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Original Research

Priority setting for oncology in South Africa using a burden of disease approach

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ABSTRACT

Objectives: To forecast the provincial supply of oncologists in South Africa through 2030 using a health need–based approach grounded in disability-adjusted life years (DALYs), and to identify shortfalls under scenarios aimed at reducing human resources for health (HRH) inequities as highlighted in Disease Control Priorities, Volume 3 (DCP-3).
Study design: A retrospective forecasting study employing DALY-driven demand projections for oncology services in each of South Africa's nine provinces, with scenario analyses evaluating horizontal equity in HRH distribution.
Methods: Age-standardized provincial DALYs for cancer were obtained from the Institute for Health Metrics and Evaluation Global Burden of Disease (IHME GBD) estimates via the Global Health Data Exchange (GHDx). Mid-year population estimates for 2018 were sourced from Statistics South Africa. Using these metrics, we calculated DALY load per oncologist and projected oncologist requirements for 2020, 2025, and 2030.
Results: Under the best guess scenario, South Africa faces a shortfall of 47 oncologists in 2020, increasing to 97 by 2025 and 148 by 2030. The optimistic scenario yields national deficits of 77 (2020), 126 (2025), and 175 (2030). In the aspirational scenario, shortfalls climb to 138 (2020), 184 (2025), and 230 (2030).
Conclusions: The Workforce Projection Model offers a replicable framework for low- and middle-income countries to assess oncology workforce needs, optimize HRH allocation, and plan capacity development to enhance equitable access to cancer care.

1. Introduction

Cancer ranks as one of the primary causes of death in over 60% of countries worldwide according to estimates from the World Health Organization (WHO) in 2019. Within the next two decades, the burden of cancer incidence is expected to almost double to 28.4 million cases by 2040. One of the United Nation's Sustainable Development Goals for 2030, calls for a 30% reduction in premature mortality due to non-communicable diseases (NCDs), by implementing effective prevention and treatment interventions.[1] Norheim et al., maintains that an accelerated decrease in cancer mortality is essential to meet these goals.[2]

According to the Disease Control Priorities Network's (DCPN) 3rd edition of the Disease Control Priorities (DCP-3), the essential package of intervention for cancer control includes prevention of tobacco-related cancer and virus-related liver and cervical cancers; diagnosis and treatment of early breast cancer, cervical cancer, and selected childhood cancers; and widespread availability of palliative care, including opioids. Importantly, the DCP-3 emphasizes the need for the development of oncology related human resources for health (HRH) capacities to provide treatment for early stage cervical and breast cancers and other cancer types, as their cure rates are substantially higher than for more advanced cancers. Achieving the required expertise and resources for treatment can take years of steady investment in health infrastructure and human resources for health, thus low-income countries often have very basic cancer services within the public sector.[3]

Healthcare facilities that provide cancer services in LMICs are also further strained by a shortage[4–6] or absence of trained oncologists and cancer related professionals, adequate infrastructure and equipment for surgery, radiotherapy, pathology, and other laboratory testing services (e.g. breast cancer oestrogen receptor testing panels); supplies (e.g. chemotherapy drugs), geographical access to health facilities with affordable cancer services, public awareness of the availability and

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effectiveness of cancer control interventions, and data on cancer incidence and cause-of-death.[3]

Health inequities in South Africa further contribute to disparities in the quality of care available, with around 50 million South Africans (from rural areas) accessing health services from the under-funded public health system, versus the 8 million (urban population) covered by health insurance who can access well-resourced private sector healthcare delivery subsidised by the state.[7] The National Department of Health (NDoH) has implemented various measures to respond to cancer needs in South Africa. Taking a preventative approach against cancers caused by oncogenic viruses, the South African government included the hepatitis B vaccine (1999) in the national expanded program on immunization (EPI) and the human papilloma virus (HPV) vaccination program commenced in 2014.[8]

In an effort to decrease exposure to tobacco and smoking, the Tobacco Products Control Act 83 of 1993 and the Tobacco Products Control Amendment Act No. 12 of 1999 were enacted. In response to the high burden of disease among South African women, policies on breast cancer and cervical cancer were approved in 2017. The issuing of regulation 380 of the National Health Act of 2003 in 2011, formally established the National Cancer Registry (NCR) and made registration of confirmed cancer diagnosis in South Africa mandatory, leading to significant improvement in the reporting of cancer cases through the NCR. Furthermore, the Ministerial Advisory Committee on the Prevention and Control of Cancer (MACC) established in 2013, has been pivotal in promoting liaiso*n* between various stakeholders in the cancer arena. These include non-profit organizations, research and academic institutions and private health companies. MACC has also played a vital role in the development and finalization of the National Cancer Strategic Framework.[8]

However, despite these measures, there is still a need to ensure equity to reduce barriers and disparities, and a need to increase access to oncology services for the people of South Africa. This is especially important since patient access to oncological services varies significantly between South African provinces.[9] Improving cancer control capacity urgently requires an increased quality and more streamlined approach to all cancer-related services, ranging from pathology, to diagnosis, surgery, chemotherapy, radiotherapy, and palliative care.[4] Additionally, hospitals would need extensive upgrading to provide basic cancer surgical services and the development of cancer referral networks such as the National Cancer Grid of India would be highly beneficial.[10]

Currently, South Africa is facing a massive oncologist crisis, with a progressive decrease in clinical and radiation oncologists in the academic and state sector. According to the South African Society of Clinical and Radiation Oncology's 2018 annual census, the number of oncologists in the country has decreased by 25% in 2016 and 20.5% in 2018.[11] These HRH shortages are of varying intensity at provincial levels. To address these disparities, this current study was undertaken to estimate the supply, need and projected shortfalls of oncologists at the national and provincial level in South Africa according to three scenarios. These scenarios were created to reduce the existing HRH inequity within the respective provinces of South Africa.

2. Methods

2.1. Demographic profile

Ethics approval was obtained from the Stellenbosch University Health Research Ethics Committee (HREC Reference No: N21/03/022).

The main data set for this study was obtained from the registers of the Health Professions Council of South Africa (HPCSA)[12] for the professions of Radiation oncology, Gynaecology oncology and Medical oncology which includes medicine and paediatrics from 2002 until 2017 (January 2018). This database includes a list of all registered oncologists, their age, gender, race, residence, and category of practice.

Adopting the approach taken by Bhayat & Chikte,[13] the relevant data was extracted using a data collection sheet with the following variables: (i) category of health personnel; (ii) category of practice; (iii) geographical location; (iv) race; and (v) gender. The dataset was accessed, collected and analysed by a single operator and the accuracy of the dataset and the analysis was cross-checked. Data was analysed using the Statistical Package for the Social Sciences (SPSS version 22.0). A basic descriptive study design of the workforce is appropriate for the purpose of an exploratory study with the goal of interpreting data towards the workforces' ability to engage sustainable development.

2.2. Estimating and forecasting supply and need for oncologists up to 2030

2.2.1. Forecasting future supply (2018–2030)

The number of oncologists registered under each respective South African province was procured from the HPCSA database (up to January 2018). Based on past trends (from 2002 to 2017) for each province, the annual supply of oncologists was forecasted using an advanced Microsoft Excel model, which extrapolated the growth in number of oncologists from the year 2018 up to 2030 using Exponential Smoothing (ETS). Simultaneously, transition probabilities were explored by simultaneously varying all the transition probabilities in the predictive model using both their lower and upper 95% confidence limits.

2.2.2. Forecasting future need (2018–2030)

For estimating and predicting the need for specialized services of oncologists in a middle-income country like South Africa, we adopted the health need-based approach.[14] This exercise was carried out for each of the nine provinces of South Africa, based on Disability-Adjusted Life Year (DALY), as it represents 'lost year of "healthy" life' and plays a crucial role in determining the overall growth in such a resource-deficit country.

2.3. Disability-adjusted life year (DALY)[15]

DALY can be considered as one lost year of "healthy" life. The sum of the DALYs across the population, or the burden of disease, can be considered as a measurement of the gap between current health status and ideal health situation, where the entire population lives to an advanced age, free of disease and disability.

DALYs for a disease or health condition are calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition or its consequences:

$$\mathbf{DALY} = \mathbf{YLL} + \mathbf{YLD}$$

2.4. Data sources

Institute of Health Metrics and Evaluation Global Burden of Disease (IHME GBD) estimates for South Africa were obtained from the IHME GHDx website.[16] For each province, age-standardized DALYs was calculated with mid-year population estimates obtained from Stats SA 2018.[17]

2.5. IHME GHDx tool[18]

The Global Burden of Disease (GBD) provides a tool to quantify health loss due to diseases, injuries, and risk factors. Data from this tool can be used to improve health systems and eliminate healthcare disparities for South Africa. The South African Centre of Excellence in Epidemiology Modelling and Analysis (SACEMA) has been listed as a collaborating organization on the IHME GHDx website. Additionally, there are 873 datasets for the country listed on the same website. Globally, policymakers from various countries are collaborating with GBD researchers to adopt this approach for measuring their population's

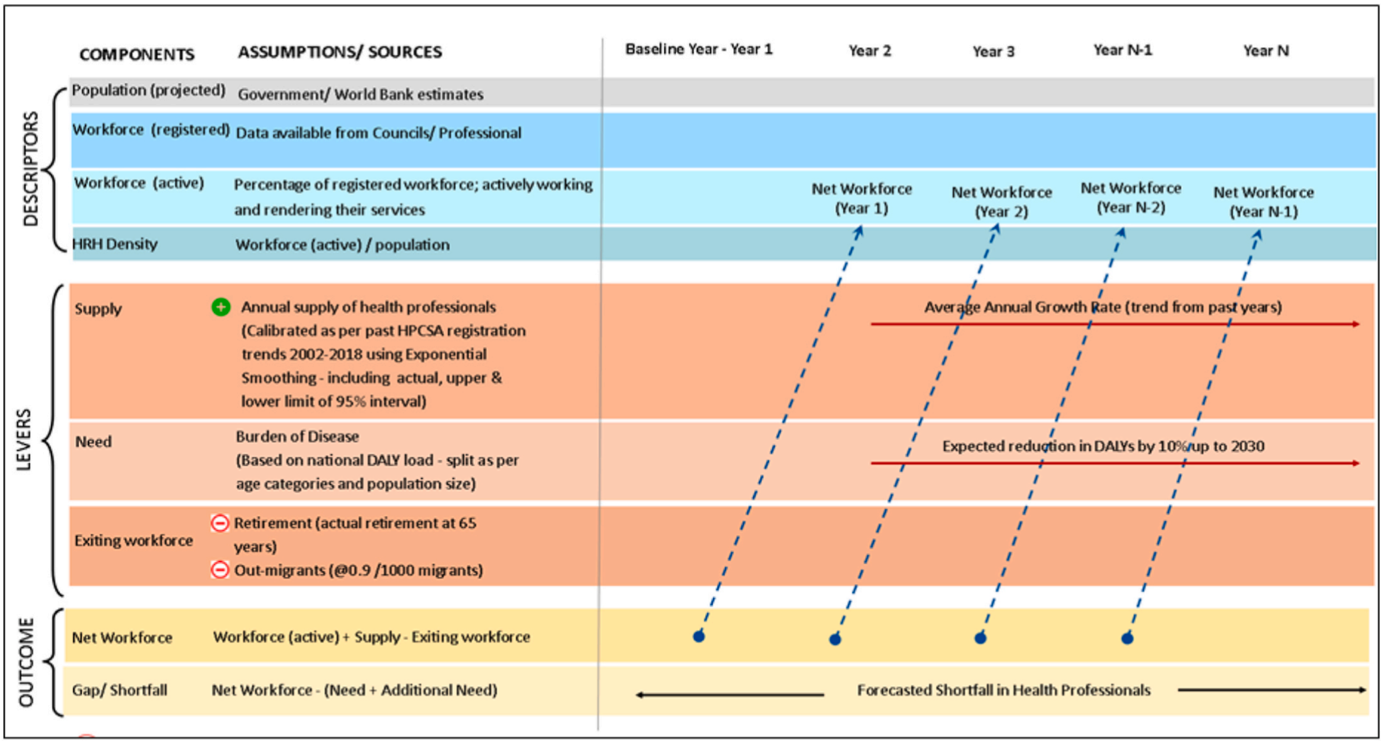

Fig. 1. Workforce projection model. This figure explains the working of the workforce projection model used for forecasting oncologists. The model mentions the calculations undertaken for each province for oncology workforce. The supply, exit factors along with need estimation has been explained. Also, it has been considered that the net workforce (active workforce + supply – existing workforce) serves as active workforce for the subsequent years. National Shortfall: To get a national picture of projected oncologists shortage based on province-based forecasts, we created three scenarios (on the basis of tertiles) to provide a roadmap for policy makers to reduce the disparity related to oncology services within provinces in South Africa.

health and how it varies by different regions, socioeconomic status, and ethnic groups.

2.6. Setting benchmarks

HRH norms from different sources and HRH density per population for different countries were available.[19,20] However, since their applicability is not standardized according to lower income countries or middle-income countries, we decided to forecast set benchmarks on the basis of DALYs per oncologist (as in different provinces in South Africa).

2.7. Need estimation

Global DALYs are projected to decline by approximately 10% in absolute numbers between 2004 and 2030.[21] Thus, it was assumed that the DALY load by 2030, the current DALY load will be reduced by a maximum of 10% in an upper middle income country (UMIC) like South Africa.[22] On the basis of this, the remaining values from 2019 to 2029 were imputed. The need for oncologists was thus estimated using the DALY load per oncologist as estimated for benchmarking with respect to geo-spatial (inter-provincial) inequity in health workforce distribution. The equity-based scenarios created for forecasting here attempt to achieve horizontal equity and to achieve an “equal treatment of all”.

2.8. Forecasting oncologists exiting workforce

We considered exiting oncologists’ numbers according to two major factors: retirement and migration. For retirement, assuming the retirement age to be 65 years for oncologists, we calculated the outflow from the year 2018 onwards up to 2030.[12] The age details of the oncologists available in the pool were available from the HPCSA database (up to 2018). For migration, the migration rate of oncologists was estimated at

Table 1
Shortfall of oncologists according to three national scenarios.

Scenarios	National Scenario
Scenario 1 - Best Guess	Business as usual
Scenario 2 - Optimistic	Last three provinces (of the last tertile) will have improved DALY per oncologist load equivalent to province at 70 percentiles (6th Rank Province)
Scenario 3 - Aspirational	Last six provinces (of the last two tertiles) will have improved DALY per oncologist load equivalent to province at 30 percentiles (3rd Rank Province)

0.9 migrant(s)/1000 population.[23]

2.9. Gap estimation

The number of oncologists currently active and working were assumed to be 95% of the total number of registrations under the category of oncologists for the baseline year 2018. For subsequent years, we estimated net workforce as:

$$\textit{Net workforce} = \{\text{Number of oncologists in health workforce (active and working)} + \text{supply of oncologists}\} - \text{exiting oncologists from workforce}$$

For subsequent years, the net workforce from previous year is assumed to be number of oncologists currently active and working. This methodology has been adopted from similar HRH forecasting studies[24,25] (Fig. 1).

2.10. National shortfall

To get a national picture of projected oncologists shortage based on

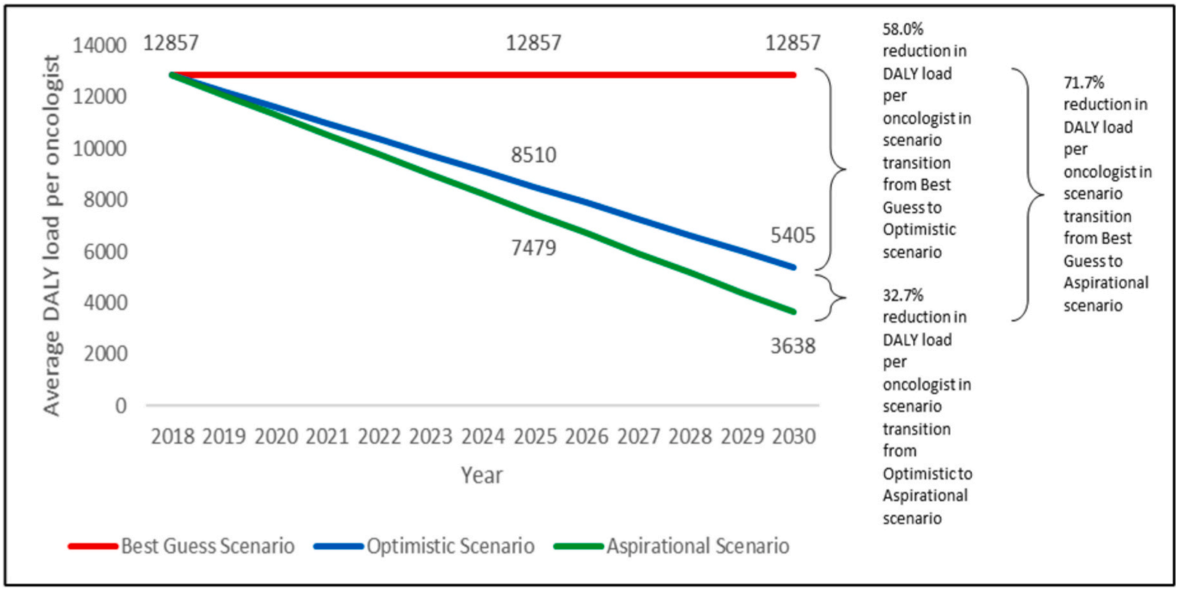

Fig. 2. Change in national average of DALY load per oncologist over years.

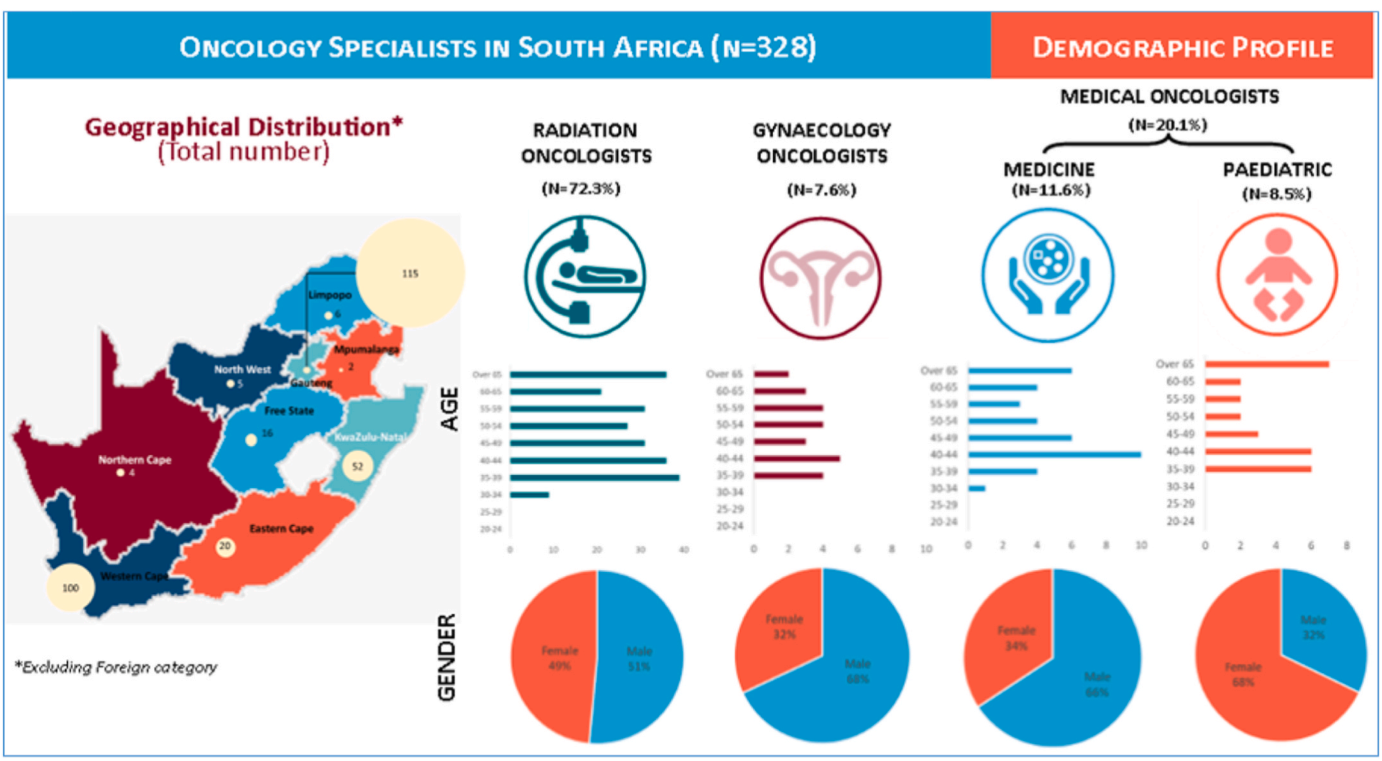

Fig. 3. Demographic Profile of oncologists in South Africa (January 2018). This infographic is the representation of demographic profile of oncology specialists (category wise) within South Africa.

province-based forecasts, we created three scenarios (based on tertiles) to provide a roadmap for policy makers to reduce the disparity related to oncology services within provinces in South Africa (Table 1).

2.11. Projected change in national average of DALY load per oncologist over years

The national average DALY load per oncologist is expected to change if there is a transition within scenarios. In the optimistic scenario, the DALY load per oncologist for the last three provinces is improved and made equivalent to province at 70 percentiles (6th Rank Province i.e. Eastern Cape), leading to a 58% average reduction in the DALY load per oncologist. In the aspirational scenario, the last six provinces will have improved DALY per oncologist load equivalent to province at 30 percentiles (3rd Rank Province i.e. Free State), leading to a 71.7% average reduction. The aspirational scenario reduced the average DALY load by 32.7% in relation to the optimistic scenario (see Table 3 and Fig. 2).

Table 2
Geographical distribution[a] of Oncologists in South African provinces (January 2018).

Category	Radiation Oncologists	Gynaecology Oncologists	Medical Oncologists		Total workforce
			Medicine	Paediatric	
Gauteng	61	11	32	11	115
KwaZulu-Natal	48	3	1	–	52
Mpumalanga	2	–	–	–	2
Western Cape	77	10	2	11	100
Limpopo	3	–	–	3	6
Eastern Cape	17	1	–	2	20
North West	4	–	1	–	5
Free State	15	–	–	1	16
Northern Cape	4	–	–	–	4
Total	231	25	36	28	320

[a] Excluding Foreign.

Table 3
Province wide - DALYs, number of oncologists and DALY load per oncologists in SA.

Province	Population	DALYs	Number of Oncologists*	DALY load per Oncologist	Percentile	Rank	Tertile	Scenario
Western Cape	6621103	145818	100	1458	11%	1	First Tertile	Optimistic; Best Guess; Aspirational
Gauteng	14717040	324117	115	2818	22%	2		
Free State	2954348	65064	16	4067	33%	3		
KwaZulu-Natal	11384722	250728	52	4822	44%	4	Second Tertile	
Northern Cape	1225555	26991	4	6748	56%	5		
Eastern Cape	6522734	143652	20	7183	67%	6		
North West	3978955	87629	5	17526	78%	7	Third Tertile	
Limpopo	5797275	127675	6	21279	89%	8		
Mpumalanga	4523874	99630	2	49815	100%	9		

*Excluding foreign category

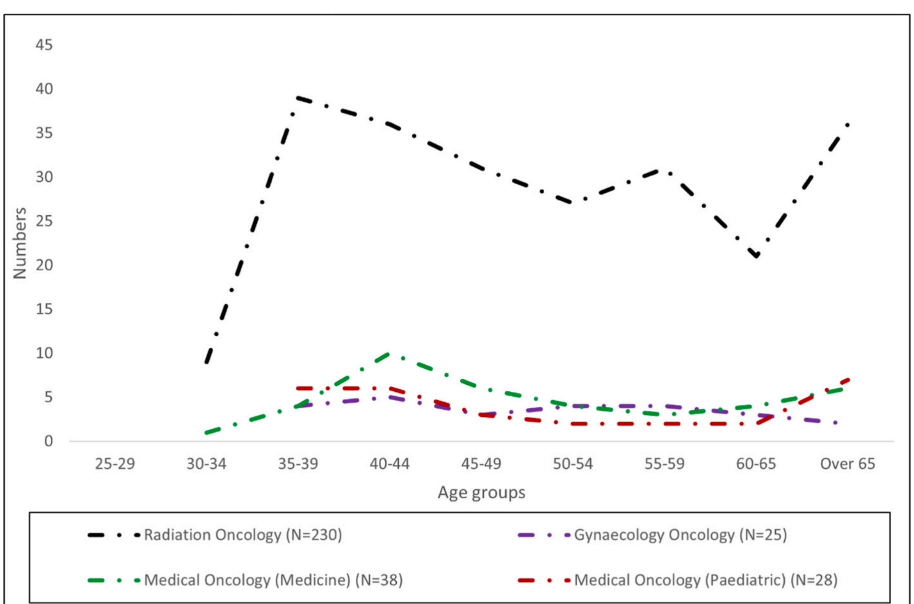

Fig. 4. Distribution of South Africa's Oncologists by age*(January 2018). * Excluding unknown and under 20 years of age.

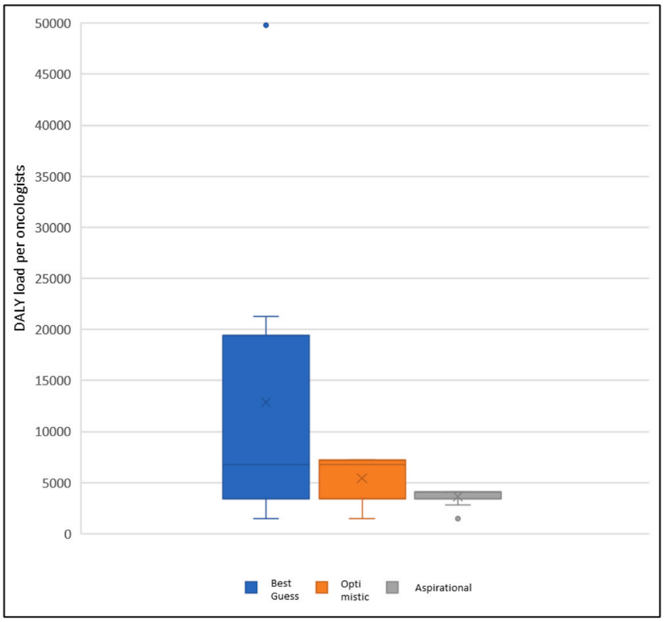

Fig. 5. DALY load per oncologist for SA in three scenarios i.e. best guess, optimistic and aspirational.

3. Results

3.1. Demographic profile

Details for registrations under the categories of Radiation oncology, Gynaecology oncology and Medical oncology (medicine and paediatrics) were analysed according to the following parameters: category of health personnel, geographical location, age, race, and gender. The demographic profile of Oncologists is illustrated as an infographic in Fig. 3.

3.1.1. Category of health personnel

According to the dataset, the workforce was calculated at 237 (72.3%) Radiation oncologists, 25 (7.6%) Gynaecology oncologists, 38 (11.6%) Medical oncologist (medicine) and 28 (8.5%) Medical oncologist (paediatrics).

3.1.2. Geographical distribution

As presented in Table 2, Gauteng has the highest number of all four categories of oncologists (115). The Western Cape follows at second place with a total of 100 oncologists across the various categories. However, geographical distribution is the poorest in Mpumalanga,[2] Northern Cape,[4] North West[5] and Limpopo.[6]

3.1.3. Gender

Men makes up the majority of healthcare professionals across the Radiation Oncology 122 (51%), Gynaecology Oncology 17 (68%) and Medical Oncology 25 (Medicine) (66%) categories. Whereas in Medical Oncology (Pediatrics), female professionals make up the majority 19 (68%). The overall workforce is made up by male oncologists 173 (52.7%) as compared to female oncologists 155 (47.3%) (Fig. 3).

3.1.4. Age

As displayed in Fig. 4, most professions are between 40 and 44 years of age (57), followed by 35–39 years (53).

3.2. Estimating and forecasting supply, and need for oncologists up to 2030

According to IHME GBD estimates for South Africa, DALYs were obtained from the IHME GHDx website.[16] At national level, the total DALY load for the country for the year 2017 is 1,271,304 (Neoplasms for all ages).[16] DALY load was estimated on the basis of population[17] of each province. The province-wide DALY load was then divided by the number of oncologists registered in each province. On the basis of this exercise, ranking was awarded to each province i.e. the lower the DALY load per oncologist, the higher the ranking. Since there are nine provinces, we divided them into three tertiles (Table 3).

According to DALY load per oncologist, the Western Cape, Gauteng and Free State are the best performing provinces (first tertile), whereas the North West, Limpopo and Mpumalanga are the last performing provinces (third tertile). DALY per oncologist load in KwaZulu-Natal, Northern Cape and Eastern Cape are in the moderate range compared to rest of the provinces (second tertile). Disparity exists in services delivery being offered to the population in the different provinces. Even though the population size of the Western and Eastern Cape is nearly equivalent, however, based on the DALY load per oncologist, the Western Cape performs better. This impacts the availability of health infrastructure and related oncology services.

3.3. Business as usual province-wide forecasts

Using the above methodology (Fig. 1), province-wide forecasts were generated for oncologists up to 2030 in South Africa (Fig. 5). If the oncology workforce continues to expand in the way that it has since 2002, the shortfall would happen according to past trends. The Western Cape is an illustration of this point, it may have a shortfall of 54 oncologists as compared to Eastern Cape, with an estimated shortage of 11 oncologists in 2030. Despite these provinces having the same population size, their health needs are being decided based on past HRH trends, health facilities and infrastructure available in these provinces. Thus, there was a need to undertake province-wide HRH forecasting to showcase the existing disparity and resources' inequity among provinces in South Africa.

3.4. Scenario-based national forecasts

To guide policy making and the Department of Health, we developed the following three scenarios based on reducing HRH inequity among the provinces. For this exercise, actual supply forecasts were considered and the upper and lower limit of 95% confidence interval were not considered. The national shortfall of oncologists in the three scenarios has been provided in Figs. 4 and 5.

- Scenario 1 – Best Guess: In this scenario the shortfall for oncologists was compiled province-wide to present a national figure of 47 (2020), 97 (2025) and 148 (2030).
- Scenario 2 – Optimistic: In this scenario, the shortfall in the last three provinces (third tertile) of North West, Limpopo and Mpumalanga was estimated at the DALY per oncologist rate of 70 percentiles (i.e. Eastern Cape 7183). At national level, a shortfall of 77, 126 and 175 oncologists were forecasted for 2020, 2025 and 2030, respectively.
- Scenario 3 – Aspirational: In this scenario, the shortfall in the last three provinces (third tertile) (North West, Limpopo and Mpumalanga) and three moderate provinces (second tertile) (KwaZulu Natal, Northern Cape and Eastern Cape) were estimated at the DALY per oncologist rate of 30 percentiles (i.e. Free State 4067). Thus, at national level a shortfall of 138, 184 and 230 oncologists were forecasted for 2020, 2025 and 2030, respectively.

Figs. 6–8 presents the oncologists' shortage forecasts at provincial, national (in graph) and national (heat map) forecasts for level (up to

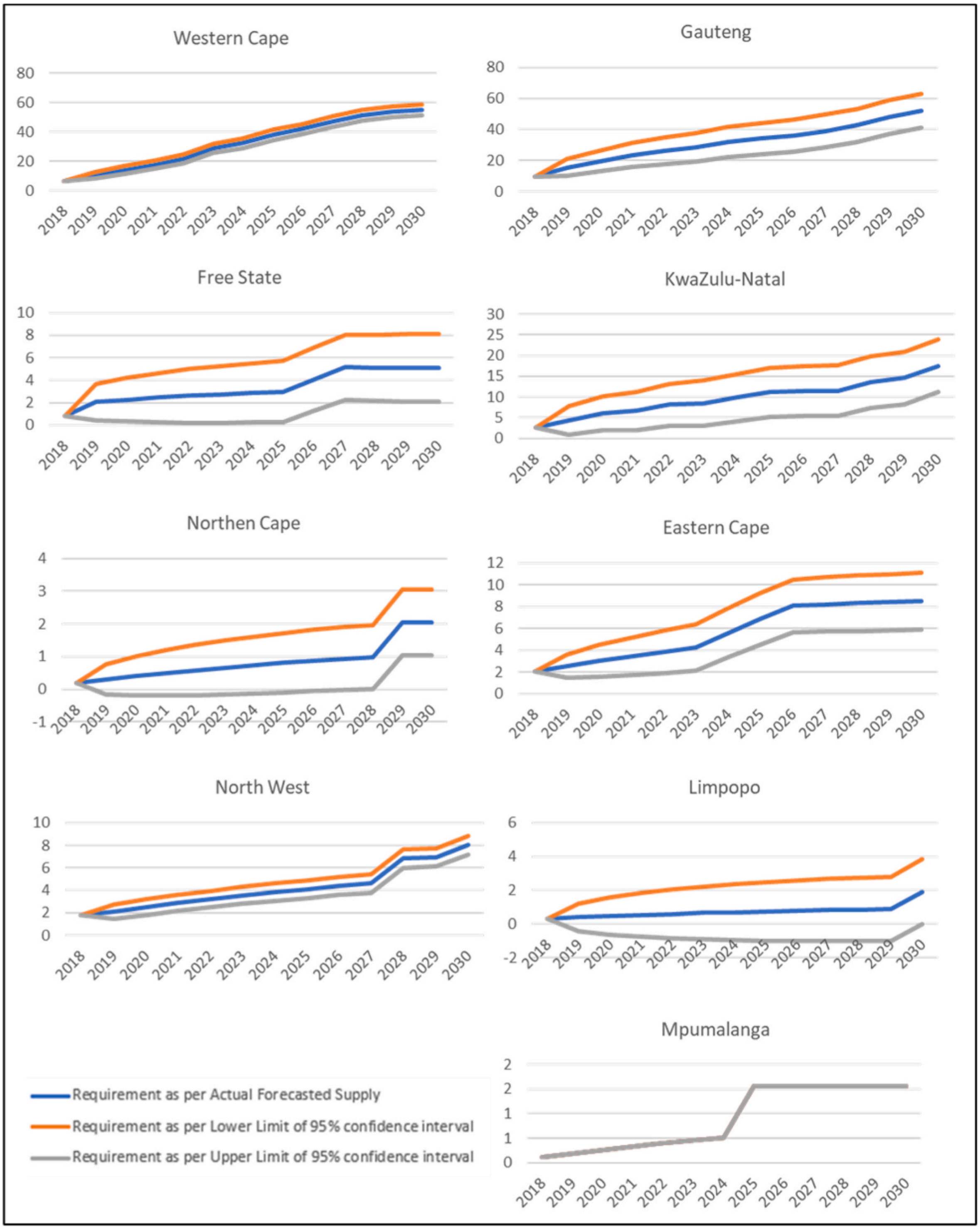

Fig. 6. Forecasted province wide shortage of oncologists for SA (up to 2030) in best guess (business as usual scenario). This infographic is the representation of requirement of oncologists up to 2030 at provincial level as per forecasted supply (with 95% upper and lower confidence interval as well).

2030).

4. Discussion

This study demonstrates how a burden of disease–informed priority-setting approach can be used to guide oncology planning in a highly unequal middle-income country. For policymakers and health system planners globally, our findings illustrate how aligning cancer control priorities with disease burden can support more efficient, equitable, and transparent allocation of scarce resources.

According to WHO estimates on tobacco control, both human papilloma virus (HPV) and hepatitis B vaccination programs, alongside regular cervical cancer screenings could avoid approximately 6% of cancer-related deaths by 2030 (about 200,000 deaths annually before age 70 years).[26] The implementation of the Disease Control Priorities, 3rd edition (DCP-3) essential package could achieve an even greater reduction in cancer mortality.[3] Our findings reinforce the importance of prioritising population-level prevention and early detection strategies

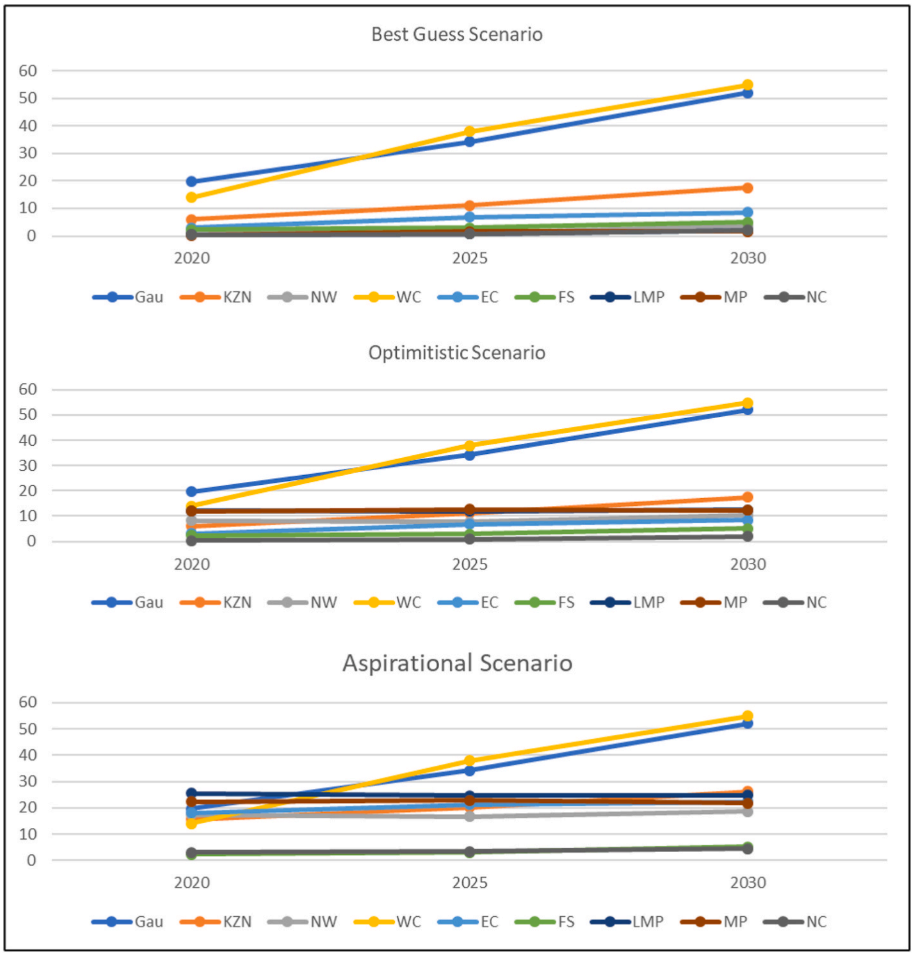

Fig. 7. National Shortfall for oncologists based on three scenarios (up to 2030)
These graphs represent the requirement for oncologists at national level for 2020, 2025 and 2030.

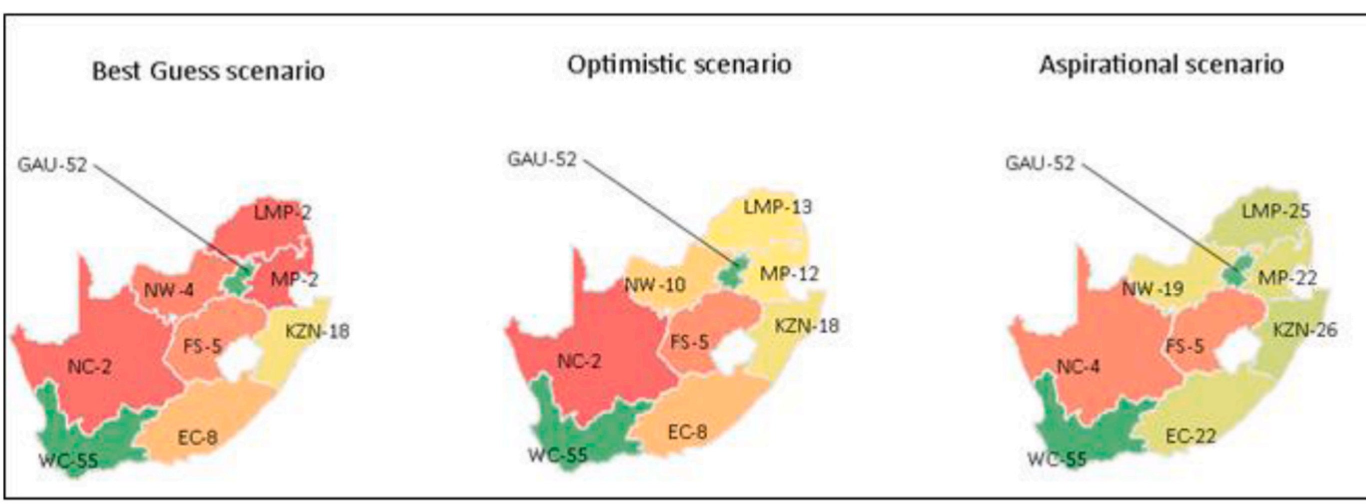

Fig. 8. National Shortfall for oncologists based on three scenarios for 2030. These maps represent the requirement for oncologists at national level for 2020, 2025 and 2030. As we move from left to right, the horizontal equity increases and thus the need for oncologists is depicted to increase within provinces. Thus, green colour denotes more requirement vs red colour denotes lesser requirement. Here the focus is to bring last performing provinces into the green zone i.e. to increase their requirement for oncologists for better cancer control. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

that yield high impact at relatively low cost—an insight that is directly relevant to health systems facing fiscal constraints.[3]

Furthermore, the cancer-related mortality rate can be substantially reduced by increasing the access to timely diagnosis and treatment for common, treatable cancers. From a global health perspective, expanding cancer services based on burden rather than historical investment patterns may also help narrow socioeconomic health disparities, as many cancers and associated risk factors disproportionately affect populations at lower socioeconomic levels.[27]

The availability, skills mix and geographic distribution of the health workforce remain critical constraints in oncology service delivery. A motivated and adequately trained health workforce is central to a strong, integrated and people-centred health system, and health systems strengthening and human resources for health (HRH) have been prioritized under the Sustainable Development Goals (SDGs). New SDG targets explicitly call for achieving universal health coverage (UHC) and substantially increasing health financing and recruitment, and retention of the health workforce in developing countries.

Within the DCP-3 framework, cancer control tasks require different oncology specialists depending on cancer type and stage. For example, the gynaecological oncologist play a central role in cervical cancer screening using visual inspection methods that can detect and treat precancerous lesions cost-effectively, often within a single visit.[28] Evidence suggests that two such screenings at 5–10 year intervals among women aged 30–35 years should reduce the lifetime cervical cancer risk by approximately 50 percent.[29] Similarly, in childhood cancers, paediatric medical oncologists are essential for achieving favourable outcomes through specialized treatment centres and coordinated national referral systems.[30]

Although cancer screening programs may be expanded in the future, our findings suggest that, in many LMIC settings, a more immediate priority remains ensuring adequate and equitable treatment for cancers that are already being diagnosed. This sequencing of interventions—-treatment alongside targeted prevention may be particularly relevant for countries transitioning towards UHC.

South Africa's context of extreme inequality further reinforces the importance of equity-oriented priority setting. With a Gini coefficient of 0.63 in 2015, South Africa has been termed as the most unequal country globally, characterized by high wealth inequality and limited intergenerational mobility.[31] As the country moves towards National Health Insurance (NHI), access to cancer prevention, diagnosis, and treatment services must be made universal. This example from South Africa can be used as a salient case study of how priority-setting frameworks can be applied in settings where inequality poses a major barrier to achieving UHC.

Equity must be addressed on both the supply and demand sides of the health system. On the supply side, sufficient numbers of appropriately trained oncologists must be integrated into the system; on the demand side, services must be accessible across provinces and socioeconomic groups, accounting for waiting times, user fees, and other barriers to care. The roadmap for upscaling oncology services recognizes the influence of both demand and supply side factors, shaped by preferences, perceptions, and potential biases of both patients and providers.[32]

4.1. Limitations

This study has several limitations that should be considered when interpreting the findings. First, the analysis relies on available burden of disease estimates, which may be affected by under-reporting, misclassification, or delays in cancer registration. These challenges in reporting burden of disease are common in many LMIC settings. Second, while the burden of disease approach provides a valuable quantitative basis for priority setting, it does not fully capture social, political, or ethical considerations, such as patient preferences or feasibility constraints, which are also critical for policymaking. Third, the focus on South Africa means that some contextual factors, such as health system structure and financing mechanisms which may limit direct generalizability. However, the underlying approach and insights are transferable to other settings facing similar constraints. Finally, workforce estimates were based on existing frameworks and assumptions, which may not fully reflect future changes in technology, task shifting, or service delivery models.

Ethics statement

The study was approved by the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa (HREC Ref: N21/03/022).

Author contributions

All authors contributed to the conception, design, acquisition of data, analysis and interpretation of data, drafting of the manuscript, and critical revision thereof.

Availability of study materials and data

Datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Declaration of competing interest

The authors declare that they have no competing interests.

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