



The South African Government has committed to the globally promoted 90-90-90 scale-up targets and shares the vision of **Ending AIDS by 2030 (Sustainable Development Goal time horizon, 95-95-95 targets)**. In 2012, it was estimated that in South Africa, **two-thirds of new HIV infections occur in urban areas** (over 300,000), and that the incidence rate in informal urban settlements was at 2.5% compared to 1.1% nationally.¹

WHY WAS THIS ANALYSIS DONE?

The Gauteng cities of Johannesburg, Ekurhuleni and Tshwane, and the KwaZulu-Natal metro of eThekweni, are the health districts (metros) driving the national HIV statistics. The Johannesburg Health District alone is thought to have 22% of all people living with HIV (PLHIV) in any of the eight metros.^{2,3} Johannesburg District has a population of approximately 4.8 million and annual population growth of about 3%.⁴

Cities and metropolitan areas offer both scope and opportunities to take the country closer to the 90-90-90 targets due to the concentration of population and HIV burden. South Africa's eight metros only cover 2% of the national territory but account for 39% of the country's population. They are responsible for 70% of the Gross Domestic Product, and contain half of all unemployed South Africans.⁵ The metros are vital areas for HIV and health interventions to succeed due to their economic importance for national prosperity.

WHY IS ALLOCATIVE EFFICIENCY IMPORTANT?

Given the size of the South African HIV epidemic and the associated health care costs, allocating HIV resources optimally at local level remains a national priority. The health district is the unit for HIV planning and resource allocation and all 52 districts have a District Implementation Plan (DIP) for programme scale-up from FY2016/17. The South African DIP process in 2015 showed that relatively little analytical/modelling evidence is available to support target-setting and district-level decision-making on resource allocation. While there is effective antiretroviral treatment (ART) available, there are other proven interventions such as medical male circumcision, condoms, and pre-exposure prophylaxis (PrEP) for sex workers, which showed up as key response elements in the National HIV Investment Case.⁶ There are also novel service combinations such as the DREAMS package for young women and adolescent girls. With these various interventions available, the country intends to reach the internationally promoted 90 targets. The necessary scale-up of HIV services needs to take into account the epidemic and demographic dynamics of the city, and allocate HIV resources in an optimal way for impact.



HOW WAS IT APPROACHED?

The analysis was conducted in partnership with the South African government, an academic institution (Burnet Institute) and the World Bank. *Optima HIV* was used for allocative efficiency analysis. This software provides epidemic modelling, resource projections for reaching specific targets, and impact/cost-effectiveness analysis. The special and unique features of *Optima HIV* are: high flexibility/customisable structure, its mathematical optimisation function for allocation of resource envelopes, and ability to include constraints to reflect real-life policy scenarios.⁷ *Optima HIV* has helped decision-makers, programme managers, and funding partners plan for maximum impact with the funding available for the HIV response and hence work toward improved efficiency and sustainability.⁸

The analysis built on South Africa's 2015 HIV investment case and linked to the DIP targets. It took into account the general population based and sex work-based transmission networks. Data on the HIV epidemic and response, HIV expenditure, population size estimations, among others, were captured in *Optima HIV*,⁹ the available DREAMS plans for Johannesburg Health District were reviewed, and cost functions established. The epidemic model was calibrated using data from 2000–15 on 26 population groups to ensure best fit. Stakeholder discussions were held in a data workshop and the Durban fast-track meeting in March 2016.

KEY JOHANNESBURG FACTS AND DATA

- In 2016, an estimated **12% of the population are HIV infected** and there are close to **600,000 PLHIV** (Optima HIV model estimates)

- There are approximately **25,000 new HIV infections** and approximately **8,500 HIV-related deaths in 2016** (Optima HIV model estimates)

- The 4.8 million strong population includes 500,000 children below 5 years of age, 647,000 children aged 5–14, 441,000 females aged 15–24, and 372,000 males 15–24 (extrapolated from 2011 population census)

- It is estimated that the **female sex worker population is approximately 15,000**, the **MSM population about 94,000** and that there are about **1,400 persons who inject drugs** (with high mobility to e.g., Tshwane District) (estimates from key population surveys)

- The human development index is 0.72 (0.64 nationally, 2014 data: HIS Global Insight)

- About **15.6% of the population lives below the food poverty line** (23.2% nationally, 2014 data: HIS Global Insight)

- Functional literacy is at **92%** (82% nationally, 2014 data)

- In 2014/15, about **Rand 900 million** public sector funding was **allocated to Johannesburg's HIV response** (Johannesburg District expenditure data 2014/15, Gauteng DOH)

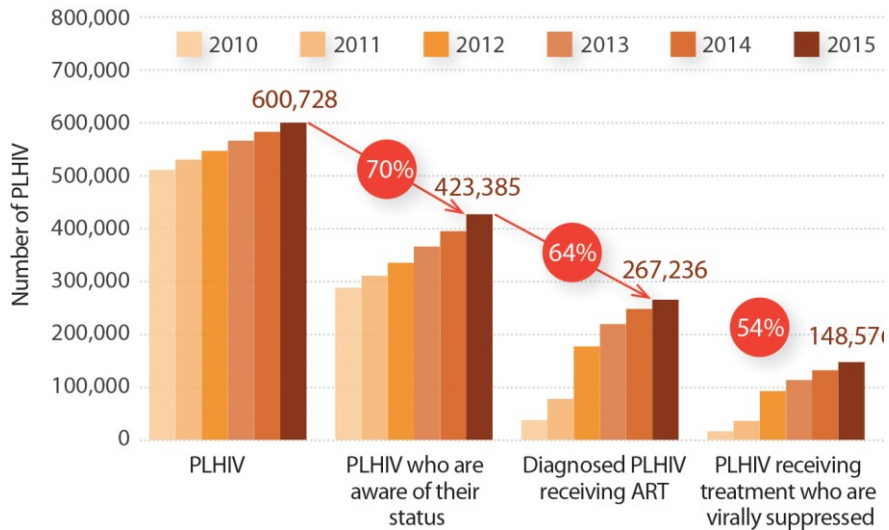
- **Over 80%** of these conditional grant and voted funds for the HIV response **were allocated to HIV treatment** (Johannesburg District expenditure data 2014/15, Gauteng DOH)

WHAT WERE THE MAIN FINDINGS?

1. Johannesburg has rapidly expanded HIV diagnosis and treatment between 2010 and 2015, reaching 267,236 PLHIV with the ART programme in 2015

Due to population growth in the city and the life-extending effects of ART, the number of PLHIV steadily grew. More and more PLHIV know about their positive status (an estimated 70% by 2015). While about 64% of diagnosed PLHIV access treatment, only about 54% of them were known to be virally suppressed in 2015.

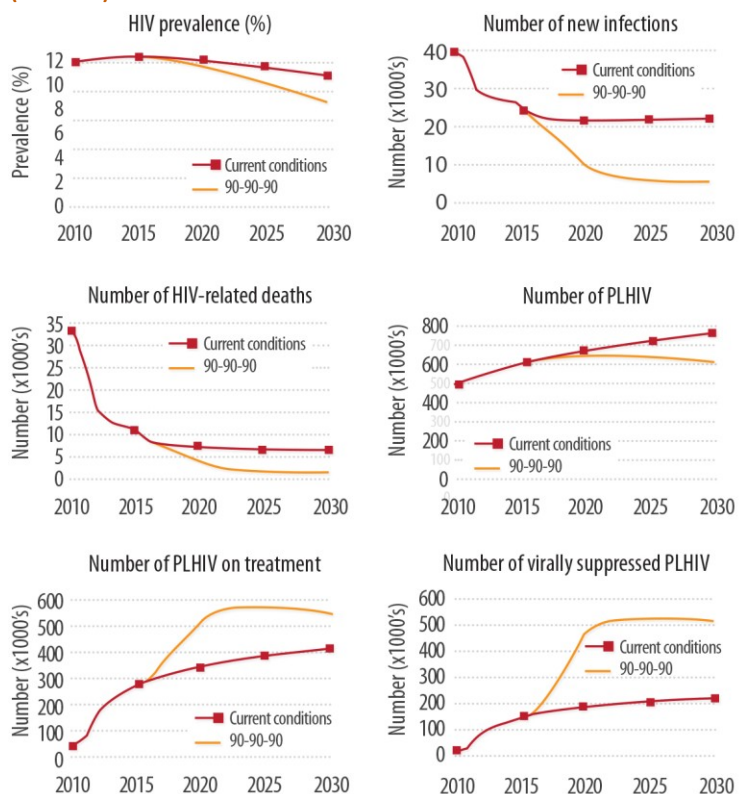
Model-derived HIV care cascade, Johannesburg (2010–15)



2. The projected health impact of successfully scaling-up HIV testing (HCT), treatment and ART adherence to the 2020 and 2030 SDG target levels is very large in Johannesburg

The increase in PLHIV on treatment results in reductions in new HIV infections, a cumulative difference of ~327 thousand infections from 2016–30. It also results in reductions in HIV-related deaths, a cumulative difference of ~104 thousand deaths from 2016–30. The reduction in new infections combined with the reduction in deaths results in a net decrease in the number of PLHIV, leading to a decline in HIV prevalence.

Epidemic projections for baseline vs. HCT/ART scale-up, Johannesburg (2010–30)

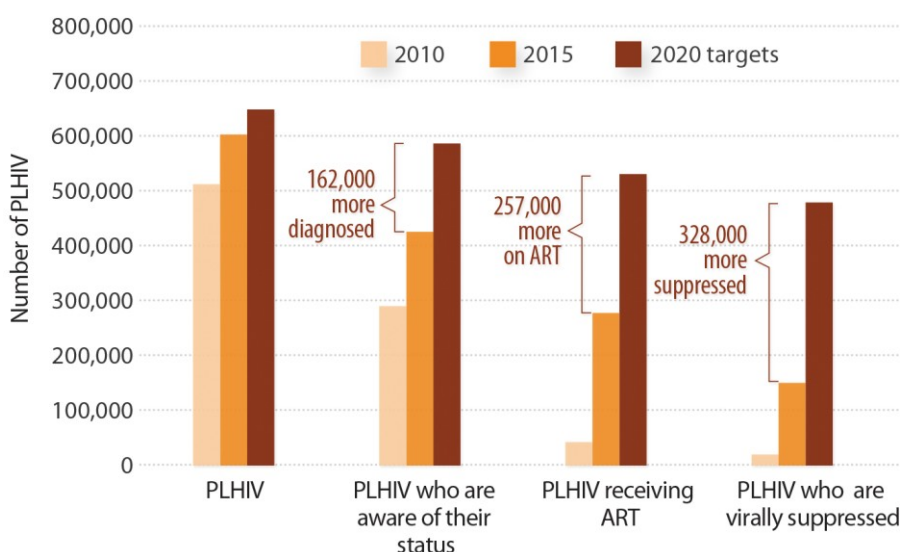


Note: Colours of lines red = maintain coverage; orange = 90-90-90 by 2020 and 95-95-95 by 2030

3. The dynamic Optima HIV model provides target numbers for planning and factors in the prevention effect of ART on the future PLHIV numbers

Under the HCT/ART scale-up scenario, there are 31 thousand fewer PLHIV in 2020 (left-hand brown bar) compared to the baseline of constant ART coverage at 2015 levels. A smaller pool of PLHIV means the 2020 and 2030 targets become more feasible. An additional ~162 thousand HIV diagnoses would be required to reach the first 90 by 2020.

Modelled HIV care cascade to 2020, Johannesburg (if reaching 90 targets)



An additional ~257 thousand PLHIV would need to be on ART to attain the second 90 (=81% of PLHIV on ART by 2020). This means almost doubling the 2015 ART patient number. However, by 2020 most of the scale-up and expansion work would have been achieved, as the scale-up would have dramatically reduced the PLHIV number by 2030 (to ~612 thousand, compared to a projected ~770 thousand if ART coverage was kept at 2015 levels).

Using available ART unit costs from the HIV Investment Case (R 3 879.26 per person per annum), this implies an investment of ~R 2 billion in year 2020 alone (assuming the same unit costs apply). This is about 50% more than current total expenditure including all HIV funding streams from domestic and external sources.

However, the growing funding necessary for expanding the ART programme in Johannesburg Health District may not always be available as required for the 2020 targets.

- The Johannesburg **2016/17 HIV budget** is only 5.8% higher (R 959 M) than the **2014/15 HIV expenditure** (R 907 M). The **CPI** for urban areas annual inflation rate is 7,0%* and was 6,2% the previous year
- This means the actual funding has decreased due to monetary inflation, aggravated by demographic growth

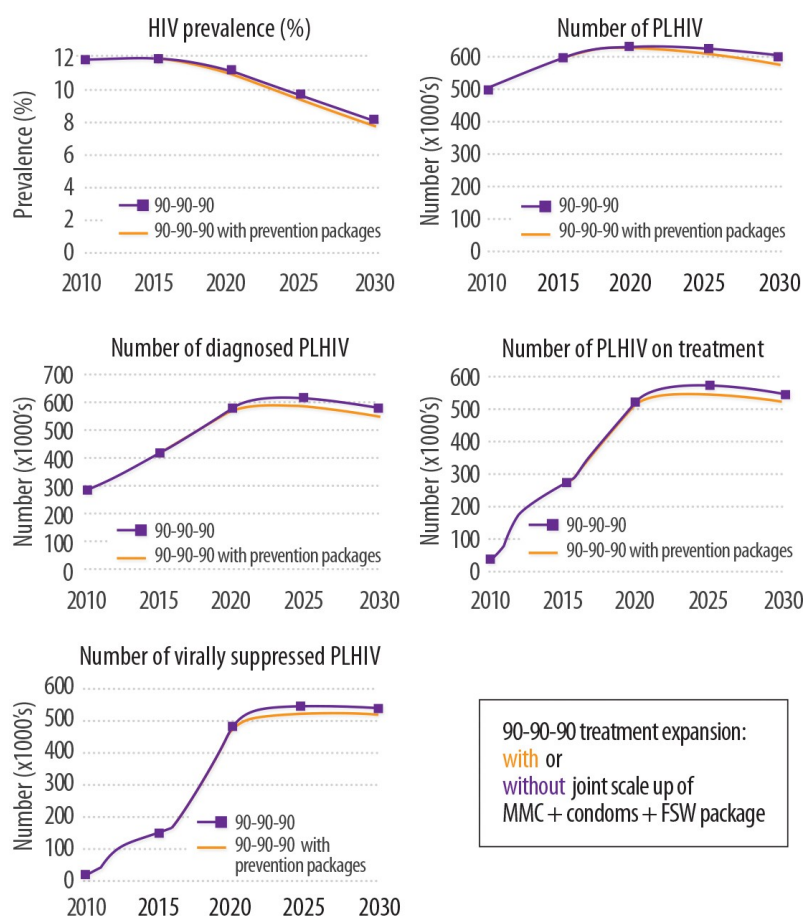
A funding freeze on the 2014/15 HIV budget would lead to:

- ▶ decrease in actual ART coverage of PLHIV as the number of PLHIV continuously increases in this district
- ▶ new infections and HIV deaths would rise very steeply in this context of ~3% demographic growth

4. A realistic scale-up of other proven HIV interventions would yield a 5–10% reduction in total treatment costs whilst still achieving the three 90s.

Treatment needs (and costs) are reduced if the HCT/ART scale-up is combined with medical male circumcision, an expanded condom programme, and comprehensive service packages for FSWs and young females (DREAMS package). With this combination approach, an additional ~13 thousand infections would be averted 2016–30. 2030 targets would be reached with ~526 thousand people on ART, compared to ~553 thousand if the prevention packages were not scaled-up. The cumulative difference in the annual treatment need to 2030 would be ~285 thousand PLHIV (or R 1.1 billion saved at current prices).

Epidemic projections for combined scale-up, Johannesburg (2010–30)



WHAT ARE THE CONCLUSIONS FROM THIS ANALYSIS?

- A very large effort is needed:** Analysis shows that the HCT/ART scale-up was rapid in the last 5 years, but that a **doubling of scale-up** is needed to reach 2020 targets
- Strategic investments in proven interventions** such as **medical male circumcision, an expanded condom programme, and comprehensive packages for FSWs and young females** will help “get” Johannesburg the 90 targets (and with these, the 95 targets too)
- Evidence-informed programmes for young women and adolescent girls (like DREAMS)** are likely to make a significant contribution to incidence reduction in these age groups, if implemented at scale
- An innovative mix of HIV testing approaches** is needed to reach more PLHIV not sufficiently covered with current services (an additional 100–160 thousand diagnoses needed by 2020, and finding new HIV cases is becoming harder to achieve)
- Rapid scale-up of funds is needed** to achieve aspirational targets, especially in the context of rising prices. Stagnant HIV budgets likely lead to increases in infections and deaths and undermine the scale-up momentum the City of Johannesburg has gained
- Analytical approaches supported by modelling** can be useful to help set targets, monitor progress and project the health and financial impacts
- Johannesburg with its strong economic position and elevated human development** offers large opportunities for successful scale-up and as a city benefits from the proximity of population to services, good communication networks, and a mix of providers.

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¹ Shisana O, Rehle, T., LC, S., Zuma, K., et al. *South African National HIV Prevalence, Incidence and Behaviour Survey, 2012*. Cape Town: HSRC Press. 2014.

² Estimate based on 2011 population census data and 2012 HIV survey data.

³ Buffalo City (formerly East London), City of Cape Town, City of Johannesburg, City of Tshwane, Ekurhuleni, eThekweni, Mangaung (formerly Bloemfontein), and Nelson Mandela Bay

⁴ Statistics SA (<http://www.statssa.gov.za/>)

⁵ Stat SA, 2011

⁶ Department of Health of the Republic of South Africa (DoH) and South African National AIDS Council (NAC). 2016. South African HIV and TB Investment Case - Summary Report Phase 1. <http://sanac.org.za/wp-content/uploads/2016/03/1603-Investment-Case-Report-LowRes-18-Mar.pdf>. Accessed 17 June 2016.

⁷ www.optimamodel.com. Note that Optima HIV can also do geographic prioritisation, different service delivery modalities for HCT and ART, and long-term financial commitment analysis)

⁸ See <http://optimamodel.com/publications.html> for technical reports and journal articles, and <http://optimamodel.com/results.html> for a case study

⁹ Other model entries—HIV transmission probabilities: Based on international evidence (by type of sexual intercourse, by injection practice, by breastfeeding status, by intervention), relative transmissibility during acute infection phase 5.6x higher than after acute phase, increased HIV transmission at CD4<200 and at CD4<50, reduction in transmissibility from virally suppressive ART=90% and from non-virally suppressive ART=50%. HIV and mortality: Mortality for CD4<50: ~15% pa (if not on ART), TB co-factor 2.17. Treatment failure/drug resistance: 5.4% p.a. VL suppression level of people reported on ART from secondary laboratory data analysis of Johannesburg data: 54% of total patients reported on ART had a suppressed VL test result (69% of ART patients had a test, and of these 78% had suppressed result). Age-related and risk-related population transitions: based on demographic and behavioural data.