| 4. | **Sexually-transmitted infections, including Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS) –** Sexually-transmitted infections such as syphilis, gonorrhoea, chlamydia, hepatitis B and, most importantly, HIV/AIDS. Linkages of TB will be discussed where relevant under HIV, but often linked to EHA1. |
| 5. | **Soil-, water- and waste-related diseases** – Diseases that are transmitted directly or indirectly through contaminated water, soil or non-hazardous waste (e.g., diarrheal diseases, schistosomiasis, hepatitis A and E, poliomyelitis, soil-transmitted helminthiases, etc.). |
| 6. | **Food- and nutrition-related issues** – Adverse health effects such as malnutrition, anaemia or micronutrient deficiencies due to e.g., changes in agricultural and subsistence practices, or food inflation; gastroenteritis, food-borne trematodiases, etc. This will also consider feeding behaviours and practices. |
| 7. | **Accidents/injuries** – Road traffic or work-related accidents and injuries (home and Project related); drowning. |

| Environmental Health Areas (EHAs) | |
|---|---|
| 8. | **Exposure to potentially hazardous materials, noise and malodours** – This considers the environmental health determinants linked to the Project and related activities. Noise, water and air pollution (indoor and outdoor) as well as visual impacts will be considered in this biophysical category. It can also include exposure to heavy metals and hazardous chemical substances and other compounds, solvents or spills and releases from road traffic and exposure to mal-odours. There is a significant overlap in the environmental impact assessment in this section. Ionizing radiation also falls into this category. |
| 9. | **Social determinants of health** – Including psychosocial stress (due to e.g., resettlement, overcrowding, political or economic crisis), mental health, depression, gender issues, domestic violence, suicide, ethnic conflicts, security concerns, substance misuse (drug, alcohol, smoking), family planning, health seeking behaviours, etc. There is a significant overlap in the Social Impact Assessment (SIA) in this section. |
| 10. | **Cultural health practices** – Role of traditional medical providers, indigenous medicines, and unique cultural health practices. |
| 11. | **Health systems issues** – Physical health infrastructure (e.g., capacity, equipment, staffing levels and competencies, future development plans); program management delivery systems (e.g., malaria-, TB-, HIV/AIDS-initiatives, maternal and child health, etc.). |
| 12. | **Non-communicable diseases** – Cardiovascular diseases, cancer, diabetes, obesity, etc. |

### 7.11 Direct versus Indirect and Cumulative Effects

The purpose of an HIA is to 'unravel the determinants of health, which include individual, social and environmental, and institutional factors, that are directly or indirectly (representing underlying issues), and cumulatively affected by the proposed project. Consideration of these aspects allows for better management of the risks associated with individual determinants' (IFC, 2009).

Numerous health determinants are affected by individual factors which may be genetic, biological, lifestyle or behavioural in nature, and specific circumstances (IFC, 2009). These factors include indicators of vulnerability that describes individual exposure, susceptibility or the ability to cope. Examples include gender, age, dietary intake, exercise, alcohol and tobacco use, education, and employment. The relationship between a project and the individual determinants is complex and often controversial. 'The HIA is not a "social engineering" exercise; instead, the assessment aims to systematically analyse those potential direct, indirect (underlying), and cumulative community impacts that are predicted to occur due to the project' (IFC, 2009).

Activities identified for the project during the construction, commissioning, operational and decommissioning phases have been used to identify relevant generic key issues as recommended by the IFC HIA Guidelines (IFC,

2009). Associated EHAs and their implications in terms of the project activities were then used to guide the selection of potential positive and/or negative impacts.

### 7.12 Data Gaps and Limitations of the HIA Study

This Baseline HIA has focused on understanding the high-level health issues associated with the proposed Crematorium Project site. The Final HIA will also assess health data gaps that may exist and determined whether additional information would be required to inform a more comprehensive health evidence-base.

The gap analysis included a critical appraisal of data quality of sources identified during the HIA process.

The following are the recognised limitations of the HIA study:

- The HIA study often refers to local level data which has some limitations that need to be understood and respected. Recording and reporting of the health data within the visited Healthcare facilities is completed manually, and it is likely that the recording may lack required accuracy. However, this information is invaluable in understanding the health challenges in the area, although the limitation must be considered when evaluating information, as its ability to be used as a robust baseline and to monitor relevant health impacts is limited; and
- Interviews are normally based on respondents' self-declaration which may be prone to recall or response bias. Moreover, when it comes to questions on one's private life, study participants tend to be affected by a social desirability bias, where they may choose to give answers that are socially acceptable.

This HIA must be viewed as a prospective / predictive study as there has as yet been no initiation of any construction activities on the proposed site.

## 8 Country Health Profile: South Africa

Since the end of apartheid in 1994, South Africa has experienced notable changes in population health. The first years of post-apartheid South Africa were characterised by economic growth and noteworthy steps towards reducing inequalities in health and high levels of mortality from infectious and maternal causes. Unfortunately, the emergence of the HIV/AIDS epidemic during the early 2000s, prior to the rollout of antiretroviral drug therapy (ART), resulted in massive shocks to the health system and reversed many previous gains in health. Concerted efforts by successive administrations, coupled with international support, have stabilised the epidemic and have begun to shift health policy towards longer-term strategies and goals that now include a wider range of priorities such as non-communicable disease (NCD) prevention and National Health Insurance (NHI)—South Africa's approach to achieving universal health coverage (ibid).

South Africa is a dynamic and complex country. A middle-income nation that has dedicated substantial resources to health and human capital investments, South Africa has a progressive Constitution that guarantees the right to

health care and a vibrant civil society. National Health Insurance (NHI) is the central means by which the government aims to achieve universal coverage, under the principles of social solidarity and equity elaborated in the National Development Plan. To implement NHI, the government is revitalizing service delivery, changing the way that health services are financed, ensuring the provision of primary care, improving access to qualified human resources for health, and ensuring the availability of quality assured medical products.

Life expectancy has increased due to innovations and rapid scale-up of HIV/AIDs and Tuberculosis (TB) treatment and care, and expanded access to immunizations. Life expectancy which incorporates the impact of AIDS increased from 52.1 years in 2005 to 61.2 years in 2014 (Statistics South Africa, 2014). The estimated national HIV prevalence among the general population aged 15 – 49 years has remained 17.3% since 2005 (Department of Health Strategic Plan 2014/15-2018/9). Two in three TB patients also are HIV positive. South Africa has one of the highest TB incidence rates in the world (834 per 100,000 populations). The treatment success rate for new and relapse cases registered in 2013 is 78% (Global TB Report 2015).

South Africa also contributes about 10.4% of the global burden of reported Multi-drug Resistant Tuberculosis (MDR-TB) initiated on treatment. A National DRTB Survey to ascertain the burden of DR-TB was made available in the first quarter of 2016. Diagnosis and management of drug resistant cases account for nearly half of the TB budget, and treatment success rates are 49% for MDR-TB and 20% for XDR-TB (Global TB Report, 2015).

Progress in maternal and child health has been hindered by the HIV and tuberculosis epidemics, and the performance of the health system. Efforts to accelerate prevention interventions are underway, including the prevention of maternal to child transmission of HIV. Important reductions have occurred in under-five and neonatal mortality (42 and 14 per 1000 live births (2013/14)), although these rates are higher in comparison with other countries of similar socioeconomic status. Maternal mortality ratios remain high, estimated at 269 deaths per 100 000 live births. Immunization remains critical to improving child health. The government currently has eleven antigens on its national immunization schedule, including rotavirus and Pneumococcal Conjugate Vaccine, which has markedly reduced child morbidity and mortality. A national HPV campaign was launched in March 2014.

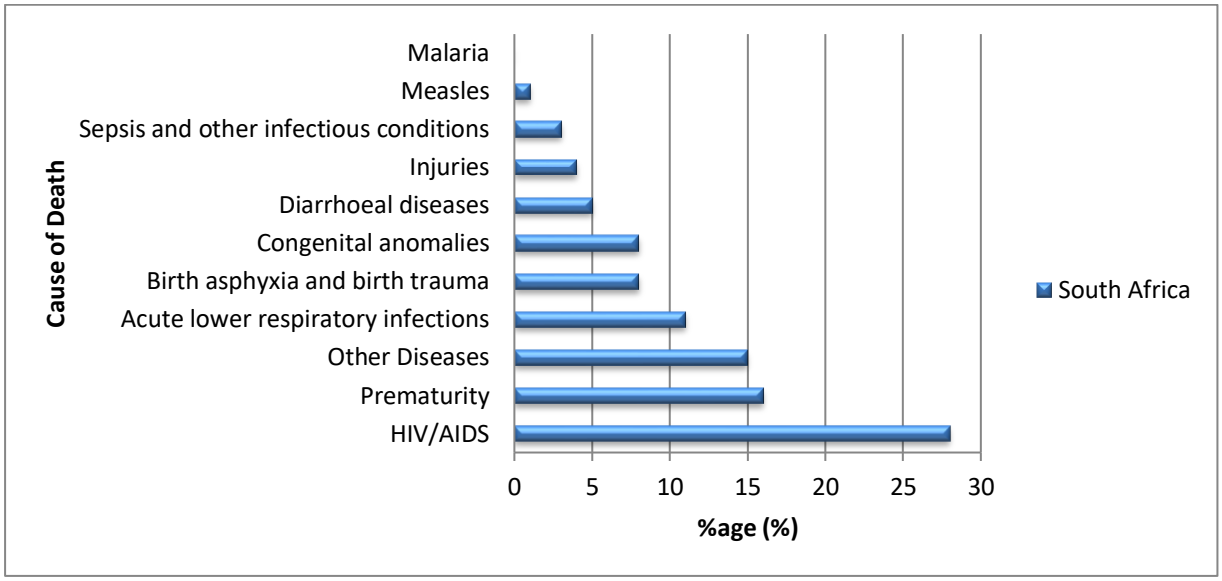



**Figure 8-1: Distribution of causes of death among children aged under 5, % of totals in RSA**

Approximately two in five deaths are attributable to non-communicable diseases. Some 40% of mortality from non-communicable conditions among men occurred before the age of 60 years - and is therefore considered premature. Second to non-communicable conditions is the burden of mortality and disability from violence and injuries. A rapid increase in motor vehicles has led to increases in road traffic accidents that now account for more than one-quarter of deaths due to injuries. For nearly two decades, tobacco-use declined because of strong legislation and policies to control tobacco consumption. The WHO FCTC was ratified in 2005. However, smoking rates are among the highest in the continent (21.5% in 2014). Harmful alcohol consumption is the third most important risk factor contributing to non-communicable diseases, injuries, and communicable diseases. Alcohol use is a major underlying factor in injuries and road traffic accidents. Patterns of harmful use exist among those who drink. Harmful and excessive alcohol consumption also contributes to non-communicable conditions, and can also accelerate the progression of infectious diseases.

Overweight and obesity pose major nutritional challenges. More than seven in ten women above 35 years old are overweight. A contributing factor is the rapidly increasing consumption of packaged foods high in calories, saturated fats, animal proteins, sugars, and salt. In addition, physical activity levels are low. Approximately half of adults are physically inactive, and two in five schoolchildren do not participate in sufficient physical activity. Improvement in the sustainable development sector has resulted in improved quality of life. Access to improved water sources is nearly universal. However, coal is used as a cheap source of energy for industry, and thus South Africa ranks as the highest greenhouse gas emitter in the continent. Climate change is one of the key priorities of Government, who views mitigation to ensure an internationally competitive lower carbon economy.

## 8.1 Burden of Disease

GBD 2019 estimated the incidence and prevalence of a range of disease, injuries, and sequelae, summarised here in YLDs. Population growth and ageing were key drivers of nonfatal disease burden: the total number of YLDs nationwide increased from 3.59 (95% UI 2.67–4.61) million in 1990 to 6.50 (4.86–8.37) million in 2019, while age-standardised YLD rates increased from 11 587 (8677–14 796) per 100 000 in 1990 to 12 053 YLDs (9046–15 474) per 100 000 in 2019. Trends in YLDs by province for specific causes of disability are illustrated in the Figure below. Aside from YLDs due to HIV/AIDS and its sequelae (including tuberculosis), which increased several orders of magnitude, the largest increases among leading causes of YLDs were from diabetes, chronic kidney disease, neonatal disorders and other musculoskeletal disorders.

The 21 leading causes of YLDs in 2019 (in descending order) are shown here, except for HIV/AIDS, which had annualised per cent change values that exceeded the scale of this figure by orders of magnitude. (A) Change over 1990–2007. (B) Change over 2007–2019. YLDs, years lived with disability.

All provinces except for North-West experienced a considerable increase in YLDs from NCDs between 2007 and 2019 from the combined effects of demographic change and rising age-specific prevalence of NCDs such as diabetes and chronic kidney disease. The largest increase in YLDs from NCDs was in Northern Cape at 3.8% (+3.5 to +4.0%) per year, while YLDs in North-West decreased at −0.6% (−0.4% to −0.8%). Due to their high prevalence, mental disorders as a group contributed to the largest total number of YLDs in all provinces, though their rate of increase between 1990 and 2019 was less pronounced than for other NCDs. Injuries accounted for about 4.6% of total YLDs in Limpopo and Northern Cape (the highest two provinces), as compared with 3.2% and 3.7% of total YLDs in KwaZulu-Natal and Mpumalanga (the lowest two provinces).

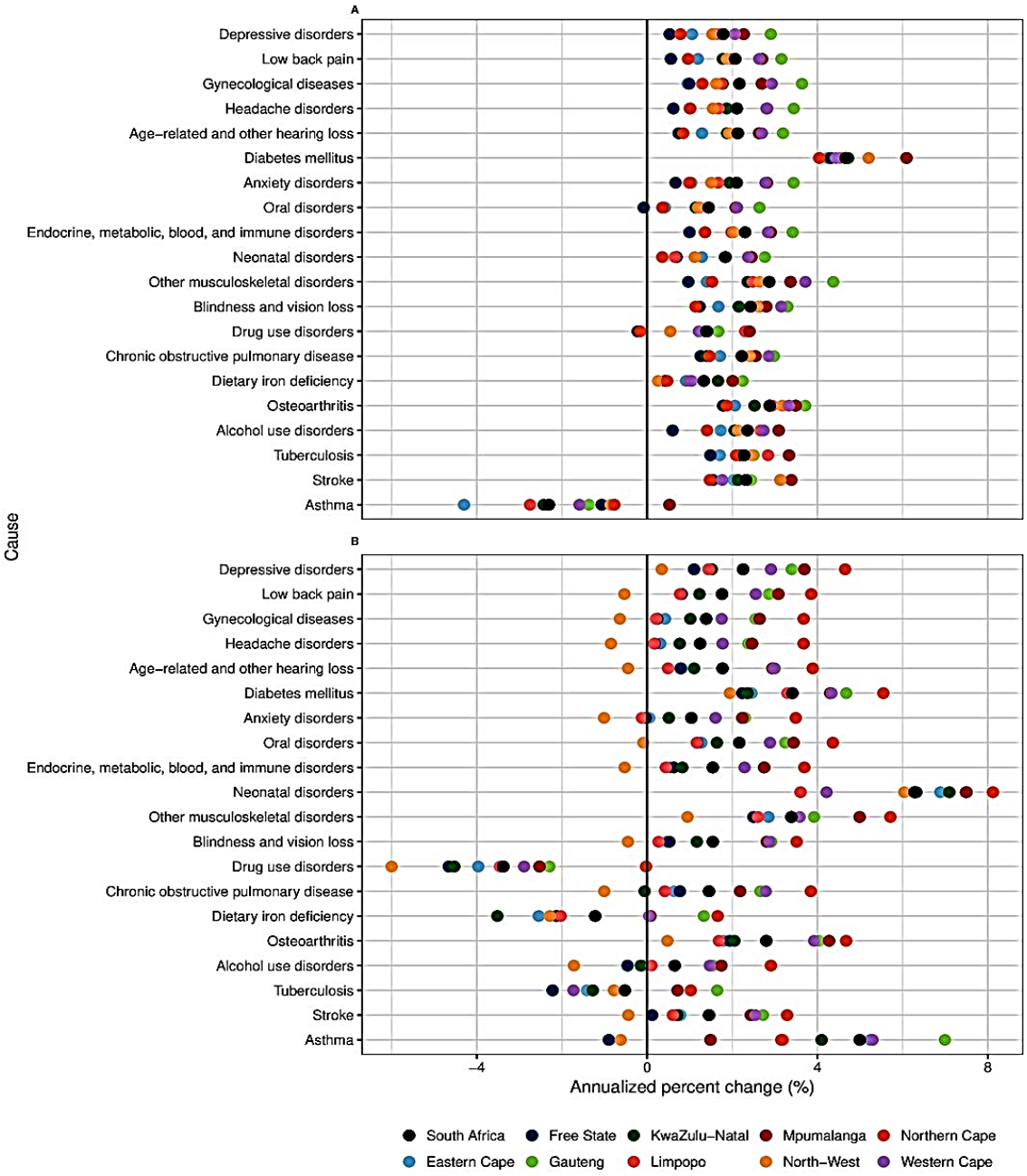
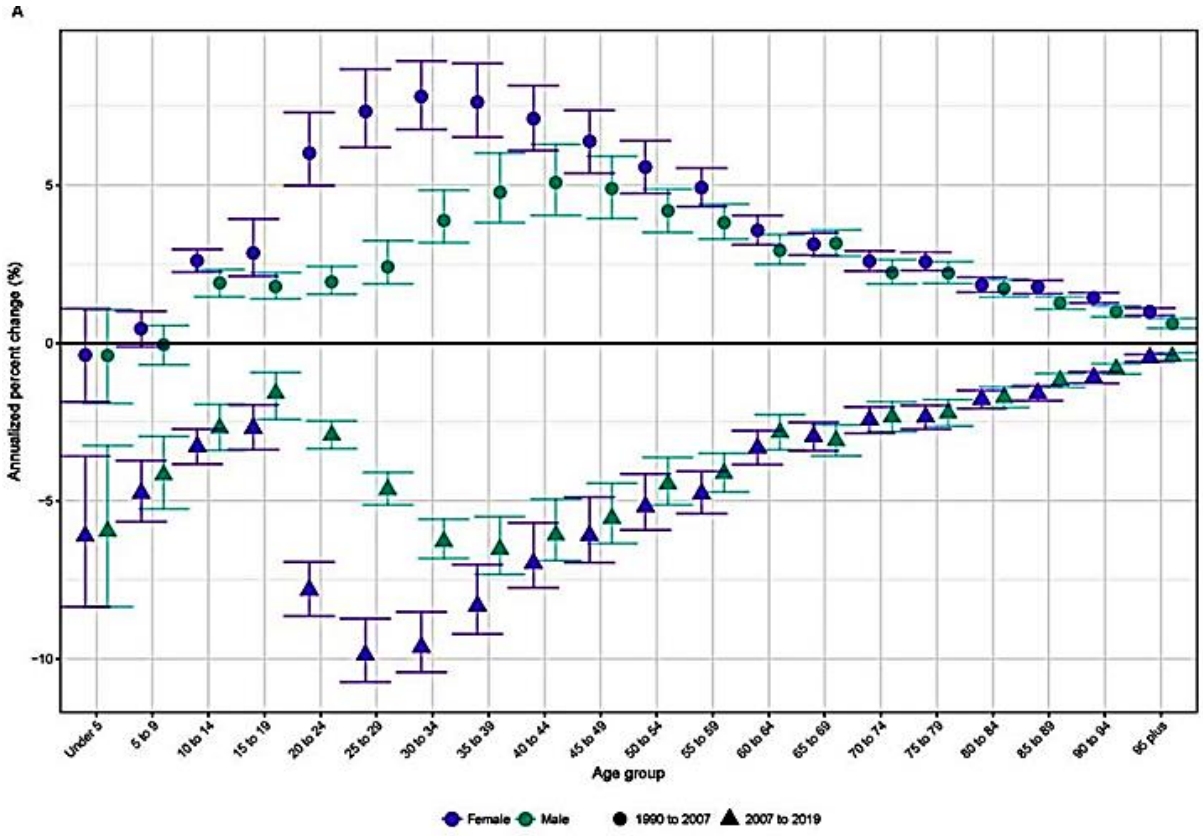



**Figure 8-2: Annualised per cent change in YLDs (all ages, both sexes) by province, 1990–2019**

## 8.2 Mortality Levels and Trends

The number of deaths in South Africa increased from 293 904 deaths (95% 280 307–308 060) in 1990 to 724 828 deaths (667 154–797 221) in 2007, then declined to 521 802 deaths (494 683–554 967) in 2019. Trends in all-cause mortality by age and sex (figure 1A) tracked reasonably closely with trends in HIV/AIDS-specific mortality (figure 1B), with increases in both between 1990 and 2007 and decreases in both between 2007 and 2019. Changes in all-cause mortality were most pronounced in working-age adults. The exception to these

overall positive trends was a modest, although noteworthy, increase in mortality among adolescent males and females over 2007–2019.



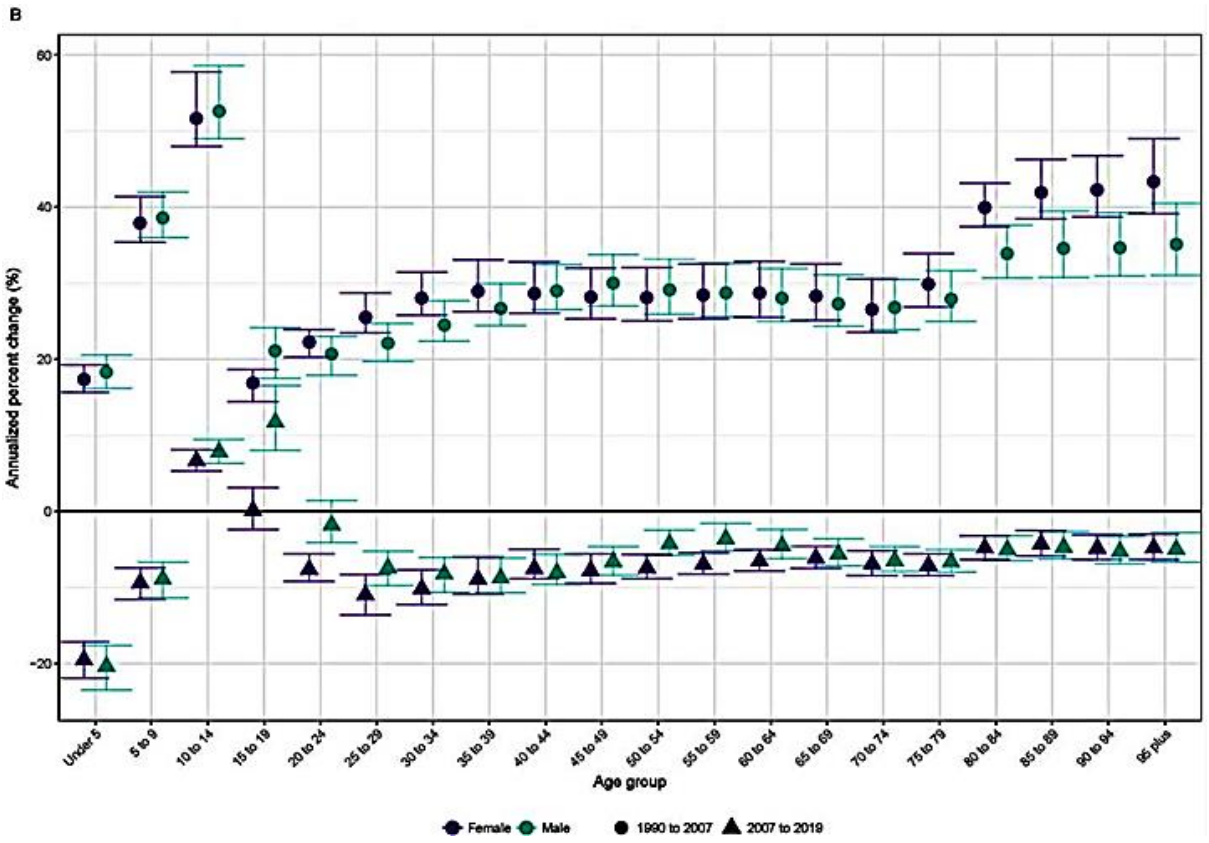



**Figure 8-3: Annualised per cent change in age-specific and sex-specific mortality rates, 1990–2007 and 2007–2019**

## 8.3 Public and Private Health Sector

South Africa has a large public sector and a smaller but fast-growing private sector. The country's Healthcare system comprises a network of health facilities providing primary health care, supported by several higher levels of care. Healthcare in South Africa varies from the most basic primary healthcare, offered free by the state, to highly specialised, hi-tech health services available in both the public and private sector.

The public health sector is stretched and under-resourced in several places. While the state contributes about 40% of all expenditure on health, the public health sector is under pressure to deliver services to about 80% of the population. The private sector, on the other hand, is run largely on commercial lines and caters to middle- and high-income earners who tend to be members of medical schemes (South Africa Info, 2013). It also attracts most of the country's health professionals.

This two-tiered system is not only inequitable and inaccessible to a large portion of South Africans, but institutions in the public sector have suffered poor management, underfunding and deteriorating infrastructure. While access has improved, the quality of health care has fallen. The situation is compounded by public health

challenges, including the burden of diseases such as HIV and Tuberculosis (TB), and a shortage of key medical personnel.

## 8.4 South African Health Care System

The South African government has been responding with a far-reaching reform plan to revitalise and restructure the South African health care system, including:

- Fast-tracking the implementation of a National Health Insurance scheme, which will eventually cover all South Africans;
- Strengthening the fight against HIV and TB, non-communicable diseases (NCDs), as well as injury and violence;
- Improving human-resource management at state hospitals and strengthening co- ordination between the public and private health sector;
- Deploying "health teams" to communities and schools;
- Regulating costs to make health care affordable to all; and
- Increasing life expectancy from 56.5 years in 2009 to 58.5 years in 2014.

## 8.5 Traditional Medicine

Traditional medicines are widely used in South Africa where, despite the influx of western treatments, around 27 million South Africans continue to use indigenous medicine (Cocks and Møller, 2002). The use of shrubs, herbs and trees for medicinal purposes is an ancient practice with long-standing importance to people from all levels of society.

The use of traditional healthcare comprising of plant-based medicines is not just with natural illnesses, but also for afflictions believed to be caused by the supernatural. In fact, a study of a South African village has shown that approximately one-third of the wild plants used served cultural and spiritual needs rather than basic utilitarian purposes (Cocks *et al*., 2008). In South Africa there are an estimated 200 000 registered healers (Summerton, 2006) whose extensive knowledge and reported ability to connect with ancestors are in continuous demand. Furthermore, self-medication remains popular amongst the general public, especially for minor ailments such as coughing and diarrhoea (Dahlberg and Trygger, 2009).

The WHO observes that it is difficult to assign one definition to the broad range of characteristics and elements of traditional medicine, but that a working definition is essential. It thus concludes that traditional medicines: "[Include] diverse health practices, approaches, knowledge and beliefs incorporating plant, animal and/or mineral-based medicines, spiritual therapies, manual techniques and exercises applied singularly or in combination to maintain well-being, as well as to treat, diagnose or prevent illness" (WHO, 2002).

Traditional healers are generally divided into two categories – those that serve the role of diviner-diagnostician (or diviner-mediums) and those who are healers (or herbalists). The diviner provides a diagnosis usually through spiritual means, while the herbalist chooses and applies relevant remedies.

The WHO estimates that up to 80% of the population in Africa makes use of traditional medicine. In Sub-Saharan Africa, the ratio of traditional healers to the population is approximately 1:500, while medical doctors have a 1:40 000 ratio to the rest of the population (Abdool-Karim, 2002). It is clear that traditional healers play an influential role in the lives of African people and have the potential to serve as crucial components of a comprehensive health care strategy. The Medical Research Council (MRC) founded a traditional medicines research unit in 1997 to introduce modern research methodologies around the use of traditional medicines. It has also aimed to develop a series of patents for promising new entities derived from medicinal plants.

### 8.6 Healthcare System Performance

Literature compares HAQ Index values for the year 1990 and 2019 across all nine provinces and with the other 15 SADC member countries (figure 5; online supplemental figure S5). In terms of overall performance, South Africa ranked third in 1990 and fourth in 2019, surpassed only by Mauritius and Seychelles in both years. However, HAQ Index values varied considerably between provinces, with the highest values in 2019 for Western Cape and KwaZulu-Natal (similar to Mauritius in 1990), and the lowest values for Free State, Northern Cape, and Eastern Cape (between Eswatini and Namibia in 2019). These three provinces also had the smallest improvements over time. By contrast, the largest improvements in HAQ Index were in KwaZulu-Natal, Mpumalanga and Gauteng; the only SADC neighbours that had a larger improvement than KwaZulu-Natal were Seychelles, Zambia, Botswana, Angola and Namibia.

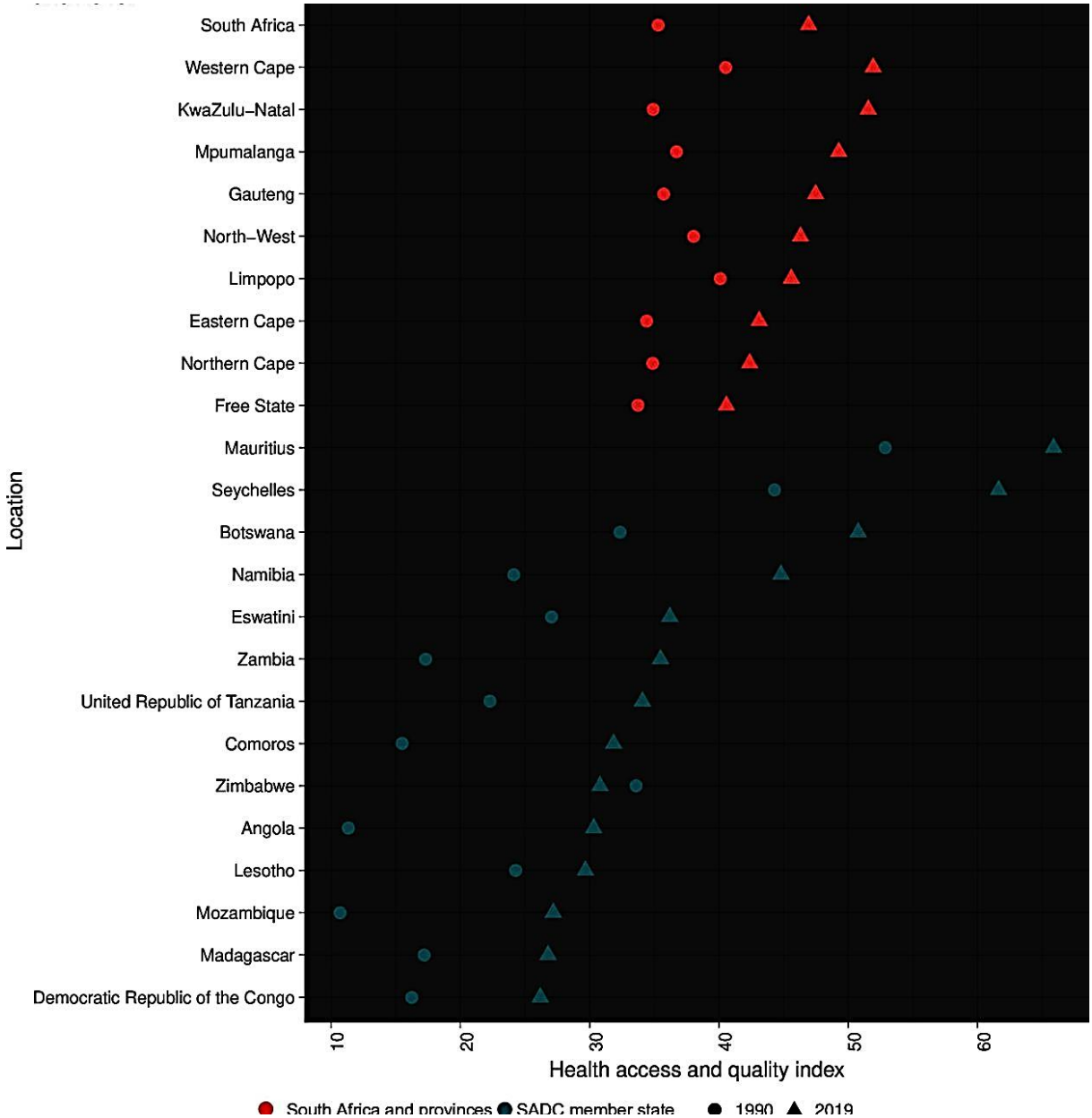



**Figure 8-4: GBD healthcare access and quality index values for South Africa and provinces compared with Southern African Development Community member states, 1990 and 2019**

The GBD healthcare access and quality index is a summary measure of health system performance that incorporates estimates of age-standardised and risk-standardised mortality rates for 32 causes that are amenable to healthcare. The index scale ranges from 0 to 100, with higher values indicating better performance. GBD, Global Burden of Disease; SADC, Southern African Development Community.

## 8.7 Healthcare Facilities

There are 4 200 public health facilities in South Africa. The number of people per clinic as per figures from 2013, was 13 718, exceeding WHO guidelines of 10 000 per clinic. However, figures from March 2009 show that

people averaged 2.5 visits a year to public health facilities and the usable bed occupancy rates were between 65% and 77% at hospitals (South Africa Info, 2013).

Since 1994, more than 1 600 clinics have been built or upgraded. Free health care for children under the age of 6 and for pregnant or breastfeeding mothers was introduced in the mid-1990s (South Africa Info, 2013).

The National Health Laboratory Service (NHLS) is the largest pathology service in South Africa. It has 265 laboratories, serving 80% of South Africans. The laboratories provide diagnostic services as well as health-related research (South Africa Info, 2013).

### 8.8 Doctor Shortages

In March 2012, 165 371 qualified health practitioners in both public and private sectors were registered with the Health Professions Council of South Africa (HPCSA), the health practitioner watchdog body. This includes 38 236 doctors and 5 560 dentists (South Africa Info, 2013).

The doctor-to-population ratio is estimated to be 0.77 per 1 000. Due to the clear majority of General Practitioners – 73% – working in the private sector, there is approximately one practising doctor for every 4 219 people for public health care (South Africa Info, 2013). In response, the Department of Health (DoH) has introduced clinical health associates, midlevel health-care providers, to work in underserved rural areas.

Approximately 1 200 medical students graduate annually. In some communities, medical students provide health services at clinics under supervision (South Africa Info, 2013). Newly graduating doctors and pharmacists complete a year of compulsory community service in understaffed hospitals and clinics.

### 8.9 Quality of Services

Public health facilities in South Africa collectively scored less than 50% compliance with vital measures in two out of the six ministerial priority areas. These measures included: patient safety and security (34%) and positive and caring attitudes (30%) (DoH, 2012). The priority area waiting times scored the highest compliance to vital measures at 68%. Primary care facilities on average scored lower than hospitals in all priority areas. Overall, the facilities in Gauteng province obtained the highest compliance score on quality (69%) while the Northern Cape reflected the lowest (40%) (DoH, 2012).

### 8.10 Functionality of Services

In terms of performance in the five functional areas (Clinical Services, Infrastructure, Management, Patient Care, Support Services and Clinical Care), the compliance score obtained by the country's facilities is the lowest for Clinical Services (38%) (DoH, 2012). Within Clinical Services, the area of Health Technology recorded the lowest

compliance for both Primary Health Care (PHC) and hospital facilities followed by Pharmacy. This, and the low number of pharmacists working in public health facilities, needs urgent attention.

### 8.11 Health-related Sustainable Development Goal Targets

Health has been recognized as central to international development for more than 20 years, and major efforts have been made to reduce morbidity and mortality either universally, or through a focus on specific population subgroups (e.g., “the poor”, “women and children”) (World Bank, 1993).

The United Nations Sustainable Development Goals (UN SDGs, also known as the Global Goals) are 17 goals with 169 targets that all UN Member States have agreed to work towards achieving by the year 2030. They set out a vision for a world free from poverty, hunger and disease. Health has a central place in SDG 3 “Ensure healthy lives and promote well-being for all at all ages”, underpinned by 13 targets that cover a wide spectrum of WHO’s work. Almost all of the other 16 goals are related to health or their achievement will contribute to health indirectly.

Sustainable Development Goal 3 (SDG 3 or Global Goal 3), regarding "Good Health and Well-being" targets, indicators and progress include:

- Target 3.1: Reduce maternal mortality
- Target 3.2: End all preventable deaths under five years of age
- Target 3.3: Fight communicable diseases
- Target 3.4: Reduce mortality from non-communicable diseases and promote mental health
- Target 3.5: Prevent and treat substance abuse
- Target 3.6: Reduce road injuries and deaths
- Target 3.7: Universal access to sexual and reproductive care, family planning and education
- Target 3.8: Achieve universal health coverage
- Target 3.9: Reduce illnesses and deaths from hazardous chemicals and pollution
- Target 3.a: Implement the WHO framework convention on tobacco control
- Target 3.b: Support research, development and universal access to affordable vaccines and medicines
- Target 3.c: Increase health financing and support health workforce in developing countries
- Target 3.d: Improve early warning systems for global health risks


HEALTH IN THE SDG ERA
3 GOOD HEALTH AND WELL-BEING
ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES
1 NO POVERTY
PRIORITIZING THE HEALTH NEEDS OF THE POOR
2 ZERO HUNGER
ADDRESSING THE CAUSES AND CONSEQUENCES OF ALL FORMS OF MALNUTRITION
4 QUALITY EDUCATION
SUPPORTING HIGH-QUALITY EDUCATION FOR ALL TO IMPROVE HEALTH AND HEALTH EQUITY
5 GENDER EQUALITY
FIGHTING GENDER INEQUITIES, INCLUDING VIOLENCE AGAINST WOMEN
6 CLEAN WATER AND SANITATION
PREVENTING DISEASE THROUGH SAFE WATER AND SANITATION FOR ALL
7 AFFORDABLE AND CLEAN ENERGY
PROMOTING SUSTAINABLE ENERGY FOR HEALTHY HOMES AND LIVES
8 DECENT WORK AND ECONOMIC GROWTH
PROMOTING HEALTH EMPLOYMENT AS A DRIVER OF INCLUSIVE ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
PROMOTING NATIONAL R&D CAPACITY AND MANUFACTURING OF AFFORDABLE ESSENTIAL MEDICAL PRODUCTS
10 REDUCED INEQUALITIES
ENSURING EQUITABLE ACCESS TO HEALTH SERVICES THROUGH UNIVERSAL HEALTH COVERAGE BASED ON STRONGER PRIMARY CARE
11 SUSTAINABLE CITIES AND COMMUNITIES
FOSTERING HEALTHIER CITIES THROUGH URBAN PLANNING FOR CLEANER AIR AND SAFER AND MORE ACTIVE LIVING
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
PROMOTING RESPONSIBLE CONSUMPTION OF MEDICINES TO COMBAT ANTIBIOTIC RESISTANCE
13 CLIMATE ACTION
PROTECTING HEALTH FROM CLIMATE RISKS, AND PROMOTING HEALTH THROUGH LOW-CARBON DEVELOPMENT
14 LIFE BELOW WATER
SUPPORTING THE RESTORATION OF FISH STOCKS TO IMPROVE SAFE AND DIVERSIFIED HEALTHY DIETS
15 LIFE ON LAND
PROMOTING HEALTH AND PREVENTING DISEASE THROUGH HEALTHY NATURAL ENVIRONMENTS
16 PEACE AND JUSTICE
EMPOWERING STRONG LOCAL INSTITUTIONS TO DEVELOP, IMPLEMENT, MONITOR AND ACCOUNT FOR AMBITIOUS NATIONAL SDG RESPONSES
17 PARTNERSHIPS FOR THE GOALS
MOBILIZING PARTNERS TO MONITOR AND ATTAIN THE HEALTH-RELATED SDGs
World Health Organization
WWW.WHO.INT/SDGS
SUSTAINABLE DEVELOPMENT GOALS

**Figure 8-5: Sustainable Development Goals**

Figure 10-6 plots the observed average annualised rate of change (ARC) (2015–2019) in key quantitative SDG-3 targets by province and compares these to the rate of change that is needed to achieve the target. The Global Burden of Disease estimates that all nine provinces are currently on track to achieve the NCD target, and five are on track to achieve the under-5 mortality rates (U5MR) target. Two provinces at most are currently on track to achieve neonatal mortality and maternal mortality ratio (MMR) targets, respectively. HIV incidence declined quite slowly over 2015–2019, and tuberculosis incidence increased, suggesting these targets will be very challenging to achieve.

This analysis adds to the literature on mortality in South Africa and represents the largest systematic effort to date to quantify levels and long-term trends in nonfatal outcomes, risk-attributable burden, and comparative healthcare system performance in South Africa and its provinces. As in other countries, a subnational lens on health progress is important in South Africa because of considerable health inequalities and decentralisation of health planning and policy. South Africa is committed to achieving the health-related Sustainable Development Goals (SDGs). Achieving SDG targets necessitates monitoring of health outcomes and associated risks, as well as inequality in health infrastructure and inequitable access to services. One practical use of these subnational estimates is to identify which provinces are on track to achieve specific SDG targets to provide opportunities to share best practices and shore up disease-specific programmes in provinces that are off-track. It was found that most health indicators varied greatly by province, with poorer and more rural provinces generally showing lower levels of health and less progress since 1990.

While all provinces have made progress on HAQ since 1990, economically advantaged provinces have generally progressed at a faster rate, and performance in disadvantaged provinces has lagged behind neighbouring middle-income SADC countries. Many of the inequalities within and across provinces in South Africa are also due to the fragmented nature of the health system, with an under-resourced public health sector serving most of the people and a well-resourced private sector serving a minority of the population. The NHI provides a vital opportunity to close these gaps by integrating the public and private sector financing. In addition, the COVID-19 pandemic has stressed a fragile healthcare system and has highlighted the ‘syndemic’ nature of South Africa’s quadruple burden of disease by exposing the dominant role of shared risk factors (like harmful alcohol use) and social-structural vulnerabilities in driving disease and injury trends. Further, significant contraction of the local and regional economies is expected to exacerbate inequities in access to healthcare for the most vulnerable.19 20 Together, our findings suggest that a doubling-down on investments in key health programmes is needed in nearly all provinces, especially the least advantaged—and these investments are particularly urgent in the wake of COVID-19-related health service disruptions.

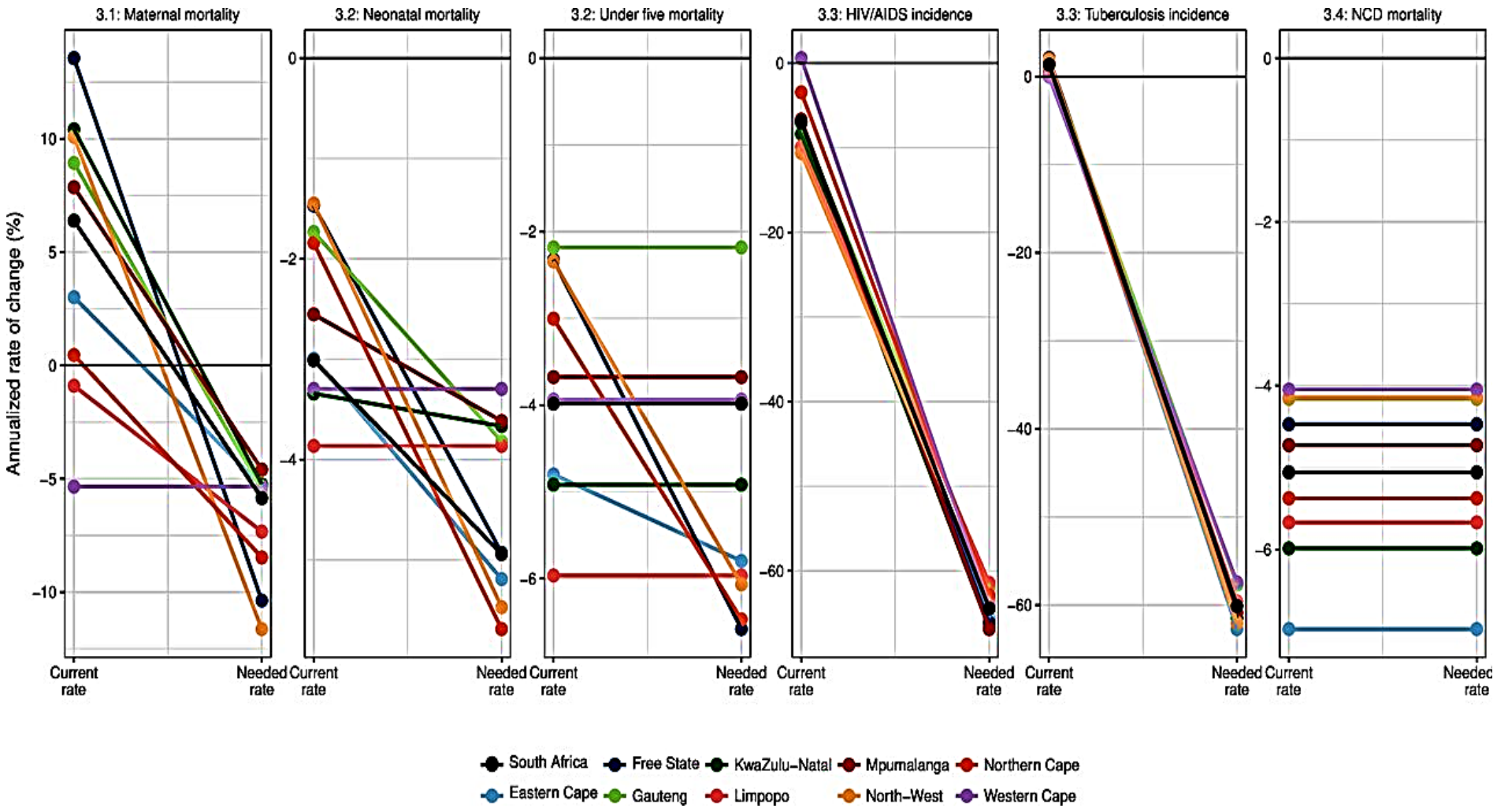



**Figure 8-6: Progress towards achievement of key health-related sustainable development goal targets in South Africa and provinces**

Unsurprisingly, the impact of HIV/AIDS and concurrent tuberculosis still dominate much of the quadruple burden of disease in South Africa and remain major drivers of changes in population health. Our analysis confirms that the national response to HIV/AIDS after 2007, including the rollout of ART, significantly improved life expectancy thereafter. It was also found an increase in the burden of HIV/AIDS and tuberculosis among adolescents, suggesting that more intensive, integrated efforts are needed for prevention and treatment in this age group. Given the rapid rises in NCDs and associated risk factors, integrated care for adolescents should also have a strong emphasis on NCD prevention. Furthermore, while significant progress has been made in controlling tuberculosis among people living with HIV, in part because of expanded ART, limited progress has been made in controlling tuberculosis in HIV-negative populations. This further supports the need for strategies targeting other non-HIV risk factors associated with tuberculosis that are increasingly prevalent, such as diabetes and alcohol abuse. The COVID-19 response in South Africa will need to ensure greater support for people living with HIV and that the HIV care continuum is not significantly disrupted and intensify efforts to prevent a resurgence in tuberculosis in 2021 and beyond.

Maternal and child survival has been an area of success since 1990, though most provinces do not appear to be on track to meet the SDG targets. To some extent, recent progress reflects the rollout of ART, including prevention of mother-to-child transmission, coupled with increased coverage of core Expanded Programme on Immunisation vaccines and, more recently, pneumococcal conjugate and rotavirus vaccines.27 28 Crucially, stay-at-home orders that have been implemented to limit the spread of COVID-19 could significantly disrupt immunisation activities, thus increasing the risk of children contracting other infectious diseases, as documented in Pakistan, for example. A recent modelling study found that the risk of COVID-19 death in the context of receiving immunisation services was far outweighed by the risk of death from a vaccine-preventable disease that resulted from not receiving these services. To prevent increases in child mortality from vaccine-preventable diseases, the Department of Health will need to assess where provincial and sub-provincial immunisation services have been most disrupted and redirect resources to targeted, mop-up campaigns.

Injuries, especially from interpersonal violence, have been a consistent feature of the South African landscape over the past 25 years. Evidence suggests that violence can increase during and in the aftermath of disease pandemics, as has been observed in the context of COVID-19-related lockdown/stay-at-home orders, suggesting a nuanced approach to COVID-19 mitigation will be required to balance direct and indirect health effects.30 The single most important risk factor for injuries in South Africa is a high prevalence of harmful use of alcohol. While WHO and others acknowledge alcohol taxes and regulations as ‘best buys’ in terms of their population health impact, practical challenges remain in implementing these policies in the South African context. Alcohol consumption remains a primary form of recreation for many and is strongly linked to perceptions of masculinity; a large local alcohol industry also ensures easy access. Past efforts to reduce alcohol and drug abuse locally have generally failed to combine interventions targeting high-risk persons and groups with population-wide

approaches to reduce per-capita consumption. Further, alcohol policies may have limited impact without concurrent efforts to address firearm possession and use, or to de-link heavy drinking from gender norms. Integrated alcohol and firearm control policies, combined with sustained public campaigns addressing drinking culture, will be necessary to reduce interpersonal violence, and they could generate extensive social and economic benefits.

The image also illustrates a rapid increase in nonfatal disease burden and NCD risk factors in all provinces, despite notable progress on reducing age-specific NCD death rates. These increases, driven by prevalent conditions like diabetes, have implications for health planning and resource allocation at the provincial level. Health promotion and prevention efforts are urgently needed in order to prevent a resurgence in NCD mortality and reduce fiscal pressures on NHI.35 Tobacco control was an early success story for South Africa, but more recently tobacco use as a risk factor has been replaced by obesity and physical inactivity. Dietary policies (including taxes, subsidies and regulations) and efforts to promote exercise through the built environment will probably have an outsized role in the intersectoral agenda in the coming years. In addition, a critical gap in the South African health system is the lack of integrated care for mental disorders at the primary level, a highly-specific, evidence-based, best-buy intervention were almost 27 million cases globally and almost 900 000 deaths, with virtually all countries affected. At this point, North and South America and Southeast Asia had the largest number of people infected with the virus.

### 8.12 Covid-19

Coronavirus disease 2019 is a contagious disease caused by a virus, the severe acute respiratory syndrome coronavirus 2. The first known case was identified in Wuhan, China, in December 2019. The disease has since spread worldwide, leading to an ongoing pandemic (WHO, 2021).

The first case of COVID-19 was reported to the World Health Organization (WHO) in December 2019 from Wuhan City, Hubei Province in China, and in January 2020 the WHO declared the COVID-19 outbreak a public health emergency of international concern. The first case of COVID-19 in South Africa was detection on the 5th March 2020, and the announcement was made by the WHO on 11 March 2020 characterising COVID-19 as a pandemic, the President of South Africa declared the pandemic to be a national disaster on 15 March 2020.

The pandemic has had devastating socio-economic costs; an estimated 2.8 million South Africans have lost their jobs. South Africa's budgetary and Public Finance Management systems channelled the allocation of more than R20 billion to the health sector COVID-19 response and an additional R100 billion has been spent on income support through new social grants.

COVID-19 has placed an even greater strain on South Africa's overburdened and under-resourced health system and has stymied the progress the country has made in strengthening health systems towards achieving universal

health coverage. It has also disrupted access to health care for chronic conditions, including non-communicable diseases, testing, treatment initiation, and continuity of care for HIV and TB, as well as for sexual and reproductive health services, due to both travel restrictions and the re-orientation of healthcare services to respond to the pandemic.

Overall, findings show that the COVID-19 pandemic placed an additional burden on already resource-constrained healthcare facilities, with nurses enduring shortages of basic resources, rapid depletion and delayed restocking of COVID-19-related equipment, and additional strain due to staff shortages. Healthcare workers also experienced daily dilemmas and internal conflicts associated with the pandemic, which affected their health and well-being, and their ability to deliver services.

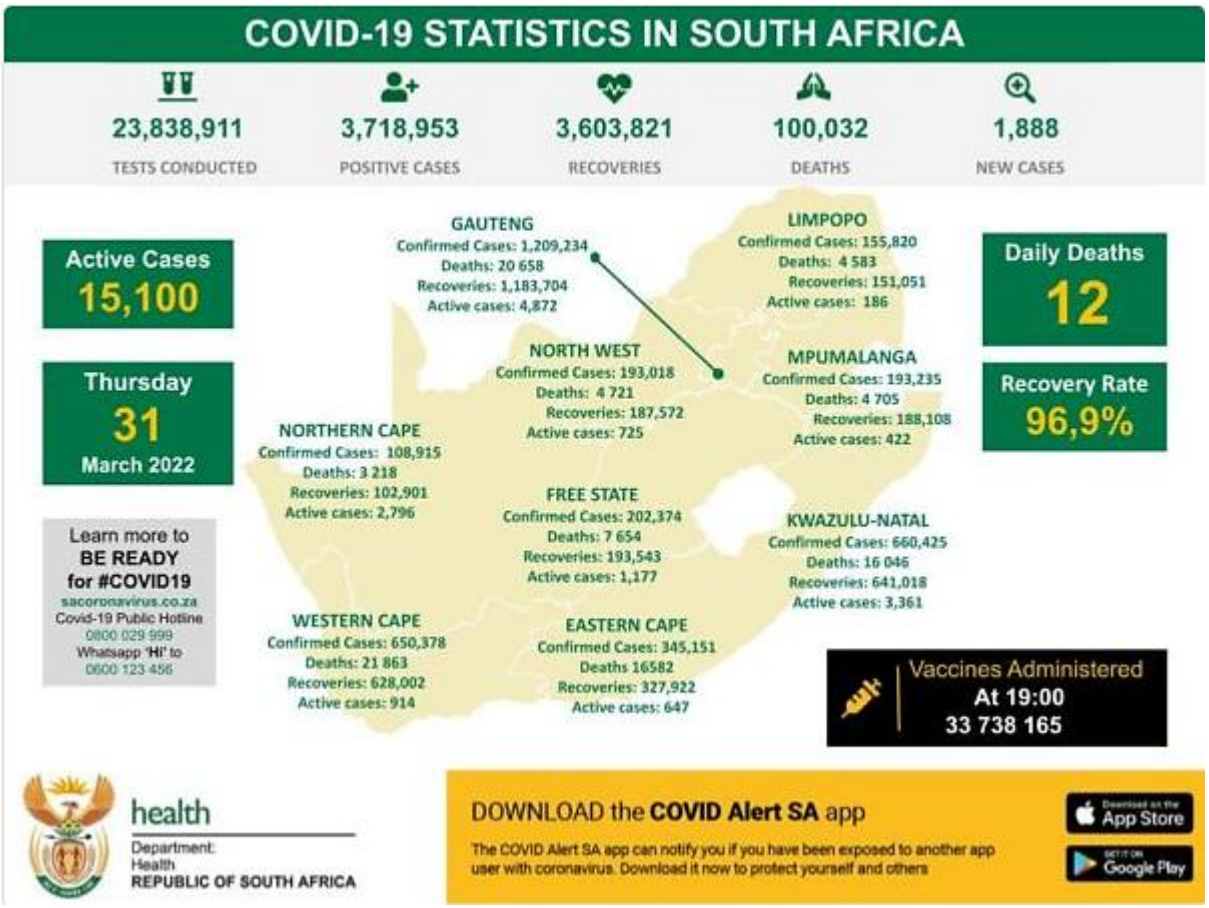



**Figure 8-7: Update on Covid-19 (Thursday 31 March 2022)**

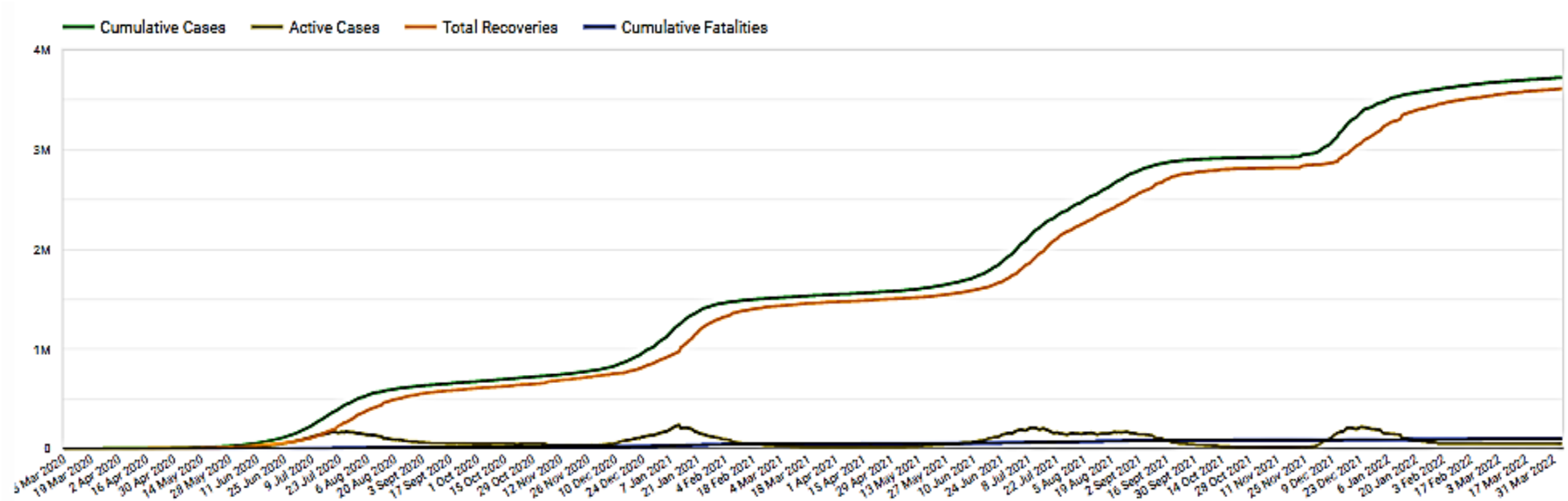



**Figure 8-8: Recoveries and active cases of Covid-19 in South Africa**

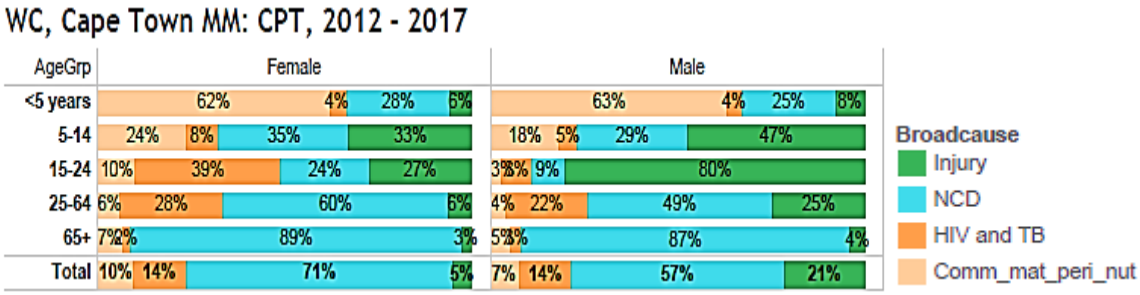
# 9 Regional Overview: City of Cape Town

The City of Cape Town Metropolitan municipality is situated on the southern peninsula of the Western Cape Province. The City of Cape Town Metropolitan Municipality incorporates eight health sub-districts, namely: Cape Town Eastern, Cape Town Northern, Cape Town Southern, Cape Town Western, Khayelitsha, Klipfontein, Mitchell's Plain and Tygerberg.

The main cities/ towns include: Athlone, Atlantis, Belhar, Bellville, Blackheath, Blouberg, Blue Downs, Brackenfell, Cape Point, Cape Town, Delft, Durbanville, Elsies Rivier, Fish Hoek, Goodwood, Gordon's Bay, Grassy Park, Guguletu, Hout Bay, Khayelitsha, Kommetjie, Kraaifontein, Kuils River, Langa, Macassar, Matroosfontein, Melkbosstrand, Milnerton, Mitchells Plain, Muizenberg, Noordhoek, Nyanga, Parow, Philadelphia, Philippi, Robben Island, Scarborough, Simon's Town, Sir Lowry's Pass, Somerset West, Southern Suburbs, Strand, and Table View.

## 9.1 Burden of Disease Profile

For the percentage of deaths by broad cause, deaths are classified into four groups, namely: (i) injuries; (ii) noncommunicable diseases; (iii) HIV and TB; and (iv) communicable diseases together with maternal, perinatal and nutritional conditions. Data are given by gender and age group for the period 2012–2017. The second part of the graph shows the 10 leading single causes of death within each age group and by gender for 2012–2017.




According to the 2017/18 District Health Barometer the Maternal Mortality rate was 58.3/ 100 000 live births, which is lower than the national average (105.7) and national average but higher than the provincial average (55.1). The maternal mortality rate has fluctuated between 56-65/100 000 over the past 5 years. The latest data for infant mortality shows a downward trend in the Cape Metro District over 2008 - 2013 and is amongst the lowest when compared to the province's other health districts. A similarly low and downward trend is seen in mortality under 5 years.

According to the Western Cape antenatal survey reports the Cape Metro had an antenatal HIV prevalence of 20.4% in 2014. Although this is much lower than the national average of 29.7% (2013) it is still the highest

amongst all the province's districts. Khayelitsha sub district actually had a higher prevalence than the National average. The HIV prevalence was 18.2% in 2006 but seems to have stabilized at around 20% since 2011.

The TB case detection rate per 100 000 as set out below shows a heartening downward trend in recent years (J Caldwell, City of Cape Town). The district case load was 23 477 and the case detection rate 577/100 000 in 2016. Khayelitsha sub-district had the biggest proportional TB case load in 2016 and contributed 17% to the total case load of the city.

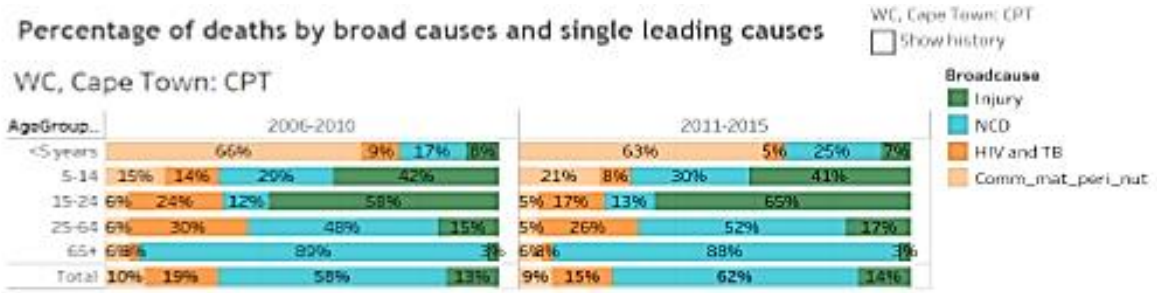



**Figure 9-1: %age of deaths by broad causes and leading causes of death**

The diagram above provides an overview of the %age of deaths by broad causes and leading causes of death. While non-communicable deceases are the leading cause of death in the ageing population at 88 and 62% respectively, injuries were the leading causes of death in the age cohort between 15 and 24 years. The main leading cause of death between the age cohort that is less than 5 years of age was maternal, perinatal and nutritional conditions.

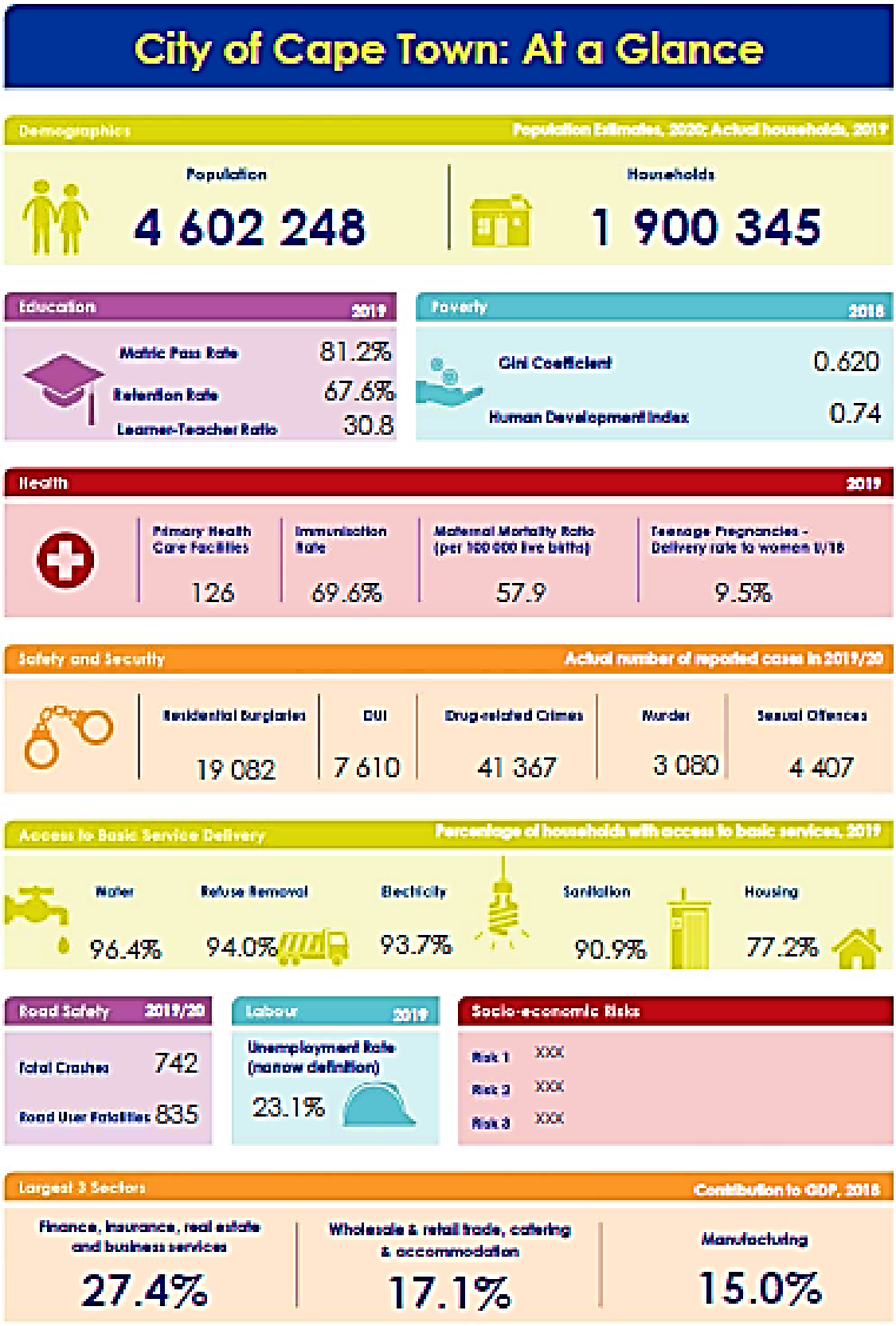



Figure 9-2: City of Cape Town Metropolitan Municipality Fact Sheet

### 9.2 Healthcare Facilities

The city had 126 primary health care clinics (PHC) IN 2019, which comprised of 69 fixed clinics (31 mobile/satellite),10 community unity health centres and 47-day centres.

### 9.3 Emergency Medical Services

Provision of more operational ambulances can provide greater coverage of emergency medical services. In 2019 the city had 116 EMS vehicles which equates to 4 per 10000 in habitants. This number only refers to provincial ambulances and excludes all private services providers.

### 9.4 HIV/AIDS/TB

The number of clients(patients) that remain committed to the antiretroviral treatment (ART) plan in the Cape Metro municipal area increased by 15600 patients between 2018/19 and 2019/2020. In total,210803 registered patients received antiretroviral treatment in the city in 2019.The number of new patients receiving ART however declined by 97 to 28758 patients in 2019/2020.There has been an average annual decline of 1.1 % between 2017/18 (237400 and 2019/20 (24264) in the number of registered patients receiving TB treatment in the city. The province as a whole experienced a 0.8 % decline a cross the same period.

### 9.5 Child Health

The immunisation coverage for children under the age of one in the cape metro improved notably from 66.4 % in 2018/19 to 69.6 % in 2019/20. The overall provincial rate also improved from 65.6 to 68.4% across the same period

The number of malnourished children under five years of age (severe acute malnutrition) per 100000 people in the Cape Metro increased slightly from 1 in 2018/19 to 1.1 in 2019/20. The malnutrition rate in the Cape Metro is however still the lowest amongst stall districts in the Western Cape and still considerably below the Provincial total of 1,6.

The national mortality rate (deaths per 1000 live births before 28 days of life) for the Cape Metro improved from 9.6 deaths in 2018/2019 to 8.9 in 2019/2020.The rate is on par with that of the Province (8.5).A total of 12.6 % of all babies born in facility in the city in 2019/20 weighed less than 25000grams.This compares favour notably to the Provincial total of 12.1 %.

### 9.6 Mental Health

The maternal mortality rate for the Cape Metro area, although improved substantially from 70.8 % in 2018/2019 to 57.9 % in 2019/2020, is still notably above the Provincial average of 48.0 %. The delivery rate to women under

19 years of age in the Cape Metro decreased ever so slightly from 9.6 in 2018/2019 to 9.5 in 2019/20.This is the lowest teenaged pregnancy rate in the Western Cape. The termination of the pregnancy rate in the Cape Metro worsened from 1.1 % 2018/19 to 1.2 % in 2019/2020.this is the highest termination rate in the Province.

## 9.7 COVID-19

The City of Cape Town is one of the leading COVID-19 hotspots in the country and the Western Cape Province. The number of infections in the City started peaking earlier than anticipated towards the end of May 2020. As at 28 June 2020 the city reported a total number of infections of 45 856 with 4 001 infections reported in that week. During the same period, the City reported a total number of 277 deaths as a result of the COVID-19 pandemic. The dashboard below provides all the details.

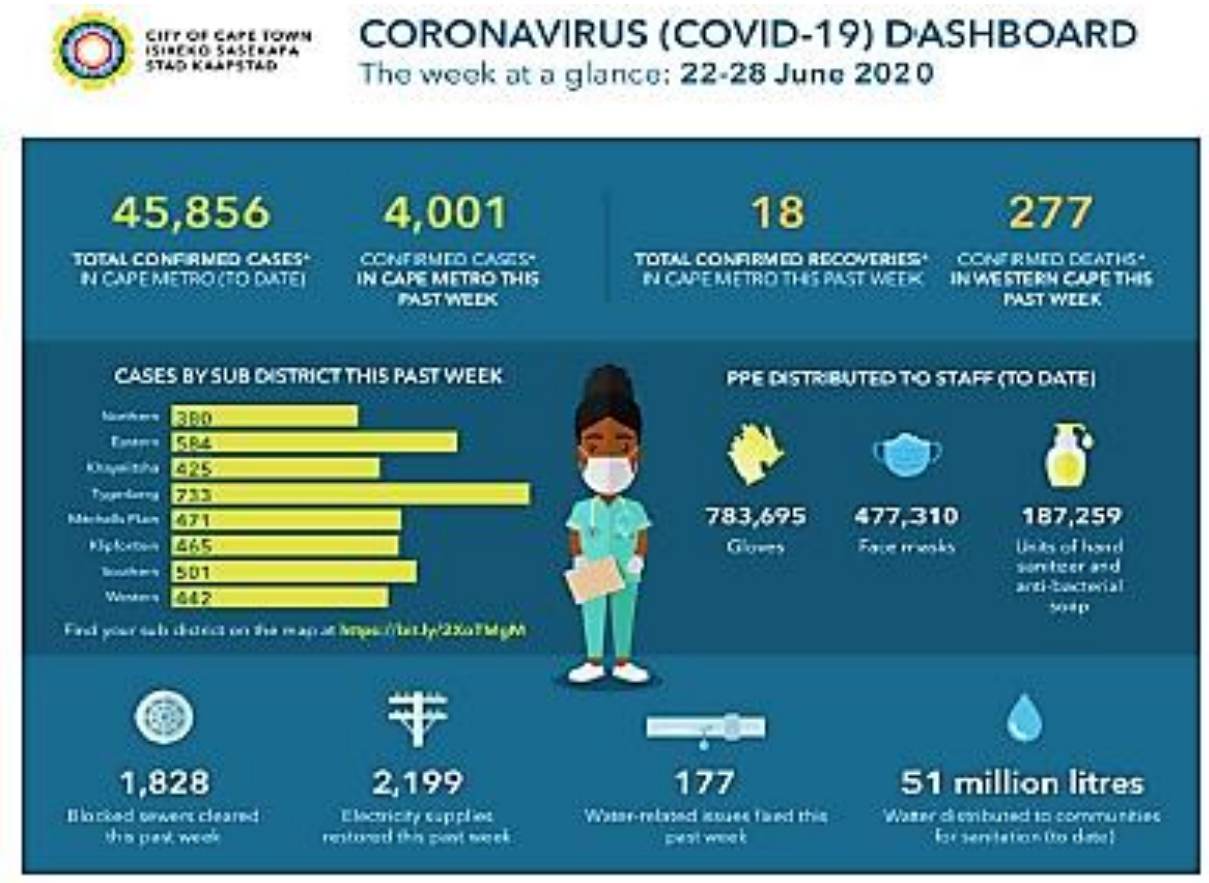



**Figure 9-3: Corona Virus Cape Town Stats**

The Council for Scientific and Industrial Research (CSIR) in collaboration with Albert Luthuli Centre for Responsible leadership developed a set of COVID-19 Vulnerability Indicators using available data. The Vulnerability Index identifies vulnerabilities present in communities and identifies areas in need of targeted coordinated interventions and early response. The purpose of the indicators is intended to support the early prevention/mitigation and preparedness phase of the disaster management cycle and informing disaster

management decision making. The Index is not based on epidemiological modelling but a response that will highlight intervention areas due to underlying situations. The composition of the index follows two main factors, namely: transmission potential and health susceptibility.

Transmission potential areas identifies areas that prevent social distancing to be practiced and were limitations of practicing good basic hygiene. The health susceptibility index denotes areas where large number of people are potential more susceptible to being adversely affected by COVID-10 due to factors such as age and underlying health conditions. The City of Cape Town vulnerability profile is presented in the map below. The map shows low vulnerability areas (blue dotted areas) versus areas with higher vulnerability (red dotted areas).

Consistent with vulnerability (including poverty and unemployment), limited access to healthcare, and population density, the following areas are most vulnerable and they are; Gugulethu, Kayelitsha, Mitchells Plain, Macasar and DuNoon. Most of these areas have been identified as hotspots in the sub-districts of the city as indicated in the table below.

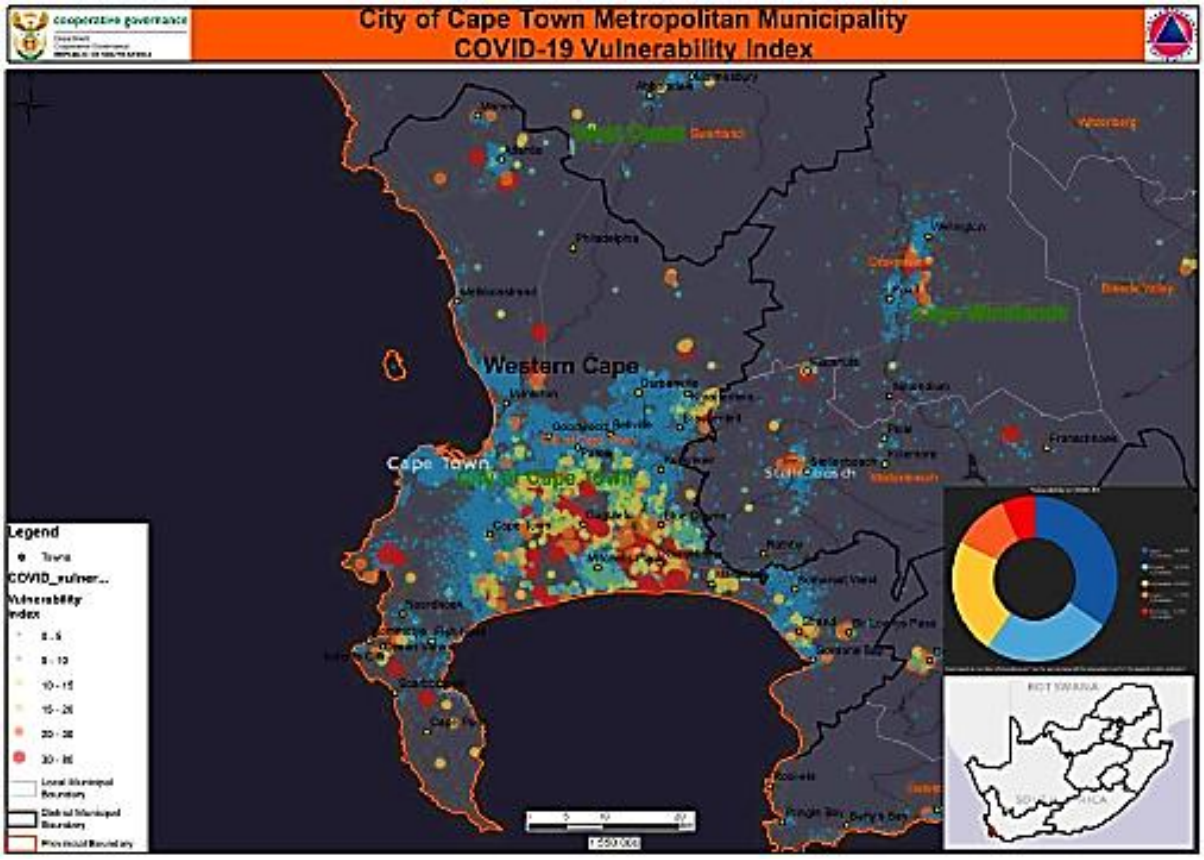



**Figure 9-4: Vulnerability Index Map**

The Vulnerability Index Map above, the table below shows a positive correlation on the hotspots that the City has identified in various sub-districts. The City of Cape Town created overflow facilities in their clinics. Certain services will be transferred from clinics to transfer facilities to facilitate social distancing and create the space

required for healthcare of staff to manage COVID-19 cases. The Health Unit in the City is finalizing preparations for the first 20 overflow facilities in clinics. At the end of this project, at least 80 clinics will have been retrofitted in keeping with the COVID-19 preparedness plan. The overflow facilities are either prefabricated structures on clinic premises, or community halls in close proximity will be used. The first phase will result in 153 additional consulting and/or treatment spaces across the 20 clinics.

The figure below illustrates that majority of fatalities in the Western Cape are aged between 61 and 70 years of age.

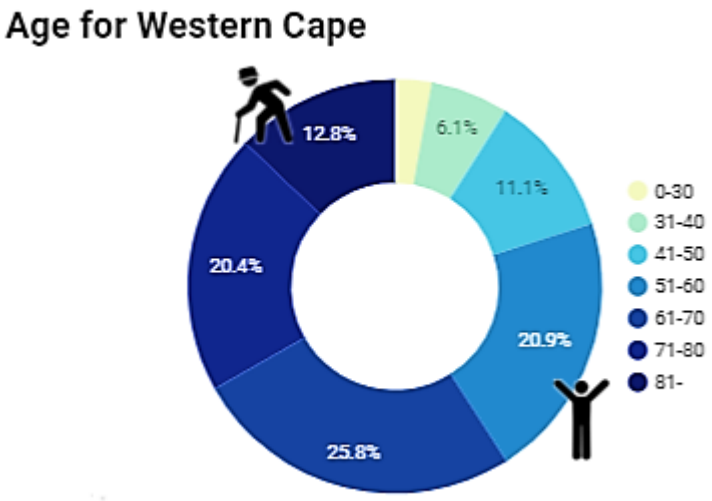



**Figure 9-5: Fatalities in Cape Town Metropolitan Municipality**

## 9.8 Safety and Security

### Crime

The actual number of selected types of crime have been grouped into the 62 police precinct boundaries of the City of Cape Town. The City of Cape Town area has 62 police stations, including Samora Machel Police Station which is a new police station in the Nyanga cluster in Cape Town.

The following categories of crime: Violent Crimes, Property-related, Commercial crime and Drug- Related and Driving under the influence of alcohol or drugs are presented in the figure below. Violent, confrontational crimes include: murder, attempted murder, total sexual crimes (including rape and indecent assault), assault with intent to inflict grievous bodily harm (violent assault), common assault, robbery with aggravating circumstances (violent robbery) and public violence. The property-related crime refers to crimes in which property is stolen without the use of violence or force (i.e., no direct confrontation between perpetrators and victims), and includes the following crime categories: burglary at non-residential premises, burglary at residential premises, common

robbery, theft of motor vehicle and motorcycle, theft out of or from motor vehicle and motorcycle, and all theft not mentioned elsewhere.

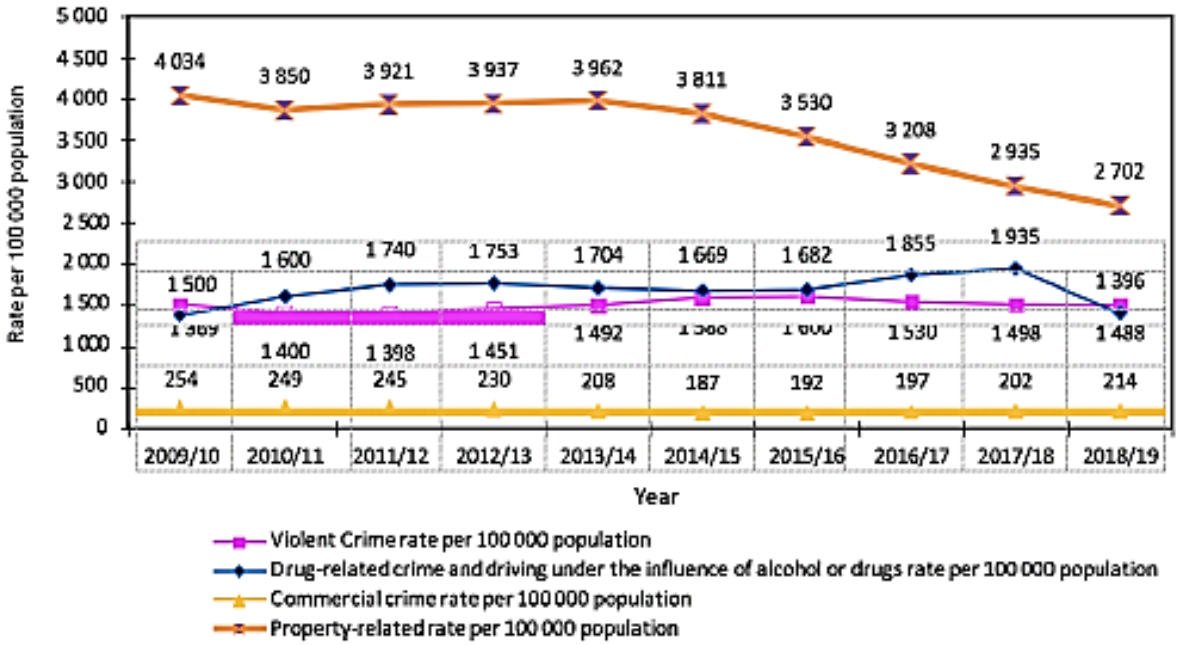



**Figure 9-6: Crime statistics for the City of Cape Town between 2009 and 2019**

The top 12 police precincts, accounted for over 40% of all reported crimes in Cape Town in 2018/19. The top five police precincts that account more than half of this (21.93%) were Cape Town Central (5.61%), Mitchells Plain (5.52%), Kraaifontein (3.88%), Delft (3.59%) and Nyanga (3.33%).

### Murder

In the City, the murder of factual murders decreased from 314 in 2018/2019 to 308 in 2019/202. This amounted to a decrease in the murder rate from 70 occurrences per 100000 people to 67 (3.9 %). The City's murder ate was in 2019/2020 higher than any other municipal area in the province .in comparison, The murder rate for the province was 57 in 2019/2020.

### Sexual Offences

The rate of sexual offences in South Africa is amongst the highest in the world. Sexual offenses in the city increased by 4.4 % from 92 occurrence per 100000 people in 2018/19 to 96 in 2019/20.This was the lowest sexual offences rates amongst the various district so of the Western Cape. Across the same period, the Western Cape sexual offences rate increased from 10 occurrences per 100000 people in 2019/20 to 104 in 2019/20

### Drug-related Offences

Driving Under the Influence (DUI)

A total number of 7610 cases of driving under the influence (DUI) of alcohol or drug were registered in the City in 2019/20.Expressed per 100000 people, the DUI rate for the City was 165 occurrences in 2019/20. This total, which amounts to a decrease of 10.2 % since 2018/19. Was lower than the Western Cape as whole (176) and also the second and lowest amongst all the other districts with 100 cases per 100000m people, the Cape Winelands District had the lowest DUI rate. The Central Karoo District had the highest DUI amongst the various district in 2019/20 with 323 occurrences. Road-user fatalities in the City increased from 740 in 2018/19 to 835 in 2019/20.

### Residential Burglaries

Residential burglaries in the city decreased sharply between 2018/19 and 2019/20. Infact, a total of 2589 fewer burglaries were recorder in 2019/20. The burglary rate per 100000 people subsequently decreased by 13.7 % to 415 in 2019/20. This was the largest decline in residential burglaries amongst the various districts. For the Western Cape as whole the Burglary rate declined by 10.2 % to 515 occurrence per 100000 people.

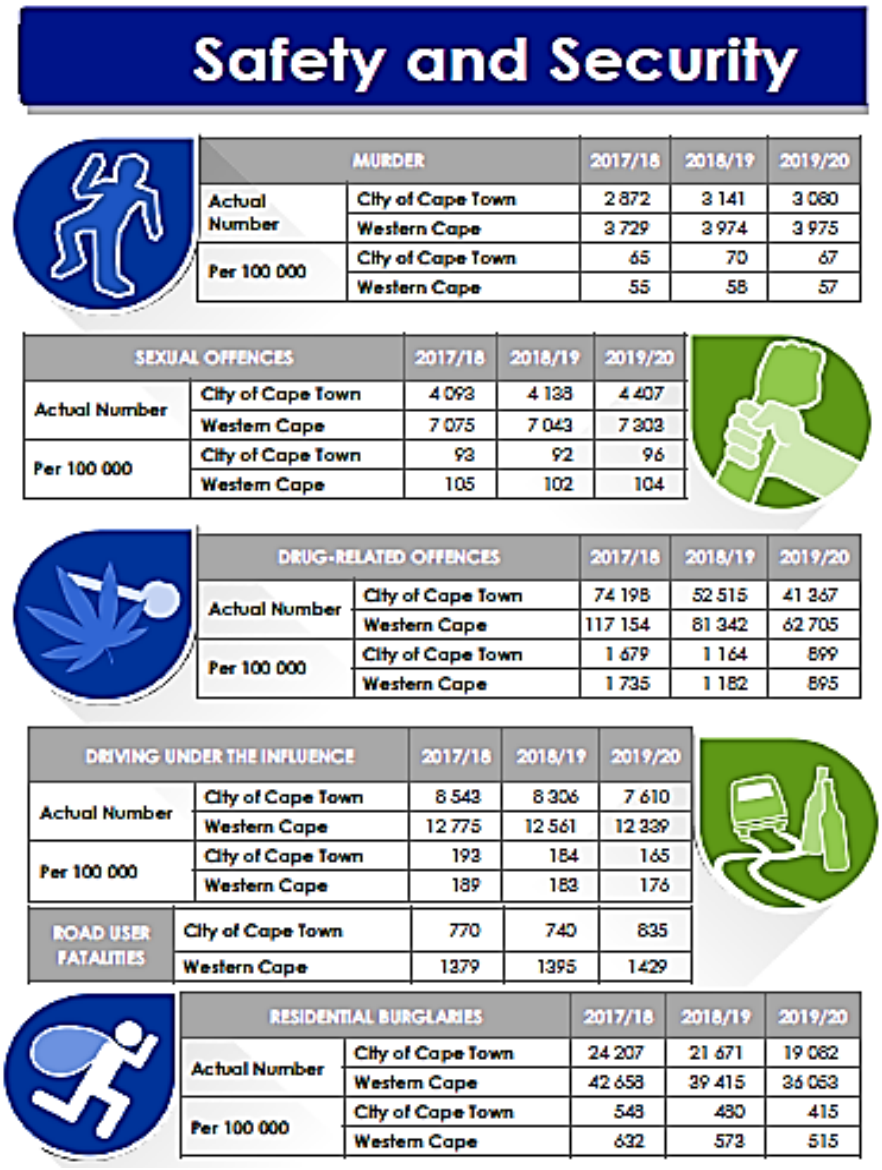



**Figure 9-7: Cape Town Safety and Security Fact Sheet**

## 9.9 Trends in leading causes of death by age

### 9.9.1 Under 5 Years

Preterm birth complications are the chief causes of death, followed by lower respiratory infections, diarrhoeal disease, sepsis/other new-born infectious, birth asphyxia, congenital heart anomalies, other perinatal conditions, diarrhoeal diseases, other respiratory (4 other congenital abnormalities and septicaemia being the least with 3.3%

### 9.9.2 15–24 Years

Tuberculosis and HIV and AIDS remained the leading causes of death in this age group. Accidental threats to breathing replaced lower respiratory infections as the third leading cause of death, followed by interpersonal violence. Diarrhoeal diseases and road injuries both moved down one position, while mechanical forces moved up. Meningitis/ encephalitis remained the same, and epilepsy replaced drowning in 10th position.

### 9.9.3 25–64 Years

Tuberculosis, HIV and AIDS accounted for over 45% of deaths in this age group, followed by lower respiratory infections, cerebrovascular disease and diarrhoeal diseases. Diabetes mellitus, hypertensive heart disease and asthma still featured in the top 10 causes of death, while meningitis/encephalitis dropped out and interpersonal violence moved in.

### 9.9.4 65 years and older

Cerebrovascular disease, hypertensive heart disease, ischaemic heart disease, diabetes mellitus, lower respiratory infections and TB remained the leading causes of death. Asthma dropped from seventh to 10th position, while nephritis/ nephrosis, chronic obstructive pulmonary disease and diarrhoeal diseases all moved up.

## 10 Potential Human Health Impacts

Cremation is normally fuelled by gas ( LPG for the Platinum Pride Project in particular) and will produce emissions associated with fossil fuel combustion as well as emissions related to the material being combusted.3,4 This can include:

- Combustion gases: carbon monoxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO2) and volatile organic compounds (VOC);
- Particulate matter and fine dust: PM10 and PM2.5;
- Organic pollutants: Compounds resulting from incomplete combustion processes or formed when organic compounds react with chlorine in materials such as plastics. These pollutants can include polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) and polycyclic aromatic hydrocarbons (PAH) amongst others;
- Heavy metals: Mercury (Hg) arising from volatilization of Hg in dental amalgam in fillings and a small quantity of various metals in tissues of the individual, or personal memorial items included in the casket.

The pollutants of most concern are those known to be toxic to humans and which can bioaccumulate in tissues (e.g., PCDD/Fs and Hg) as well as fine particulate matter (PM2.5), which can negatively impact the heart and lungs and is associated with some chronic illnesses and adverse birth outcomes. Evidence on the release of

radioactive particles, following cremation of deceased patients who had been treated with radioactive substances (e.g., cancer treatments) has not been widely studied but has been raised as an emerging area of public interest and concern.

Compared to other types of incineration facilities, such as municipal garbage incinerators or industrial operations, crematoria are typically regarded as small-scale installations with comparatively low overall emissions.

The relative contribution of each crematorium to local air pollution will vary depending on other potential sources of pollutants nearby, the quantity and kind of cremations, the makeup of the remains, the system's design, the cremator's operation, and emissions control measures.

**Table 10-1: Factors affecting the level of possible emissions from crematoria**

| | |
|---|---|
| **The composition of the casket and remains** | • The initial combustion temperature, the time period (1.5 to 5) over which emissions are generated, and the overall amount of emissions are all influenced by the size of the corpse.<br>• The presence of mercury (Hg)-containing dental amalgam fillings has an impact on 0.13 mercury emissions. Which may contains up to 0.5 g of mercury per filling, some of which may volatilize and be released into the environment.<br>• The likelihood of fine particles and organic pollutants (such Polycyclic aromatic hydrocarbons (PAHs) and Polychlorinated Dibenzofurans PCDDs) forming in the combustion chamber can be increased by plastic or polystyrene components in the funeral coffin or personal or commemorative objects contained in the casket.<br>• PCDD can be found in burial coffins that have been treated with pesticides or preservatives. Less hazardous compounds are released from caskets composed of untreated wood, cardboard, and similar materials<br>• Low quantities of radiation or radioactive particles could be present in the combustion chamber due to the existence of radioactive materials in the remains, |
| **The design of the system** | • A cremator containing two combustion chambers enables high-temperature treatment of gases and particles, which lowers emitted odours, fine dust, and incomplete combustion products like PCDD.<br>• The distribution and dilution of emissions into the atmosphere as well as their dispersion at ground level can be impacted by chimney height.<br>• Older equipment may be more prone to failure as they are less likely to be equipped with modern process controls and monitors |

| | |
|---|---|
| **Operational parameters of the cremator** | • In the initial phases of cremation, low start-up temperatures may result in incomplete combustion, which can emit particles or products of incomplete combustion (PICs).<br>• As well as ensuring there is enough oxygen for combustion, high temperatures (e.g. >850°C) and long residence times (2 s) for gases in the second chamber can minimize the amount of PICs emitted.<br>• Operators can be alerted of operational issues by modern technology with process controls and constant monitoring of pollutants. High quantities of carbon monoxide (CO) can signal poor combustion and the potential for PIC production.<br>• Lack of monitoring may make it impossible to spot human error or equipment malfunction, which could result in the inadvertent release of pollutants. |
| **Emissions control measures** | • Key pollutant emissions can be reduced through flue gas treatment, acid neutralization, activated carbon adsorption, dust collection, and good operation and maintenance procedures.<br>• Emissions of fine particles and PCDD can be reduced by taking steps to minimize dust emission.<br>• Equipment for lowering Hg emissions, such as activated carbon filters, scrubbers, and systems that bind or precipitate Hg, are effective in reducing mercury emission<br>• It is less socially acceptable and more difficult to impose, but removing dental amalgams before cremation can remove mercury at the source in a way that is both economical and environmentally beneficial. |

**Table 2** Environmental Health Areas (EHAs)

| Environmental Health Areas (EHAs) | | |
|---|---|---|
| 1 | Vector-related diseases | Any facility at which organic waste is handled and/or treated has the potential to attract pests, including insects and vermin. The presence and concentration of pests is a factor of the design of the facilities, as well as the operation, management and maintenance of facilities. Climatic conditions also play a role in promoting or limiting pest proliferation. Rat populations thrive where there is human activity. |
| 2 | Acute respiratory infections and health impacts from crematoria emissions | PCDD, mercury, and fine particulate matter (PM2.5)are the contaminants from crematoria emissions that are of most concern when it comes to toxicity to human, as exposure to may reach deep into the lungs, can aggravate other illnesses like diabetes and raise the risk of heart disease, lung cancer, asthma, and affect pregnancies. |
| 3 | Veterinary medicine and zoonotic issues | No zoonotic issues were identified during literature research. It is however, important to remain cognizant that an increase in domestic animals may increase the risk for zoonotic diseases. |
| 4 | Sexually-transmitted infections, including Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome (HIV/AIDS) | No anticipated impacts |
| 5 | Soil-, water- and waste-related diseases | No anticipated impacts as there will not e and burial activities |
| 6 | Food- and nutrition-related issues | No anticipated impacts |
| 7 | Accidents/injuries | Work related accidents and injuries which can be avoided through the implantation of safe work procedures. |

| Environmental Health Areas (EHAs) | | |
|---|---|---|
| 8 | Exposure to potentially hazardous materials, noise and malodours | Studies have shown no relation between occupational exposure of dust mercury and radiation exposures and adverse health impacts. Exposure to fine particles may occur, especially when there are no operational or engineering controls to prevent exposure to dust, and exposure to mercury has been found to be higher among crematoria employees than in the general population. |
| 9 | Social determinants of health | Stress, depression and grieve |
| 10 | Cultural health practices | Roles of traditional medical providers, indigenous medicine ad unique health practice |
| 11 | Health systems issues | Physical health infrastructures and program management delivery systems |
| 12 | Non-communicable diseases | Cardiovascular diseases (like heart attacks and stroke), cancer, chronic respiratory diseases (such as chronic obstructed pulmonary disease and asthma) and diabetes. |

## 10.1 EHA #8 Exposure to Potentially Hazardous Materials, Noise and Malodours

### 10.1.1 Noise

Noise is also a factor to consider and the health impacts of noise are well described at both a physical and psycho-social level in the Noise Impact Assessment. Noise is noted as potential environmental risks due to the nature of the Project's construction phase/ activities. The WHO published a set of guidelines relating to community noise, including potential sources, quantification and potential effects (WHO 1999). Potential health effects identified include hearing loss or loss of hearing sensitivity, sleep disturbance, cardiovascular and physiological effects, mental health effects and behavioural effects, including poor performance by school children (Stansfield and Matheson 2003, WHO 1999, Health Evidence Bulletins 1999). Environmental noise has also been found to be responsible for interference with communication, cognitive performance and annoyance (Stansfield and Matheson 2003, WHO 1999). Stansfield and Matheson (2003) concluded that the effects of environmental noise are strongest for categories linked to quality of life (or the wider determinants of health in the context of HIA) as opposed to illness (or bio physical factors).

From an occupational health perspective, noise-induced hearing loss (NIHL) begins gradually and progressively gets worse. Problems with this disease include loss of the ability to communicate and reduced response to

environmental and occupational noise and danger. Bise (2001) listed several factors that influence occupational hearing loss. These factors include the following:

- Age of employee.
- Pre-employment hearing impairment.
- Diseases of the ear.
- Sound pressure level of the noise.
- Length of daily exposure.
- Duration of employment.
- Ambient conditions of the workplace.
- Employee lifestyle outside the workplace.

The physical effect of hearing loss and impairment due to noise exposure is not a community health risk but will certainly be an important workplace occupational health consideration. The noise levels required to induce hearing loss only occur at levels above 85 dB(A) which would be intolerable for any community. Noise annoyance can however lead to stress-related impacts on health and general well-being and may also have an influence on mood, performance, fatigue and cognition. Sleep can be disturbed by noise levels as low as 35 dB(A).

### 10.1.2 Air Quality

Local communities may already be exposed to low background levels of potentially hazardous materials (e.g., dust, particulate matter, heavy metals) that can be associated with health problems such as respiratory illnesses, skin diseases, organ damage, circulatory problems, birth defects, cancers and neurological disorders.

The negative health effects of dumping sites are wide-ranging though not extensively documented. Many health effects can be directly correlated with toxic agents released into the soil, air, and groundwater by dumping, but are also related to the social environment of Gauteng, including limited economic opportunities.

Exposures and environmental health determinants as a result of the project will be covered in a number of specialist reports. These include air quality, water, noise and soil studies. Air quality and odours have been addressed in detail in the Air Quality Report.

#### *10.1.2.1 Particulate Matter*

Diesel particulate emissions are of special concern, particularly the size fraction up to 2.5 microns, known as $PM_{2.5}$. This size of particle is able to be respired deep into the lungs. PM2.5 from all sources has been implicated in numerous diseases ranging from cardiopulmonary disease to cognitive decline to cancer.

The deleterious impact on human health is incontrovertible (WA DOE 2008, California Air Resources Board 1998). Diesel engines are of particular concern as sources of particulate matter, as they typically produce $PM_{2.5}$ at a rate about twenty times greater than from gasoline (petrol) engines (WA DOE 2008, California Air Resources Board 1998).

#### *10.1.2.2 Health Impacts of PM: Cancer*

Studies show an association between exposure to diesel exhaust and lung cancer (Bhatia, 1998), as well as cancers of the bladder and soft tissues (Guo et al., 2004). Several extensive and detailed reviews have been conducted on the body of literature relating long-term exposure to diesel exhaust particles and lung cancer (California EPA, 1998; USEPA, 2002; Cohen and Nikula, 1999). In addition, over forty studies conducted among those populations exposed to diesel exhaust have found increased rates of lung cancer associated with diesel exhaust particles exposure (as cited in Cohen and Nikula, 1999). Occupational studies conducted in railroad workers and truck drivers have consistently found increased lung cancer risk, even after adjusting for comorbidities such as smoking (Bofetta, 2001). The impact of PM on cancer risk must be considered in the decision-making process for the proposed Housing Development.

#### *10.1.2.3 Health Impacts of PM: Cardiac and Pulmonary*

Although cancer risk is understandably of great concern to the public, cardiac and respiratory effects of diesel exposure have an even larger public health impact because they cause death and illness for a greater number of people. PM can exacerbate asthma and emphysema, induce heart attacks and strokes, and has been associated with congenital heart abnormalities. According to a landmark study by Pope et al (2002), each 10 ug/m3 increase in PM was associated with a 6% increase in cardiopulmonary mortality. In a follow-up to this study, Pope et al (2004) demonstrated that their previously observed increase in cardiopulmonary mortality was largely driven by increases in cardiovascular, as opposed to pulmonary mortality. In this follow-up study, a 10 ug/m3 increase in PM2.5 was associated with a 12% increase in mortality due to 'all cardiovascular disease plus diabetes' and an 18% increase in mortality due to 'ischemic heart disease'. Further epidemiological investigations have revealed that these estimates are likely largely underestimating the effect of $PM_{2.5}$ due to inadequate exposure characterization. Published in the New England Journal of Medicine, Miller et al. (2007) utilized a novel exposure characterization method and reported from the Women's Health Study that a 10 ug/m3 increase in $PM_{2.5}$ was associated with a 76% increase in death due to cardiovascular disease.

It is well understood that ambient air pollution and fine ambient particulate matter strongly contribute to disease burden and death, but it has been less clear as to how much an individual's living proximity to a major roadway or direct PM2.5 source influences health risks. An individual's exposure to $PM_{2.5}$ is dependent on where he/she lives and works and that this strongly influences health outcomes. Van Hee et al. (2009) demonstrated that living close to a major roadway was a strongly associated with left ventricular hypertrophy, an important marker of

cardiovascular disease and a strong predictor of heart failure and mortality. Additional work by this group has demonstrated an individual's exposure to PM2.5 impairs how well blood vessels dilate and how well the heart functions, providing a basis for our understanding of previously observed increases in mortality (Van Hee et al. 2011, Krishnan et al. 2012).

There are very specific physiological effects with PM exposure. A recent study by Cosselman et al (2012) showed that diesel exhaust exposure, to healthy human volunteers, rapidly increases systolic blood pressure (SBP). In their study, SBP increased within 15 minutes of being exposed to dilute diesel exhaust and reached a maximum increase in SBP within one hour. Additional work utilising controlled diesel exhaust exposures to human volunteers has revealed that these acute exposures results in impairment in blood vessel function and alters blood coagulability[3], both of which are extremely deleterious effects and increase the risk of acute cardiovascular events such as heart attack and stroke (Mills et al. 2005, 2007, and Törnqvist et al. 2007). Fitting with these findings, epidemiological investigations have consistently demonstrated that acute increases in $PM_{2.5}$ result in an increased risk of heart attack (Peters et al. 2001).

In addition to cardiovascular risk, cerebrovascular effects and risk of stroke associated with $PM_{2.5}$ exposure has been investigated. Research published in the Archives of Internal Medicine (2012) examines, for the first time, the risk of acute, short-term exposures to $PM_{2.5}$ as a key factor in triggering stroke, often within hours of exposure.

**Table 10-3: Short-term and long-term health effects associated with exposure to PM (after WHO, 2000).**

| Pollutant | Short-term exposure | Long-term exposure |
|---|---|---|
| Particulate matter | • Lung inflammatory reactions<br>• Respiratory symptoms<br>• Adverse effects on the cardiovascular system<br>• Increase in medication usage<br>• Increase in hospital admissions<br>• Increase in mortality | • Increase in lower respiratory symptoms<br>• Reduction in lung function in children<br>• Increase in chronic obstructive pulmonary disease<br>• Reduction in lung function in adults<br>• Reduction in life expectancy<br>• Reduction in lung function development |

[3] Coagulation (also known as clotting) is the process by which blood changes from a liquid to a gel, forming a blood clot. It potentially results in haemostasis, the cessation of blood loss from a damaged vessel, followed by repair.

#### 10.1.2.4 Mercury

Mercury occurs in the environment as a result of natural processes (e.g., volcanic outgassing) and human activities like mining and burning of fossil fuels

Metallic (elemental) mercury, inorganic compounds, and organic compounds are the three different types of mercury that can be found in the environment. One of the biggest public health concerns is exposure to mercury and its compounds. The degree of toxicity varies according on the types of mercury, exposure levels, and exposure routes (Piagno & Afshari, 2020)

Dental amalgam also contains elemental mercury, which contributes to its beneficial qualities and makes up around 50% of the amalgam mixture.

#### 10.1.2.5 Health Impacts of Mercury

Acute exposure to high concentrations of elemental mercury vapour, such as workers who were exposed to 0.79 mg/m3 for 1.5 years, 0.9 mg/m3 for over 5 years, and 0.014–0.076 mg/m3 for over 15 years, or in cases that are exposed for a longer period such as in occupational settings, may be followed by chest pains, dyspnea, coughing, hemoptysis, and sometimes interstitial pneumonitis leading to death (Piagno & Afshari, 2020).

Due to the long-term low-dose exposure, crematoriums are sources of air pollution, particularly mercury emissions, which have the potential to have subtle, chronic health consequences. From a health standpoint, describing the type and intensity of the evidence of causation and dose-response evaluation are required

It has been found that mercury emissions from crematoriums account for an insignificant percentage of the total emissions in the atmosphere. A risk assessment revealed no evidence that ground-level exposure to elemental mercury vapour from crematoriums posed a serious danger to human health (Piagno & Afshari, 2020).

### 10.1.3 Odour

An odour can be due to a single chemical species in the air; it can be due to a dominant odorous chemical species among many other essentially non-odorous substances; or it may be a mixture of several or many substances, some or all of which may be odorous. Some odours are more unpleasant than others and have more potential to cause offence or nuisance (DEFRA, 2006).

Foul odour may be emitted at the crematorium due to continuous incineration of organic matter. The problem is intensified if proper mitigation measures are not adopted. Odour is also emitted at the collection points if quick removal of wastes is not practised. Spreading of the waste in the area adjacent to the dustbin due to activity of ragpickers cause degradation of aesthetic quality. Uncontrolled disposal and open burning of wastes at the landfill sites create poor vision.

Odour nuisance may be mitigated through the use of a separation distance between the odour source and residential areas. According to Schauberger *et al*. (2012), different governments have different rules and ordinances, yet there is a current global trend showing the implementation of major community involvement, individually and as a whole, in regulatory steps. This trend can be seen in regulations being proposed and promulgated in Europe, Australia, and North America (Frechen, 2003). The determination of the buffer area is necessary in many situations to avoid or minimise the potential for land use conflict. While not replacing the need for best practice approaches to emission management, the use of buffers is a useful tool in achieving an acceptable environmental outcome (Moja and Mnguni, 2014).

The basic principles for odour control in wastewater and sludge treatment facilities (Rappert and Muller, 2005a) are notably:

- The reduction of odours at the generation sources; and
- The removals of odours from collected gaseous streams before the odours are discharged into the atmosphere.

Control of odours from the source was identified as an important option for solving odour problems which should involve discovering the source, measuring the odour emissions and identifying the component odorous compounds. Odour control measures at crematoriums should include containment strategies (such as physical, biological and chemical treatment of captured odorous gases), influencing process conditions and application during the cremation process.

Sakawi *et al*. (2011) indicated that weather is one of the environmental components which influence the frequency and the intensity of odour perceived by sensitive receivers. The influence of weather such as wind direction and wind speed, temperature and rainfall can all affect the concentration of odour from the crematoium. Odour, however, is not expected to be a considerable nuisance for the proposed crematorium.

## 11 Mitigation Measures

### Workers in a crematorium

According to Cui et al., (2021) cremators, incinerators, and post-processing devices are all installed in cremation workshops and operated indoors. Consequently, a large quantity of unorganized odour emissions accumulates inside the workshop and impact the health of the workshop staff. Several studies have highlighted the potential risks of inhaling radioactive ashes by crematorium staff or members of the public. Due to the prolonged half-life of some radioisotopes, if the patient dies soon after implantation, then the cremated remains would also remain radioactive (Smith *et al*.,2012). This causes a hazard to the staff and those who handle the remains, until placed into a metal urn. Pacemakers and expandable orthopaedic nails are also two potential dangers to cremation staff. Studies conducted by Korczynski (1997) and Maloney et al., 1998) exposure to Hg to be higher amongst

crematoria staff than in a control population, and exposure to fine particulates may occur, particularly where there are no operational and engineering controls to reduce exposure to dust.

### Mitigation measures

Mitigation measures (O'Keeffe, 2020);

- Minimum furnace temperature (850 °C), residence time in the second chamber (2 seconds for combustion gases) and enough air to ensure combustion in the second chamber and avoid generating products of incomplete combustion;
- Suitable air pollution control equipment, which could include temperature controls, dust control, carbon injection, fabric filtration, air tightness of combustion chambers and casings;
- Monitoring of gas temperature and flue gas $O_2$ and CO concentrations, application of relevant emission limit values and additional monitoring, including ambient monitoring of soil and air in the proximity of crematoria;
- The presence of PVC, metals and other contaminants (particularly chlorine compounds) in the coffin material and furnishings should be avoided to reduce the generation of persistent organic;
- Use of waste-derived or other fuels potentially contaminated with persistent organic pollutants should be minimized
- Operational controls, inspection and preventive maintenance;
- Sealed furnaces are essential to contain fugitive emissions while permitting heat recovery and collecting off-gases for abatement or discharge;
- Particulate matter should be removed to reduce PCDD/PCDF emissions to atmosphere (although they will be discharged to landfill);
- All crematorium staff involved in such a case should wear a mask and rubber gloves when handling the cremated materials, all cremated remains should be put in a metal urn, any unwanted radionuclides should decay in storage for 20 months before being discarded, and remains should not be scattered until 20 months after the date of implantation;
- Other good practice measures to protect crematoria workers, such as removal of radioactive implants before cremation, informing crematoria workers of recent radiotherapy treatments for deceased patients, and safe handling practices for ashes, can also reduce possible environmental releases of pollutants.

**Table1: Measures for pollutants of most concern from crematoria emissions (O'Keeffe, 2020)**

| Control Measure(s) | Pollutants | | | |
|---|---|---|---|---|
| | PCDD/Fs | Hg | $PM_{2.5}$ | Radioactivity |
| **Source Control** | | | | |
| Removal of plastics | | | | |
| Non-toxic and eco-friendly coatings or materials in caskets | | | | |
| Removal of Hg fillings | | | | |
| Removal of medical devices containing radioactive material | | | | |
| **Operational Control** | | | | |
| Minimum 850°C ($2^{nd}$ chamber) | | | | |
| Minimum residence time of 2 s ($2^{nd}$ chamber) | | | | |
| Adequate $O_2$ in combustion chamber | | | | |
| Monitoring CO releases | | | | |
| Air tightness of combustion chambers and casings | | | | |
| Maintenance | | | | |
| Operator training | | | | |
| **Emission controls** | | | | |
| Dust control (filters and scrubbers) | | | | |
| Activated carbon treatment | | | | |
| Hg removal technology (binding, precipitation etc.) | | | | |
| Adequate chimney height | General dispersion and dilution of pollutants higher into atmosphere | | | |

The table above indicates the measure which can help reduce emissions may be employed in order to monitor the various control on the key pollutants associated with the crematorium.

## 12 Conclusion

It is acknowledged that exposure to dangerous chemicals released by crematoriums raises concerns. Potentially dangerous pollutants produced by combustion processes include organic compounds (PCDD/Fs), mercury, and fine particles (PM2.5). However, no studies have been identified that demonstrate a relationship between crematoria emissions and adverse health impacts, despite the fact that these compounds have been linked to a variety of negative health effects.

We also acknowledge that design and operations parameters play a significant role in ensuring reduced emissions caused by the cremating processes, as such we confirm that Johnson Thermal Engineering are the designers of the JTE BA1 and BA2 Cremator Machines, locally manufactured and distributed in South Africa by Engineered Thermal Systems (PTY) Ltd, which is the machinery that Platinum Pride intend to use in the proposed Platinum Pride Crematorium Project.

The JTE BA2 Cremator Machines are designed as a starved combustion or substoichiometric primary chamber cremator, that ensures the gas velocities are reduced, resulting in lower particulate pickup.

The JTE BA2 Cremator Machines are configured to only start the cremation process if the secondary chamber is above 600°C in temperature. This ensures that during the cremation process the secondary chamber temperature will rapidly rise to control at 850°C or higher to result in complete combustion of the gases and odours before exiting the cremator stack.

The secondary chamber of the JTE BA2 Cremator Machines is designed with sufficient volume to provide 2 seconds of high temperature exhaust gas residence time, to ensure low carbon monoxide emission and total combustion of complex volatile organic compounds.

The JTE BA2 Cremator Machines is equipped with an ejector in base of the cremator stack to aid with the drafting of the cremator to maintain a slight negative pressure within the primary chamber, to ensure that no gases or noxious fumes are emitted into the cremator machine room when the door is opened.

This machinery expected to significant reduce emission and in turn reduces any health impact to the surrounding community which may occur due to the proposed Platinum Pride Crematorium Project

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