



**Ministry of Health**

**Impact Assessment for ART, TB  
Treatment and PMTCT  
Using Triangulation Approach**

**Final Report**

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**Swaziland Ministry of Health, Monitoring and Evaluation**



**SACEMA**  
EST/HRP Centre of Excellence in Epidemiological Modelling and Analysis



Investing in our future  
**The Global Fund**  
To Fight AIDS, Tuberculosis and Malaria



**World Health  
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**Steven V. Shongwe**

**PRINCIPAL SECRETARY, MINISTRY OF HEALTH**

## **PREFACE**

With the MoH of Swaziland, and WHO has joined forces with key partners such as the Global Fund to Fight AIDS, Tuberculosis and Malaria (GFATM) and UNAIDS for the improvement of the measurement of outcome and impact of interventions at country level. The overall aim is to strengthen further the effective use of strategic information for health, as part of health systems strengthening. The approach used is described in the steps outlined in the recently published "HIV Triangulation Resource Guide Synthesis of Results from Multiple Data Sources for Evaluation and Decision-making" (Febr. 09, [http://www.who.int/hiv/pub/surveillance/hiv\\_triangular\\_guide.pdf](http://www.who.int/hiv/pub/surveillance/hiv_triangular_guide.pdf)).

In this report, we document the country's experience in improving outcome and impact measurement (using triangulation methods) and findings with an emphasis on HIV and TB interventions but also include the PMTCT programme.

The country has shown with the present work and support, its commitment in understanding better the epidemic and the impact of the response to the epidemic. The present effort further complements previous work in this area and builds up on it.

This initiative fits and supports further the past and on-going experience and efforts in strengthening strategic information. All stakeholders from national Governments officials as well as international agencies (e.g. CDC, USAID in addition to the ones mentioned above) and several international and national NGOs (not listed here) have shown interests and agreed to support in different ways this activity and we are grateful to these institutions as well at global and country level.

## Executive Summary

### Aims and objectives

The aim of the triangulation exercise in Swaziland is to support the Ministry of Health Monitoring and Evaluation Unit in the analysis of secondary demographic, health surveillance and programmatic data to assess the impact of HIV and TB interventions, and to provide recommendations on better utilization of such information for program strengthening and health policy. The triangulation objectives and proposed outcomes are:

1. Determine if there is a relationship between expanding ART coverage and HIV and TB transmission, morbidity, and mortality
2. Examine the trends in retention on ART and related deaths supporting this evidence
3. To determine if there is population level evidence of declining adult, maternal, infant deaths in parallel to the scale-up of ART, PMTCT and TB programs

### Results

There appears to be some relationship between expanding ART coverage and HIV and TB transmission, morbidity, and mortality, as documented next, as well as with the trends in retention on ART and related deaths supporting this evidence. Unfortunately, it may be too early to determine if there is population level evidence of declining adult, maternal, infant deaths in parallel to the scale-up of ART because of scarce census data and lack of comparative data points

### HIV and ART

HIV Prevalence in Swaziland peaked and stabilised at around 26% since 2004, the same year that the Swaziland Ministry of Health launched the ART programme. The programme has since been scaled up and at the end of 2010 around 60,000 people were actively enrolled on ART with an estimated coverage of 70% (based on a CD4 count of 350/mm<sup>3</sup>). Some key findings are given below:

1. Mortality estimates are only available from censuses before and after the rapid increase of HIV prevalence and therefore indicate big increases in adult and child mortality. The first DHS was done in 2007, shortly after the scale up of ART, and future DHS's might indicate impact of ART on mortality estimates.
2. Emphasis on HTC and a shift from client initiated to provider initiated testing resulted in a rapid increase in number of HIV tests done and this in turn resulted in a gradual increase of new ART enrolments since 2007.
3. In 2009 the eligibility criteria for ART enrolment was changed from a CD4 count of 200/mm<sup>3</sup> to a count of 350/mm<sup>3</sup>. This reduced the estimated coverage, but in spite of that, coverage of ART for patients in need increased from 47% in 2007 to 70% in 2010.
4. AIDS in-patient case fatality rates have declined since the scale-up of ART in 2005 for both adults and children. TB case fatality rates have shown a decline for children since scale-up of ART, but no significant decline for adults. This may be due to the fact that co-infection rate is much higher for adults (82%) than for children (66%) and therefore

children have better recovery rates than adults. Overall case fatality rates have declined for both adults and children since 2004-5.

5. The number of hospital admissions declined before the introduction of ART due to long hospital stays and the disincentive to go to hospital due to high case fatality rates. The number of admissions started to increase again after the introduction of ART and declined after decentralisation of treatment. The trend in case fatality rate for children is showing the steepest decline, but some decline is noted for the sexually active population aged 15-49.
6. In 2010, AIDS as a first diagnosis was the fifth most common cause of death amongst children admitted to hospital. It is the second most common cause of death amongst adults admitted to hospital in 2010, after Pulmonary TB. In the same year, for patients with an AIDS diagnosis who died in hospital, TB was also diagnosed in 43% of the cases.
7. Quarterly death rates for patients on ART have dropped by 60% and quarterly lost-to-follow-up rates have decreased by 50% since the first quarter of 2005 to the last quarter of 2010. The biggest proportion of ART patients is still lost in the first year of treatment, but the proportion retained on treatment after the first year has increased from 75% for the 2007 cohort to 84% for the 2009 cohort.

### **HIV and TB**

The effect of ART roll out on TB notifications is masked by the improvement of TB case finding and treatment policies since the rapid increase of HIV prevalence. Since 2009, all patients at out-patient departments regardless of ailment and all HIV patients are screened for TB. Additional case finding is also achieved by contact tracing using diagnosed TB patients as index cases. Some key findings are given below:

1. TB case notifications rapidly increased from an already high level with the rapid increase of HIV in 2001-4. It is important to note the increase of relapse TB cases over the years, consistent with high HIV prevalence. Notifications show another rapid increase in 2008-9 due to expanded TB screening policies as described above.
2. The clearest impact of the scale-up of ART is shown in the declining trend of extra pulmonary TB, which is associated with HIV. Coverage of ART was too low in 2005-7 to have an obvious impact on pulmonary TB burden. Impact started to show in 2007-8 with a stabilisation of TB notifications, but in 2009 policies were changed to screen all HIV and OPD patients for TB, resulting in better case finding and an apparent increase in TB burden. Since 2009 all TB/HIV co-infected patients are started on ART and this is expected to have an impact on TB, especially relapse cases.
3. The proportion of unknown/smear not done TB cases has been consistently decreasing apart from a spike in 2010 due to stock-outs in the country. This decline can be attributed to more labs, improved training of staff and improved compliance to guidelines.
4. The trends in smear positive TB show that TB is most prevalent for the age groups at which HIV prevalence is highest, for both sexes. TB notification rates are higher for men than for women. Smear positive TB cases have shown declines in 2009-10 and this can partly be attributed to the positive impact of ART and partly to the increase in unknown/smear not done cases in 2010. TB notifications in children 0-14 are showing rapid increases due to active case finding and contact tracing.
5. Notified MDR-TB cases have doubled from 2007 to 2010. The impact of this is increased TB death rates in spite of the expected declines in death rates due to the uptake of ART.
6. The *success rate* of TB treatment has increased from 55% at the beginning of 2008 to a stable level of around 70% in 2010. This is still well below the WHO target of 85%. The rate of *deaths* among DOTS patients has apparently not decreased, but this can be attributable to the fact that defaulters are now tracked and therefore more deaths are

discovered. The doubling of MDR-TB from 2007 to 2010 may also have an impact on death rate.

7. Overall deaths during DOTS treatment have been increasing due to active case finding, tracking defaulters and increasing MDR-TB cases. A possible positive impact of ART may be inferred from the decrease of deaths during DOTS treatment among patients with extra-pulmonary TB from 2009-10. A sharp increase of TB/HIV co-infected deaths in 2008-9 could be attributable to the fact that all HIV patients are screened for TB since 2009.
8. There has been a decline in the in-patient TB case fatality rate since 2007 for children aged 0-14. The rate for patients aged 15-49 has not significantly declined.
9. The proportion of co-infected patients in Swaziland has been consistently high at around 80% since 2006. The percentage of TB/HIV co-infected patients on ART has increased from 19% in 2006 to 35% in 2010. This is still an under-reporting since according to policy all TB/HIV patients should be started on ART since 2009. This number will improve as data collection systems improve. The percentage of co-infected patients receiving CPT has been consistently high and at 93% in 2010. The percentage of TB patients tested for HIV sharply increased to about 86% in 2010 and this number should stabilise at around 100% in future due to recent policy changes.

### **PMTCT**

Swaziland started implementing PMTCT services within its maternal, new-born and child health services in 2003 and coverage has increased from 4% in 2004 to 85% in 2010.

1. The increased coverage may have contributed to the drop in proportion of infants born HIV-positive, among infants born to HIV-infected mothers and PCR-tested, from 24% in 2007 to 12% in 2010.
2. The proportion of HIV positive babies who are enrolled on ART has increased from 18% in 2009 to 28% in 2010.
3. Overall in-patient case fatality rates for both infants and children under 5 are showing downward trends.

### **Recommendations for monitoring and evaluation the impact of ART and PMTCT on TB and transmission**

The report concludes with several activities under next steps that should allow to pursue the present efforts for the monitoring and evaluation to improve the measurement of outcome and impact of national programmes with existing upcoming opportunities.



## List of Acronyms

ART	-	Anti-Retroviral Treatment
AZT	-	Zidovudine
BMD	-	Department of Births, Marriages and Deaths
CPT	-	Co-trimoxazole Preventative Therapy
DBS	-	Dried Blood Spot
DHS	-	Demographic and Health Survey
DNA-PCR	-	DeoxyriboNucleic Acid Polymerase Chain Reaction
DOTS	-	Directly Observed Treatment Short course
HIV	-	Human Immo-deficiency Virus
HMIS	-	Health Monitoring Information System
HTC	-	HIV Testing and Counselling
MDR	-	Multi Drug Resistant
M&E	-	Monitoring and Evaluation
NTCP	-	National TB Control Program
NVP	-	Nevirapine
OPD	-	Out-Patient Departments
PMTCT	-	Prevention of Mother to Child Transmission
SID	-	Strategic Information Department
SNAP	-	Swaziland National AIDS Programme
TB	-	Tuberculosis
URC	-	University Research Company
WHO	-	World Health Organization

## 1. Introduction

Triangulation can be broadly defined as the synthesis and integration of data from multiple sources through collection, examination, comparison and interpretation by first collecting and then comparing multiple datasets with each other. Triangulation seeks to make use of data from diverse sources and study designs, and incorporates judgements, findings and interpretations on each data source's limitations. [1]

### 1.1 Aims and objectives

The aim of the triangulation exercise in Swaziland is to support the Ministry of Health Monitoring and Evaluation Unit in the analysis of secondary demographic, health surveillance and programmatic data to assess the impact of HIV and TB interventions, and to provide recommendations on better utilization of such information for decision making, program planning and strengthening, and health policy. The triangulation objectives are to:

1. Determine if there is a relationship between expanding ART coverage and HIV and TB transmission, morbidity, and mortality
2. Examine the trends in retention on ART and related deaths supporting this evidence
3. Determine if there is population level evidence of declining adult, maternal, infant deaths in parallel to the scale-up of ART, PMTCT and TB programs

Additional benefits are to:

- Identify possible information gaps in the M&E system that can be directly beneficial through routine data analysis and use (national, region, facility-based).
- Assess effectiveness of ART, TB and PMTCT programs and recommendations for their policies
- Bring a new dimension of improved understanding of linkages between different HIV related interventions at local level and additional programmes (e.g. HTC)
- Generate information for the Ministry of Health to use in advocating for more support at both national and international levels.

Ultimately, the triangulation exercise attempts to build the capacity and strengthen the improvement of in-country data analysis for programmatic use. Finally, the planned ART in-depth assessment using triangulation brings up the important necessary linkages between the three programmes (ART, TB and PMTCT) setting the ground for future further collaboration and possible integration and sustainability of the above programmes. It starts a process of strengthening on-going monitoring and impact of outcome and impact of programmes and additional programmes (e.g. HTC) may be added at different stages, as well as further efforts of understanding impact at local level as well.

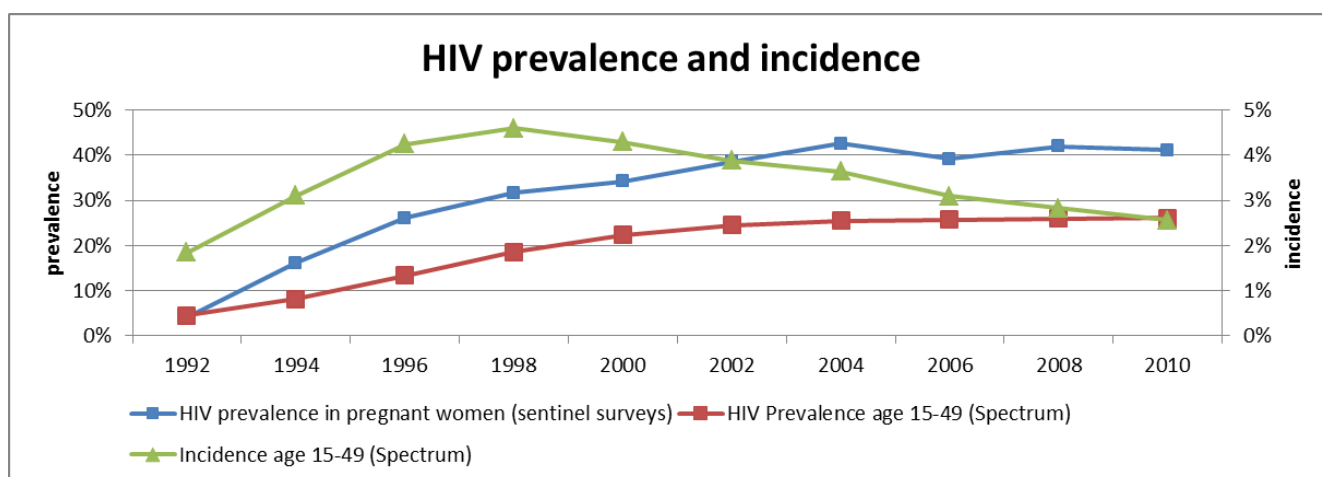
The triangulation approach is largely based on existing secondary data sources (no collection of additional data, therefore no needs for special ethical committee clearance were needed). The available data sources and their limitations are given in Appendix A.

## 1.2 Demographics and Health status of the population

According to the 2007 population census, the population of Swaziland is 1,018,449. In 2010, the population was estimated at 1,055,506 people. About 77% of the population lives in rural areas and 23 % live in urban areas.

Women of childbearing age (15-49 years) make up 26.2 % of the population while all females account for 53 % of the population. An estimated 4.6 % of the population is 60 years of age or older. According to the results of the Swaziland Demographic and Health Survey (2006-2007), about 60 % of the population is aged below 30 years of which about 39.6% are children under the age of 15 years. This reflects the young age structure of the Swazi population. The total fertility rate is estimated at an average of 3.8 births in a woman's life compared with 6.4 births in 1986. The life expectancy at birth has drastically declined from 56 years in 1986 to 45.1 years in 2007. This dramatic drop in life expectancy is mainly attributed to the impact of the HIV/AIDS epidemic.

Swaziland currently has the highest HIV prevalence in the world, with an estimated HIV prevalence rate of 26% in age group 15-49 years [2]. The HIV prevalence among pregnant women has increased from 3.9% in 1992 to 41% in 2010. The following figure illustrates trends in the incidence and prevalence of HIV over the years.



**Figure 1: HIV prevalence and incidence**

We see stabilising of HIV prevalence in pregnant women (through sentinel surveillance) and for Spectrum estimates. It cannot be determined if this is due to natural dynamics of the epidemic, prevention or the effect of ART treatment (following the scale-up). The Spectrum estimated incidence for ages 15-49 has been declining since 1998, before the 2005 ART scale-up, which is likely due to natural dynamics of the epidemic. The HIV prevalence in pregnant women shows an overall stable trend since 2004.

The present analysis is focused and limited to fairly recent data of the scale-up of national programmes, around 2001-05.

It is estimated that in 2010 the number of adults living with HIV were 177,196. Using the eligibility criteria of CD4 cell count  $350/\text{mm}^3$ , about 77,156 are in need of ART [3]. By the end of 2010, 59,802 people were actively on treatment (77.5% of people in need) comprising of 54,084 adults and 5,718 children [7].

The number of facilities providing HIV care increased from 19 in 2006 to 116 in 2010 after an outreach strategy was implemented in 2008 where ART care was decentralised to peripheral clinics serviced by staff from the mother clinics. [4] Currently, there are 51 TB treatment initiation sites that are providing both TB treatment and ART for TB patients co-infected with HIV.

## 2. HIV and ART

### 2.1 Introduction

The ART program was launched in January 2004 by the then Ministry of Health and Social Welfare. As defined in the ART national plan, the scale up was implemented in three phases. The first phase was the establishment of ART services in the 6 major hospitals in the country. The second phase was the expansion of ART service delivery to the five health centres in the country and to some private clinics. The third phase was planned to cover more private as well as public clinics. A down referral strategy has recently been adopted and implemented where care for PLHIV is provided in peripheral clinics with support from major hospitals and health centres.

Advanced HIV care services are provided in 97 health facilities countrywide of which 66 are the peripheral/outreach clinics. Provision of ART services has improved with the development and update of treatment guidelines, protocols and operational plan. Swaziland has also developed a public-private partnership between government and private practitioners. The partnership allows government to purchase and supply ARVs to private doctors who in turn provide ART services for free, and subsequently report to the Ministry of Health. There has also been a great improvement in laboratory services for CD4 count determination. The overall quality of ART services has improved through specific training of more than 80% of health workers (doctors and nurses) working in ART clinics [4]. The introduction of early infant diagnosis with DNA PCR in some health facilities in 2010, fixed dose combination tablets from time of birth and management of malnutrition in HIV positive children has improved paediatric HIV and AIDS care and treatment.

Treatment guidelines for ART were updated in 2009 where a new eligibility criterion was introduced. In these guidelines it is stipulated that HIV positive patients are eligible to start treatment at CD4 cell count of  $350/\text{mm}^3$  from the  $200/\text{mm}^3$  used before. This resulted in a rapid increase of new enrolments into ART as more people were enrolled into the programme at an earlier stage. It is also stipulated in these guidelines that all HIV positive patients co-infected with TB are eligible for starting ART.

### 2.2 The impact of uptake of ART on mortality by main age groups

This is the main assessment regarding the impact of the scale-up of ART. Some mortality information is obtainable from the countrywide census done every 10 years. The crude death rate (number of deaths/population size) has increased from 7.6 to 18.3 per 1,000 from 1997 to 2007. Estimated infant mortality rate increased from 78 per 1,000 in 1997 to 107 per 1,000 in 2007. Under-5 mortality rate has increased from 106 to 167 per 1,000 from 1997 to 2007. [5] These numbers all represent mortality before and after the rapid increase of HIV prevalence and do not provide a clear picture of the impact of ART on mortality, since ART was only introduced and scaled-up two years before the census and DHS. The longer term impact of ART on mortality might be clearer from future surveys. We should also note that a lack of clear downward trends should not be interpreted as a lack of impact of ART, but could also be attributed to the natural dynamics of the HIV epidemic. In subsequent sections we describe

impact on mortality by considering death rates of patients admitted to hospitals and improved retention on ART.

### 2.3 The impact of uptake of HTC on the uptake of ART

Early knowledge of HIV status empowers individuals to make informed decisions and choices and is likely to promote positive change in health seeking behaviour. Swaziland has adopted the approach where HTC is offered to all patients and clients as part of the standard of care in health facilities. In order to increase the uptake of HTC, both client-initiated and provider-initiated approaches have been practiced and scaled up to meet people’s needs. Although the voluntary counselling and testing (VCT) program has been implemented since 2002, reliable data is only available from 2007.

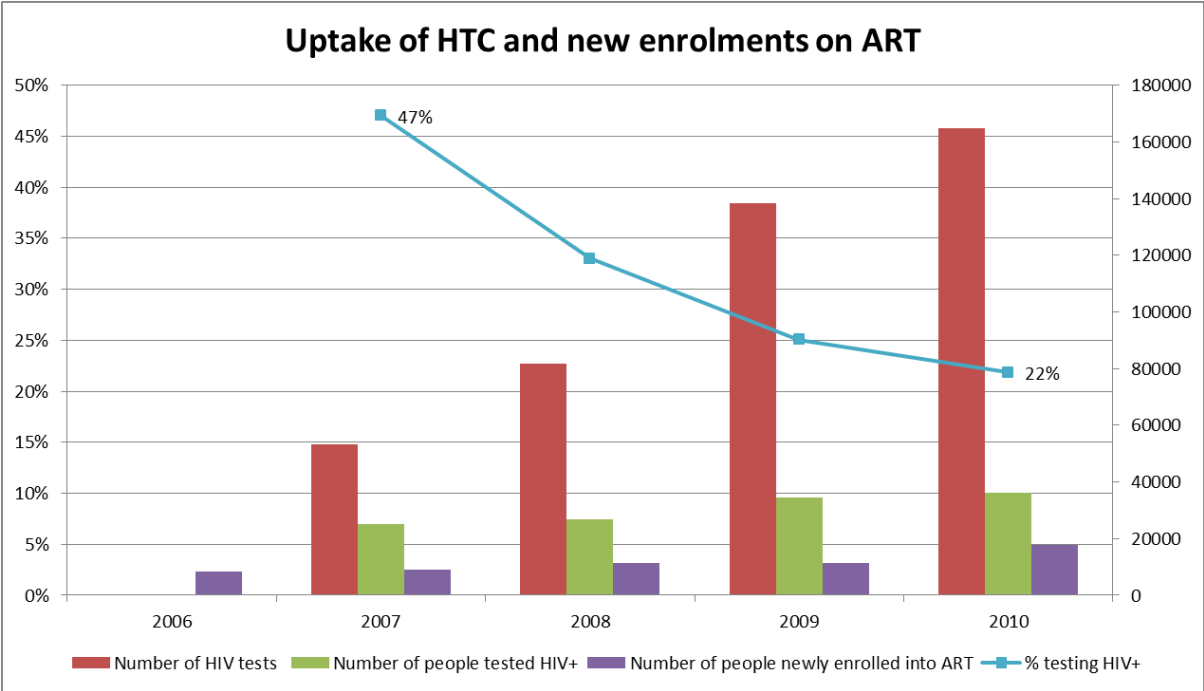


Figure 2: Uptake of HTC and new enrolments on ART

Data shows that up to 2007, HIV testing was mostly focused on client initiated HTC, where mostly people would test once they suspect they had HIV. Since then HIV testing has been scaled up and focuses on both provider and client initiated HTC, resulting in a decrease in the percentage of HIV positive tests. The uptake of HIV tests has increased substantially from 60,000 in 2007 to over 160,000 in 2010, while the number of people testing HIV positive increased gradually over the same period.

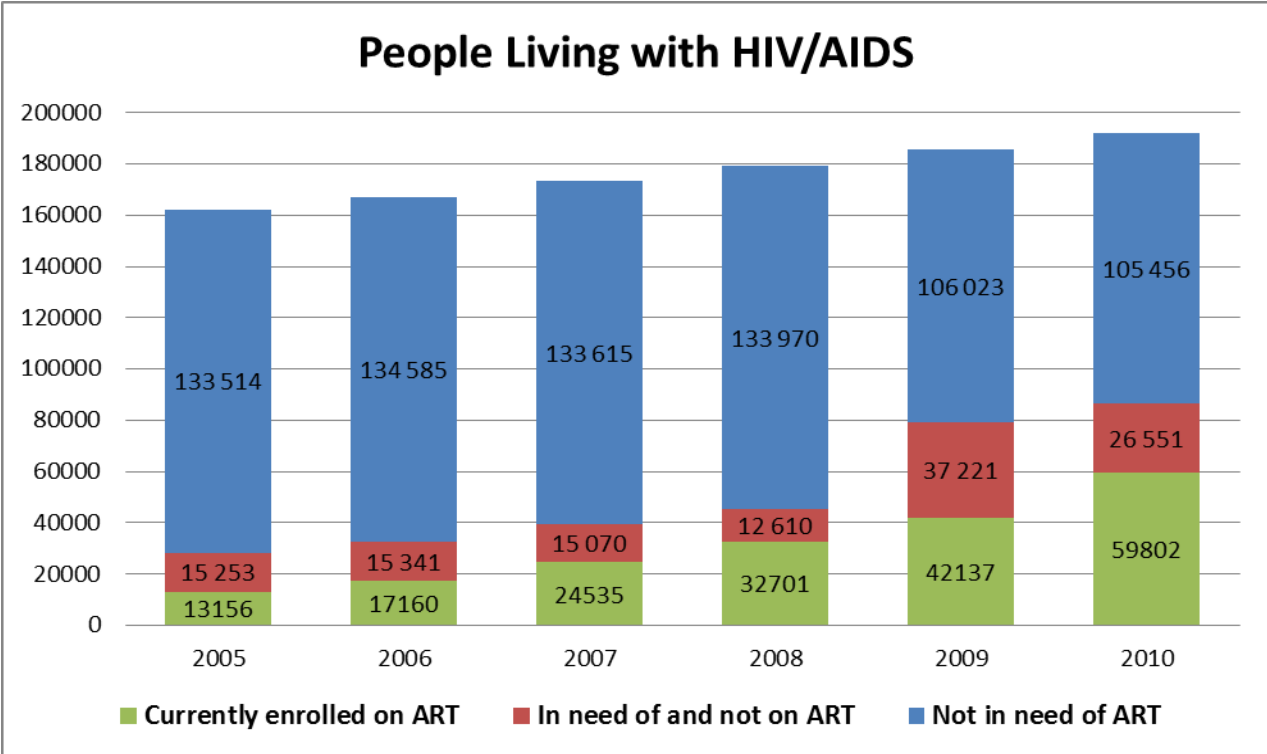
Finally, the increase in the uptake of HTC has allowed a gradual yearly increase in the number of people newly enrolled into ART as shown in Figure 2. However, the notable increase in the number of people newly enrolled on ART by 2010 is more likely due to the fact that the eligibility criteria for enrolment changed from CD4 count of 200/mm<sup>3</sup> to CD4 count of 350/mm<sup>3</sup> in 2009. At the end of 2010, 59,802 people were actively enrolled on ART.

**The impact uptake of HTC on the uptake of ART**

**Conclusion:** The sharp increase in HIV testing resulted in a gradual increase of new ART enrolments since 2007. The relative increase in ART enrolments in 2010 is due to the change in eligibility criteria from CD4 count of 200/mm<sup>3</sup> to 350/mm<sup>3</sup>.

**2.4 The coverage of ART for people living with HIV/AIDS**

Swaziland has made substantial progress in terms of providing ART to people in need, as illustrated in Figure 3.



**Figure 3: People living with HIV/AIDS and ART scale-up** (Source: Spectrum 2010)

From Figure 3 it can be observed that the scale up of ART services increased the proportion of individuals in need of ART who received ART from year 2005 to 2008. ART guidelines were reviewed in 2009 and the eligibility criteria for ART enrolment was changed from a CD4 count of 200/mm<sup>3</sup> to a count of 350/mm<sup>3</sup>. This resulted in the population in need increasing sharply during that year as more people met the eligibility criterion. In 2010 we observe that the number in need is going down again as more people are enrolled on ART.

**The coverage of ART for people living with HIV/AIDS**

**Conclusion:** The estimated proportion of people in need of ART and not on ART decreased from 53% in 2005 to 28% in 2008. This proportion jumped to 47% in 2009 due to the change in eligibility criteria but decreased to 30% again in 2010. This translates to 70% coverage of people in need of treatment and 31% coverage of all HIV patients in 2010.

## 2.5 Change in in-patient case fatality in response to increased uptake of ART

The following graph illustrates the in-patient case fatality rates recorded on the HMIS versus the uptake of ART.

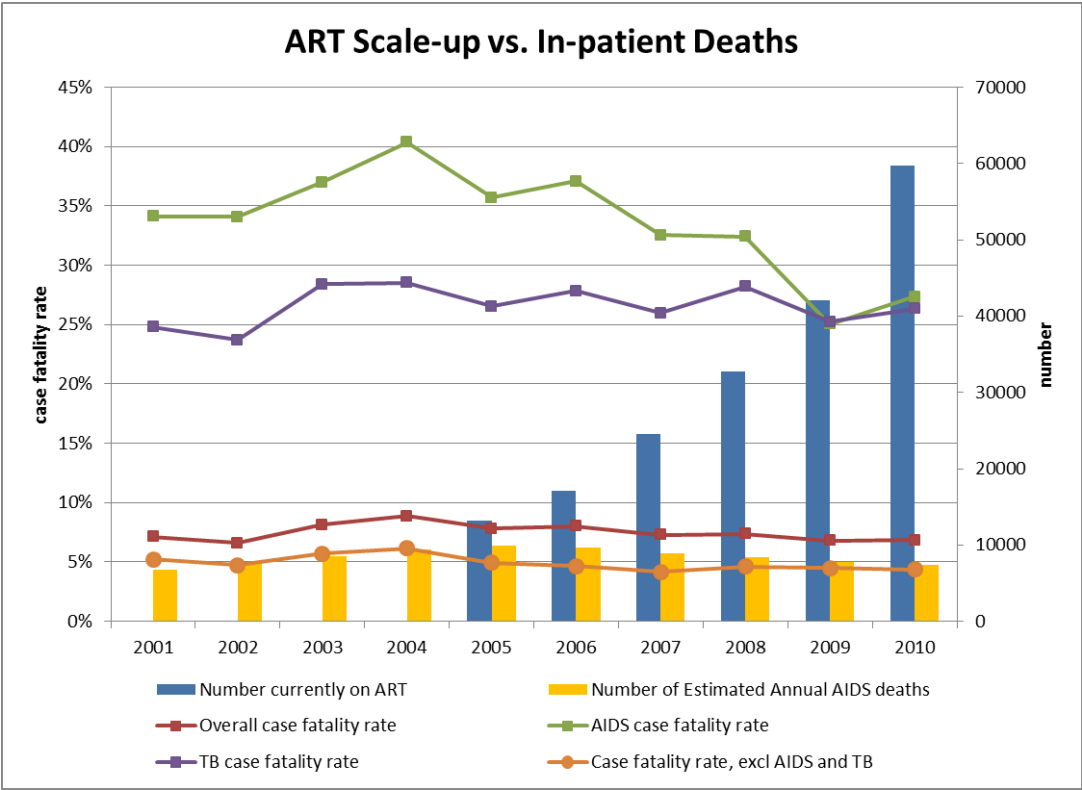


Figure 4: ART scale-up, case fatality rate and estimated annual AIDS deaths

Case fatality rate is the proportion of total patients admitted to hospital who died. Figure 4 shows that both the Spectrum estimated number of AIDS deaths and the observed in-patient AIDS case fatality rates have been declining since 2004-05. This coincides with the period of ART roll out and scale up in the country. The temporal relation of recorded case fatality rates with the start of ART roll-out suggests that these drops are direct results of ART roll-out and scale-up in the country.

However, the reported deaths among TB patients admitted in the country’s health facilities did not show a similar declining trend as with AIDS related deaths. Death among admitted TB patients only showed a very modest and un-sustained decline since 2004-5. This could be a result of increasing prevalence of MDR-TB which is associated with very high mortality even in presence of ART. Another reason could be that patients are presenting too late for treatment when they are very sick, thus ART is seen as having limited effect on TB deaths.

Deaths among hospital admissions from all causes combined and deaths among all admissions excluding AIDS and TB showed sustained decline in trend (p-value=0.011) since 2006. This observed downwards trend may also indirectly be associated with ART roll-out in the country because some of the deaths in these categories of patients may also have been related to AIDS, but were not so classified by attending clinicians and nurses (as has been noted in real practice in the country).



This data (Figure 4) can be further split into children and adults (next, Fig. 5 and Fig 6), except for the estimated annual AIDS deaths.

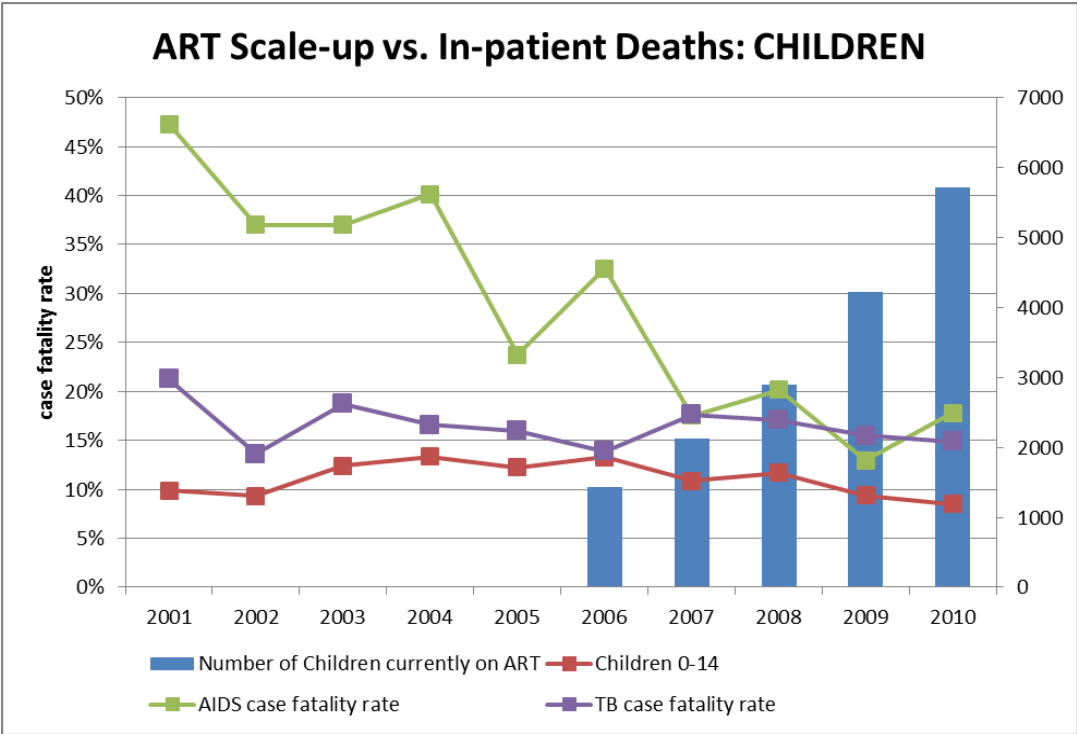


Figure 5: ART scale-up and case fatality rate for children (age 0 to 14)

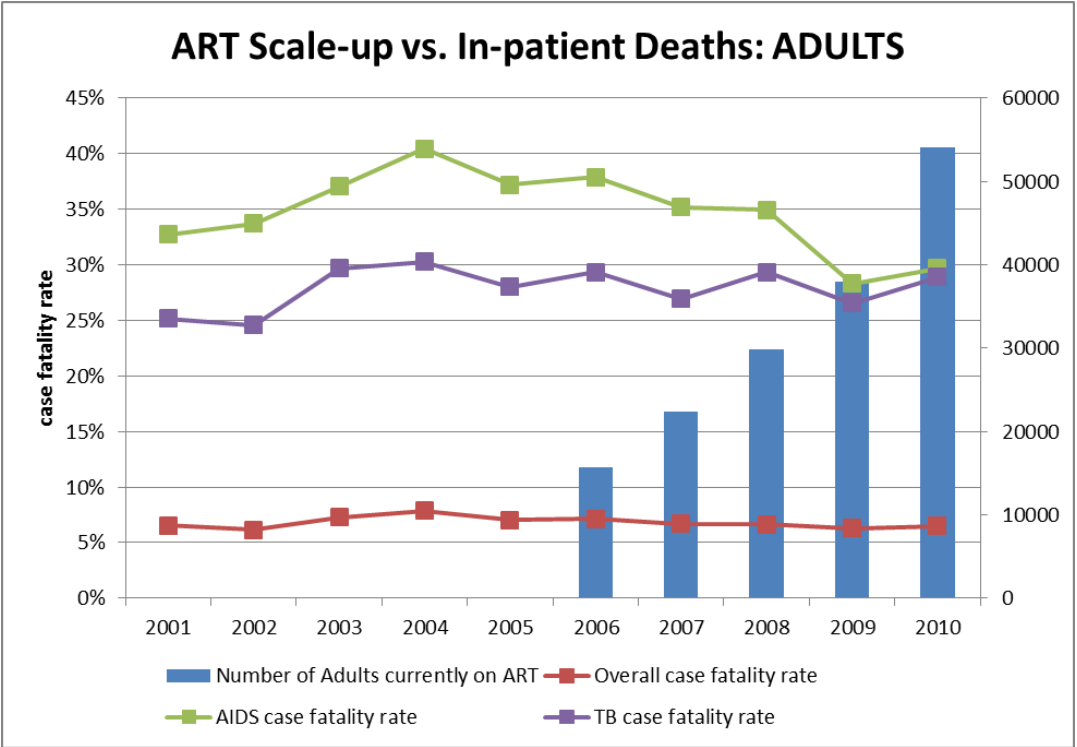


Figure 6: ART scale-up and case fatality rate for adults (age 15 and older)

Figures 5 and 6 further indicate the positive effect of ART program on AIDS case fatality rates for admitted children and adults since ART roll out in 2005. While the two graphs show

downwards trends in AIDS case fatality rates among the two groups of patients a steeper rapid decline in case fatality rate is observed among admitted children (from 40% in 2004 to 17% in 2010) compared to the decline in case fatality rate among admitted adults (from 40% in 2004 to 29% in 2010). Interventions like PMTCT, early infant diagnosis and early ART among the paediatric populations (including early initiation on CTX preventive therapy) may have contributed to the rapid decline in case fatality rate among paediatric AIDS patients during the review period.

For both age groups, TB case fatality rates among admitted patients remained unacceptably high at about the same level between 2004 and 2010 at 15% for children and 30% for admitted adults. However, for children, we see a slight drop in case fatality rates among admitted TB patients since 2007. MDR-TB which appears less prevalent among the paediatric sub-group may possibly account for this observed difference [6]. TB/HIV co-infection is lower (66%) among children than among adults (82%) which could also contribute to lower case fatality rate among children admitted with TB.

For all deaths, there was a greater decline among admitted children (from 16% in 2006 to 10% in 2010) compared to adults (from 11% in 2006 to 8% in 2010). Similar reasons could be advanced for this observation as noted above.

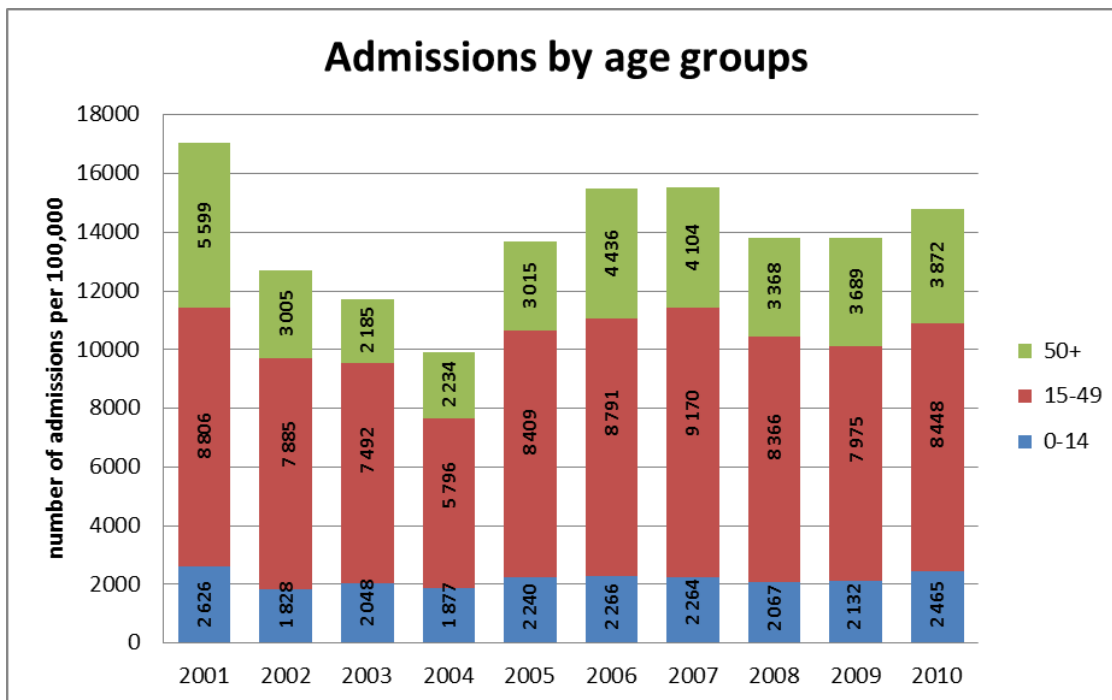
#### **Change in in-patient case fatality in response to increased uptake of ART**

Conclusion: AIDS case fatality rates have declined since the scale-up of ART in 2005 for both adults and children. TB case fatality rates have shown a decline for children since scale-up of ART, but no significant decline for adults. This may be due to the fact that co-infection rate is much higher for adults (82%) than for children (66%) and therefore children have better recovery rates than adults. Overall case fatality rates have declined for both adults and children since 2004-5.

Limitation: This picture might be slightly biased due to the fact the HIV status of all in-patient deaths are not correctly classified.

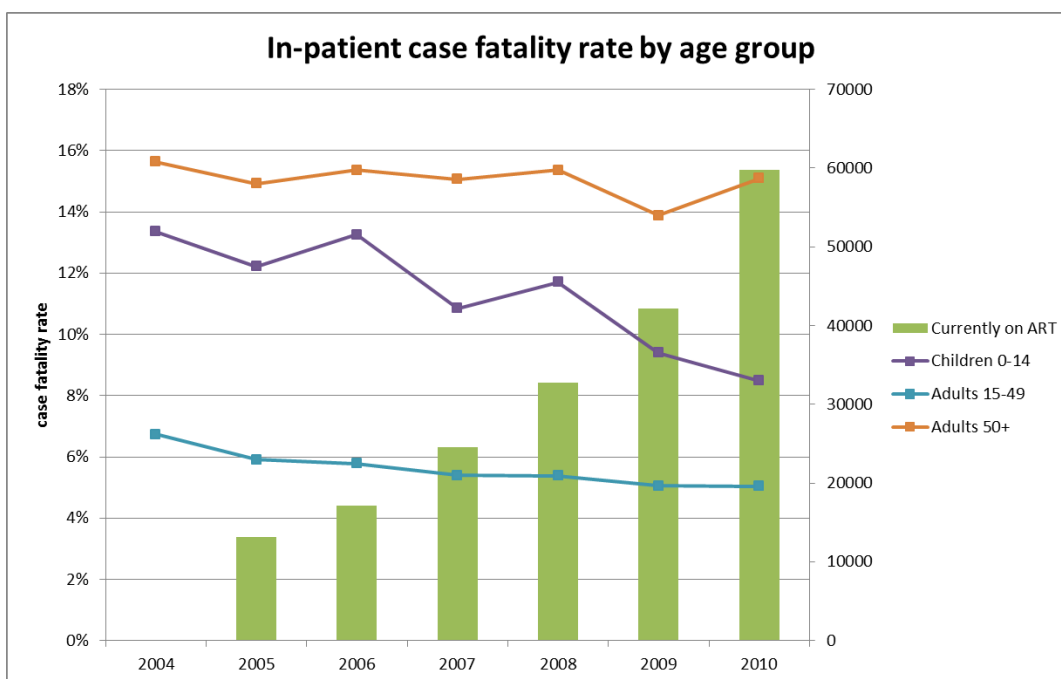
## **2.6 In-patient admissions and case fatality rate by age groups**

Figures 7 and 8 indicate the overall in-patient admissions and case fatality rates by age groups which could provide some indication of the general health of the population.



**Figure 7: Number of in-patient admissions by age group per 100,000 population**

Hospital admissions for each age group were calculated per 100,000 people to better reflect proportions. In the years preceding the introduction of ART in Swaziland (2001-2004), hospital beds were saturated for longer periods resulting in fewer hospitalisations. High hospital mortality was also a disincentive to be admitted to hospital. The introduction of ART in 2005, better management of opportunistic infections, reduction of the duration of hospitalisation and decline of fatality rate resulted in increased new hospitalisations. A possible explanation for the decrease in hospital admissions in 2008 is the decentralisation of ART in 2007-8. The increase in 2010 could be a result of improved recording systems and the introduction of routine data quality audits.



**Figure 8: Case fatality rate per age group by overall scale-up of ART**

Figure 8 shows that the percentage of hospitalised patients who die in facilities has declined steadily since 2006 for adults and more rapidly for children.

### **In-patient admissions and death rates vary by age groups**

**Conclusion:** The number of admissions was declining before the introduction of ART due to long hospital stays and the disincentive to go to hospital due to high case fatality rates. The number of admissions started to increase again after the introduction of ART and declined after decentralisation of treatment. The trend in case fatality rate for children is showing the steepest decline, but some decline is noted for the sexually active population aged 15-49.

## **2.7 The causes of in-patient deaths for HIV/AIDS**

Before looking at the leading causes of in-patient deaths for those infected with HIV, we consider the leading causes of death for all patients, for children (Table 1), and for adults (Table 2 and 3).

**Table 1: Five leading causes of in-patient deaths among children, 2010**

<b>First Diagnosis</b>	<b>Number of deaths</b>	<b>Number of admissions</b>	<b>Case fatality rate</b>
Other Non-infective Gastroenteritis and Colitis	151	1652	9%
Pneumonia, Organism Unspecified	87	618	14%
Pulmonary Tuberculosis	72	522	14%
Other and Unspecified Protein - Calorie Malnutrition	69	284	24%
Specified Acquired Immune Deficiency Syndrome	56	322	17%

**Table 2: Five leading causes of in-patient deaths among adults, 2010**

<b>First Diagnosis</b>	<b>Number of deaths</b>	<b>Number of admissions</b>	<b>Case fatality rate</b>
Pulmonary Tuberculosis	696	2396	29%
Specified Acquired Immune Deficiency Syndrome	361	1393	26%
Pneumonia, Organism Unspecified	161	588	27%
Other Non-infective Gastroenteritis and Colitis	154	1288	12%
Meningitis Of Unspecified Cause	133	302	44%

**Table 3: Five most common causes of death for HIV positive adults by reasons for admission (first diagnosis), 2010**

<b>First Diagnosis</b>	<b>Number of deaths</b>	<b>Number of admissions</b>	<b>Case fatality rate</b>
Pulmonary Tuberculosis	226	628	36%
Other Non-infective Gastroenteritis and Colitis	37	181	20%
Pneumonia, Organism Unspecified	31	87	36%
Bacterial Meningitis	19	38	50%
Other and Unspecified Anaemia	15	61	25%

Of the 696 pulmonary TB deaths, only 226 also had a diagnosis for AIDS. This represents the fact that an AIDS diagnosis does not get recorded for all admissions.

**The causes of in-patient deaths for HIV/AIDS**

Conclusion: In 2010, AIDS as a first diagnosis was the fifth most common cause of death amongst children admitted to hospital. It is the second most common cause of death amongst adults admitted to hospital in 2010, after Pulmonary TB.

Limitation: Of the 696 Pulmonary TB deaths among adults in 2010, only 226 (32%) also had an AIDS diagnosis. This number is likely to be a considerable under-estimate given that the co-infection rate is 82%. This shows that there is room for improvement in data collection systems.

**2.8 Contribution of survival and retention on ART to decline in mortality**

The objective of the ART programme is to prolong life of people living with HIV/AIDS. Figures 9, 10 and 11 illustrate the relationship between retention on ART, survival and mortality decline.

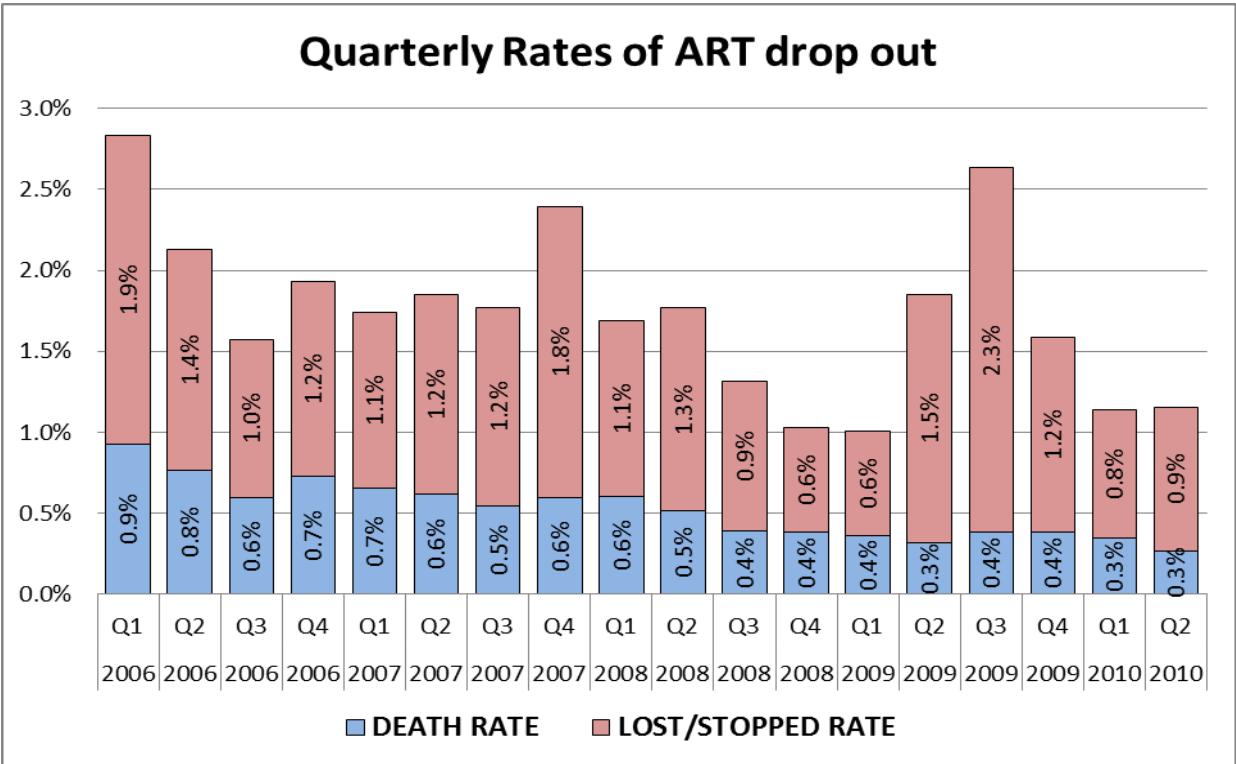
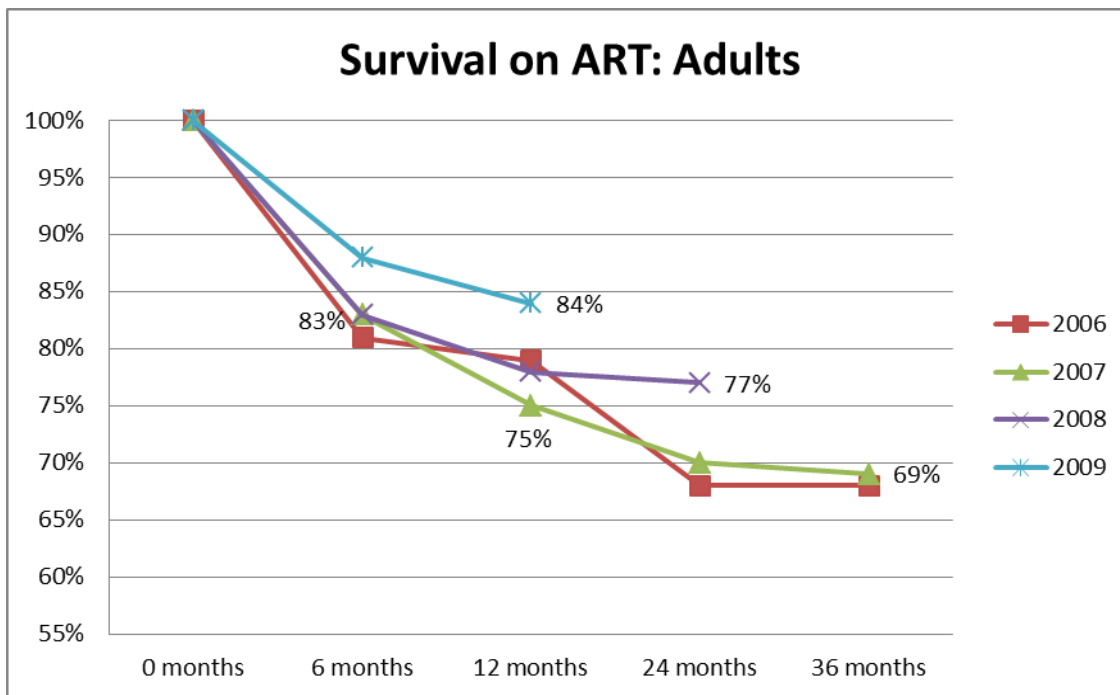


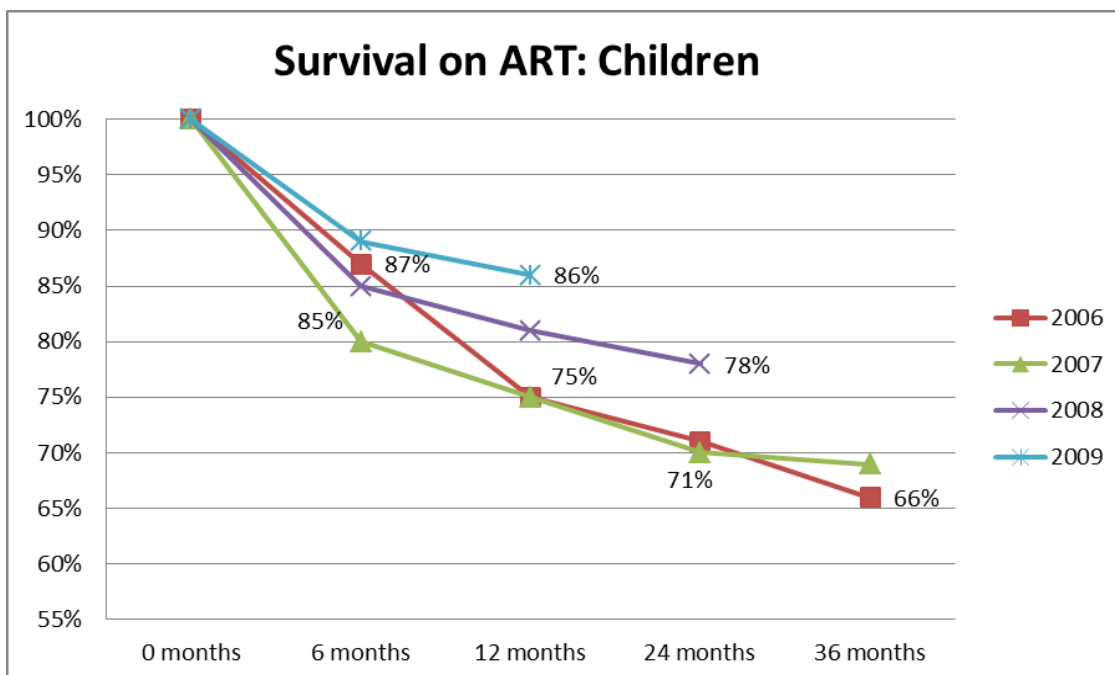
Figure 9: Quarterly rates of ART drop-out

Figure 9 shows the steady decrease in deaths and defaulter rates since the start of the national ART programme. It is clear from Figure 9 that mortality on treatment has fallen by 60% while default rates have halved since the first quarter of 2006. The decline in mortality and default rate are very encouraging.

Figures 10 and 11 depict the retention and survival rate of specific annual cohorts for patients on ART, adults and children.



**Figure 10: Adult survival on ART**



**Figure 11: Children survival on ART**

From Figures 10 and 11, it can be seen that the programme loses most of the people during their first six months on ART for both children and adults. Thereafter we observe a less steep decline in the percentage of people lost from the programme. This marked loss early in the period following ART initiation could be explained by the fact that due to late presentation for enrolment into care, most of the patients were critically ill at those early stages and many died in spite of therapy. Furthermore, patients who present late to care are more likely to experience immune reconstitution inflammatory syndrome (IRIS). This worsening of symptoms is often misinterpreted and attributed to ARV drugs, leading some of the patients to stop therapy. Other patients discontinue therapy due to poverty and lack of transport fares to

keep refill appointments during these early months when they are still too weak to work and earn some resources to keep refill appointments. As the ART program improves, more programmatic interventions are put in place to help retain higher proportion of ART clients in care. These interventions include better adherence counselling services, simplified ART regimens with less pill burden, ARVs with less severe side effect profile, and improved patient tracking system among others.

**Contribution of survival and retention on ART to a decline in mortality**

Conclusion: Figures 10 and 11 show the continuous improvement of long term treatment outcomes over time. The latest 12-month survival rate for the adult cohort enrolled in 2009 of 84% is just below the WHO target of 85%. The survival rate for the child cohort enrolled in 2009 is above the target at 86%.

It should be noted that the first six months on ART are critical since it is during this period about 15% of patient enrolled in ART die, stop or drop out

## 3. HIV and TB

### 3.1 Introduction

TB and HIV remain huge public health problems in Swaziland and both have been declared as emergency issues. The country is currently facing a severe TB, TB/HIV and MDR-TB situation, and the population needs urgent, innovative and effective interventions to address the situation. The country has had the highest estimated TB incidence per capita in the world over the last five years. There has been an increase in case notification rates to 915 per 100,000 population in 2010. HIV prevalence rate among incident TB cases is 82% and MDR-TB rate is 7.7% among new cases and 33.9% among previously treated TB cases [7, 8].

In response to the country situation as indicated above, the goals and objectives of the national TB Control programme (NTCP) are to reduce TB-related morbidity and mortality to such an extent that the disease is no longer a public health problem to the Swaziland nation. To achieve this goal, the NTCP is implementing six strategic objectives as follows, to:

1. Pursue high quality country-wide DOTS expansion and enhancement towards achieving 100% population coverage with TB diagnosis and treatment by 2015
2. Address TB/HIV, MDR/XDR-TB and TB in vulnerable populations
3. Contribute to health systems strengthening
4. Engage all care providers in TB control
5. Engage TB patients and their communities in TB control
6. Enable and promote programme-based operational research.

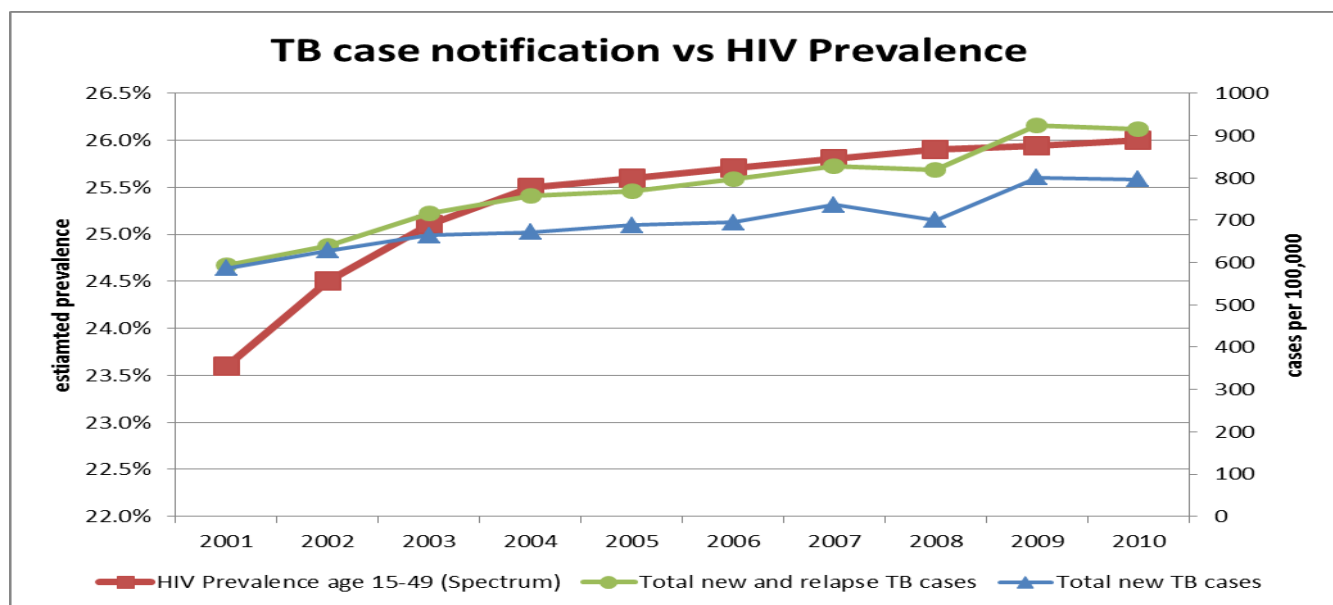
Accordingly, collaboration between the NTCP and Swaziland National AIDS Programme (SNAP) through National TB/HIV Steering Committee was established in 2007 to facilitate sharing of information & consolidate efforts in the management of TB/HIV patients. A National TB/HIV coordination committee (NCC-TB/HIV) was formed to facilitate these collaborations and it meets quarterly for joint planning and facilitating implementation of TB/HIV collaborative activities guided by the TB/HIV Policy guidelines.

MDR/XDR-TB currently constitutes a major threat to the control of TB in the country, and needs to be addressed timely and effectively. The priority of the NTCP has been on implementation of an effective programmatic management of drug resistant TB in line with WHO recommendations. In 2009 the national referral hospital for MDR-TB became operational, since then four more regional hospitals for initiation and management of MDR-TB have been accredited and started MDR-TB management and initiation in 2011. Furthermore, a national DR-TB management guideline has been finalized with the technical assistance from WHO. A surveillance system for MDR/XDR-TB has not been fully established.



### 3.2 TB case notifications trends in comparison to the HIV prevalence

The trend in TB case notifications (per 100,000) in comparison to the HIV prevalence in the country (Spectrum 2010) is shown in figure 12.



**Figure 12: TB case notification and HIV prevalence**

Overall the new and relapse TB notifications have shown a very similar increase and have stabilised as the estimated HIV prevalence has stabilised. Possible explanations for the increase in TB case notifications in 2009 are given below.

- The increases might be due to better reporting systems and improvement in diagnosis.
- All HIV positive patients have been screened for TB since 2009 which leads to a better case detection rate among HIV positive patients. This includes, in 2010 alone, a total of 1718 patients from ART sites screened for TB of whom 317 (18%) were found positive for TB.
- In addition, all HIV positive and negative patients attending any health care centres in out-patient departments (OPDs) and other departments are also screened for TB regardless of what ailment the patient initially presented.

It is important to note that the rapid increase in 2001-4 in Total New and Relapse TB cases compared to Total New TB cases was probably due to the rapid increase of HIV Prevalence. TB is a common and recurring opportunistic infection among HIV patients, hence with increased HIV prevalence the number of relapse TB cases will also increase.

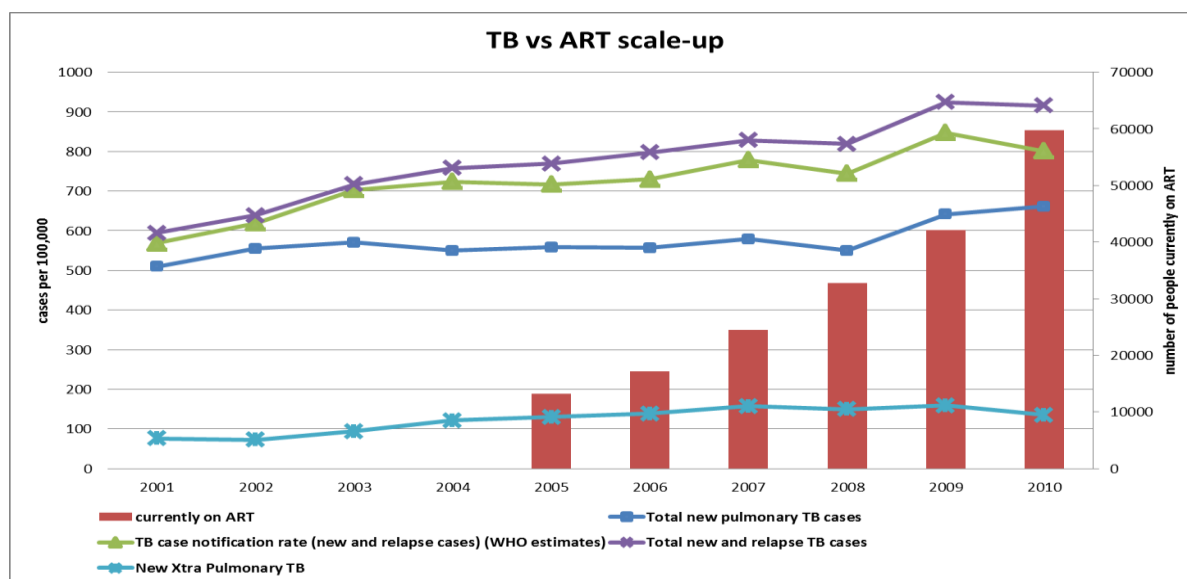
We see a slight decline in TB trends in 2009-10. This might be due to the fact that all TB/HIV co-infected patients are now started on ART and for this reason we expect further declines in relapse TB cases in future. From 2011 all HIV positive patients will be initiated on INH prophylaxis therapy for the prevention of TB and therefore TB cases are expected to decrease.

#### **TB case notification trends in comparison to the HIV prevalence**

**Conclusion:** TB case notifications rapidly increased from an already high level with the rapid increase of HIV in 2001-4. It is important to note the increase of relapse TB cases over the years, consistent with high HIV prevalence. Notifications show another rapid increase in 2008-9 due to expanded TB screening policies as described above.

### 3.3 Impact of the HIV epidemic and ART on TB case trends

This is the main assessment in describing the impact of ART on TB. It is expected that the uptake of ART in a country with high TB and HIV co-infection will reduce the burden of TB disease. The trends in Swaziland are illustrated in Figure 13.



**Figure 13: TB notifications and scale-up of ART**

The scale-up of ART only show some evidence of positive impact on TB case notification in 2007-8 and 2009-10 with stabilisation of notifications in these periods. This can be explained by the following factors:

- The proportion of HIV infected individuals receiving ART was still too small in 2005-2007 to have a positive impact on burden of TB.
- From 2009 all HIV patients and patients at OPD's are screened for TB which resulted in a spike in TB case detection.
- Weak collaboration between HIV and TB national programmes before 2009.

Extra pulmonary TB is associated with HIV infection and there is a slight decrease in the case notification rate of extra pulmonary TB since the scale-up of ART. Additionally, we see that the Total new and relapse case notification rate is higher than the WHO estimated TB case notification rate and the realised numbers are not decreasing as much as estimated in 2010.

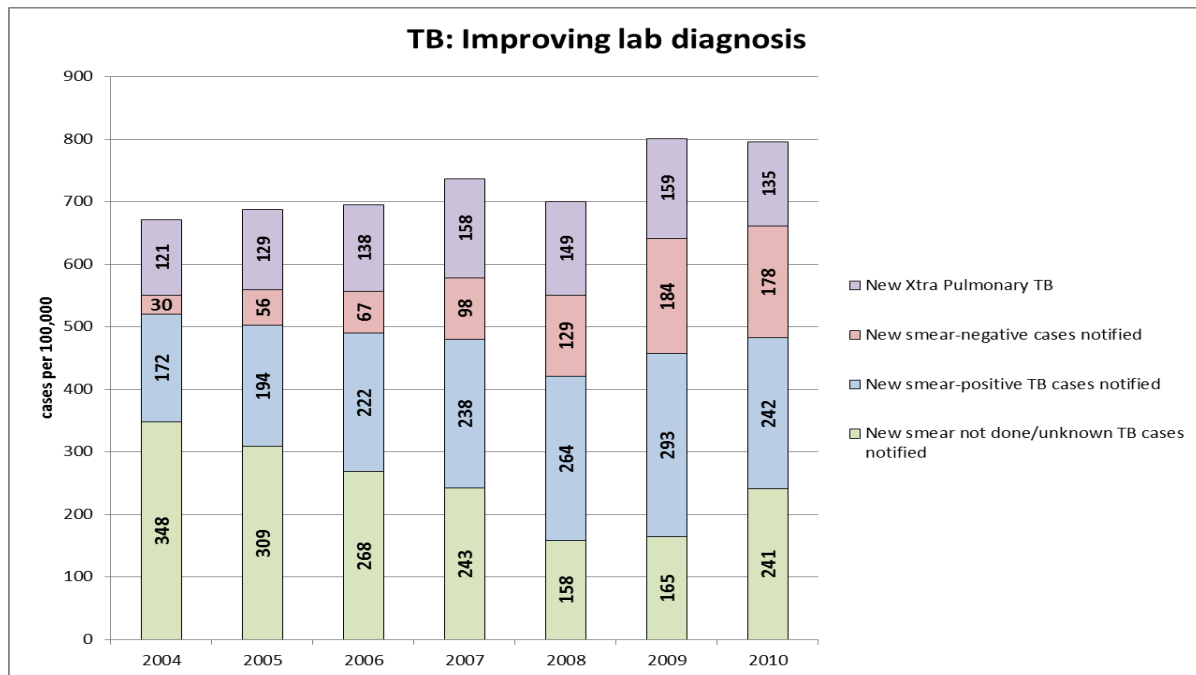
#### **Impact of the HIV epidemic and ART on TB case trends**

**Conclusion:** The clearest impact of the scale-up of ART is shown in the declining trend of extra pulmonary TB, which is associated with HIV. Coverage of ART was too low in 2005-7 to have an obvious impact on pulmonary TB burden. Impact started to show in 2007-8, but in 2009 policies were changed to screen all HIV and OPD patients for TB, resulting in better case finding and an apparent increase in TB burden. Since 2009 all TB/HIV co-infected patients are started on ART and this is expected to have an impact on TB, especially relapse cases. This impact started to show in the 2009-10 trend of 'Total new and relapsed cases' in Figure 13.

**Limitation:** The impact of ART on the number of TB notifications is masked by the influence of policy changes in TB case detection such as systematic screening of HIV infected patients for TB.

### 3.4 The implication of improved laboratory diagnosis on TB trends

The classification of TB cases into sputum smear positive, sputum smear negative, extra pulmonary TB and unknown is important to determine appropriate treatment and monitor outcome. The following graph illustrates the trends in lab diagnoses.



**Figure 14: New pulmonary TB by lab diagnosis**

The proportion of unknown/smear not done TB diagnoses decreased from 52% in 2004 to 20.5% in 2009. This decrease may be due to several factors, e.g.

- Improved compliance to TB treatment guidelines, resulting in more smears taken at the facilities than in the past.
- Improved recruitment, training and deployment of lab personnel.
- Increase in the number of labs performing TB microscopy from 6 in 2006 to 18 in 2010.

The spike in unknowns in 2010 (30% of all cases) could be due to an increased number of children registered for treatment (could not produce sputum). Several stock-outs (of bottles, reagents, etc.) occurred in 2010 and therefore some sputum samples could not be classified. Extra pulmonary TB started to show a decrease in 2007-8, but the screening of all HIV patients for TB since 2009 caused the number to increase again. A national lab sample transportation system is in place since 2010 and therefore we expect a future improvement in lab diagnosis.

#### **What are the trends in improved laboratory diagnosis telling us**

**Conclusion:** The proportion of unknown/smear not done TB cases has been consistently decreasing apart from a spike in 2010 due to reasons explained above.

### 3.5 Trends in TB case notifications by age and sex

Monitoring notifications for smear positive TB cases is important to track the transmission of TB in the population. Figures 15 and 16 illustrate case notifications for smear positive cases by age and sex.

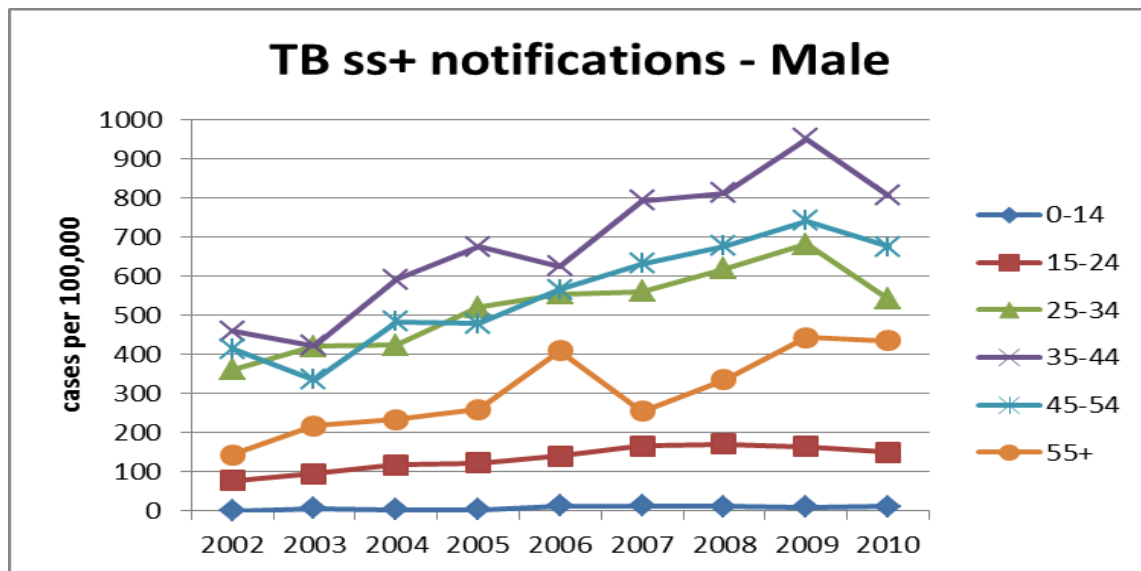


Figure 15: New Sputum smear positive TB notifications for males

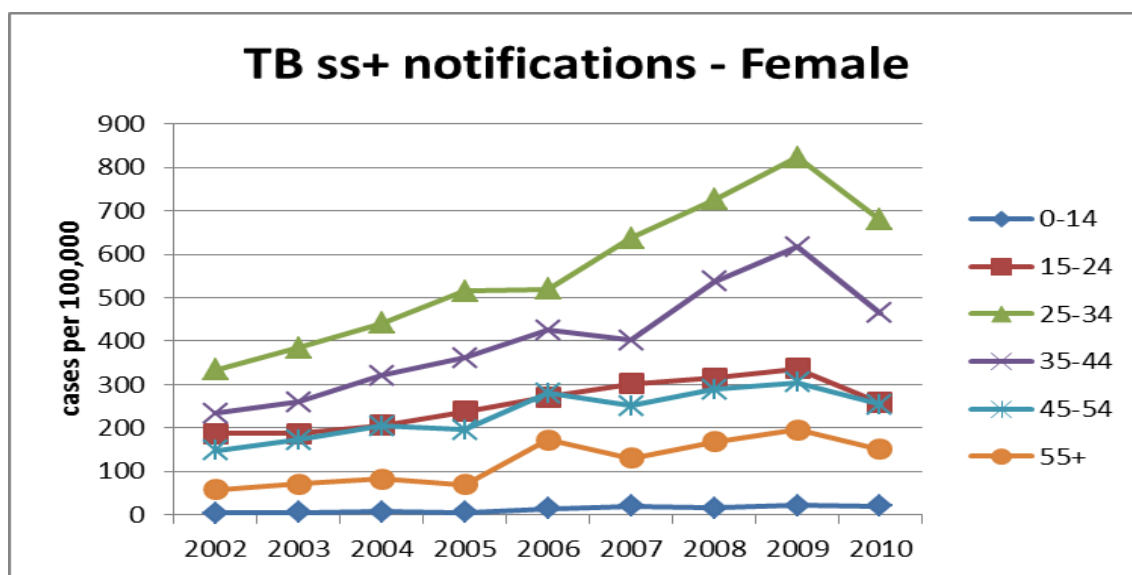


Figure 16: New Sputum smear positive TB notifications for females

There is a large increase from 2002 to 2009 in sputum smear positive TB cases that is most notable in the age groups most affected by HIV and AIDS: men aged 35-54 years, and women aged 25-44 years. The drop in smear-positive TB cases in the high HIV-prevalent age groups in 2010 is off-set by a sharp increase in smear unknown TB cases in 2010, so that the total number of TB cases was not yet decreasing in 2010 (Figure 14).

When looking at the trends in the males and females we see that males get TB later in life than females: The three most prevalent age groups for males span ages 25 to 54, while the three most prevalent age groups for females span the age groups 15 to 44. These trends are reflected by the HIV prevalence graph split according to age and sex (Figure 17). This shows that females get HIV infected at a younger age than males (commonly found in generalised epidemics).

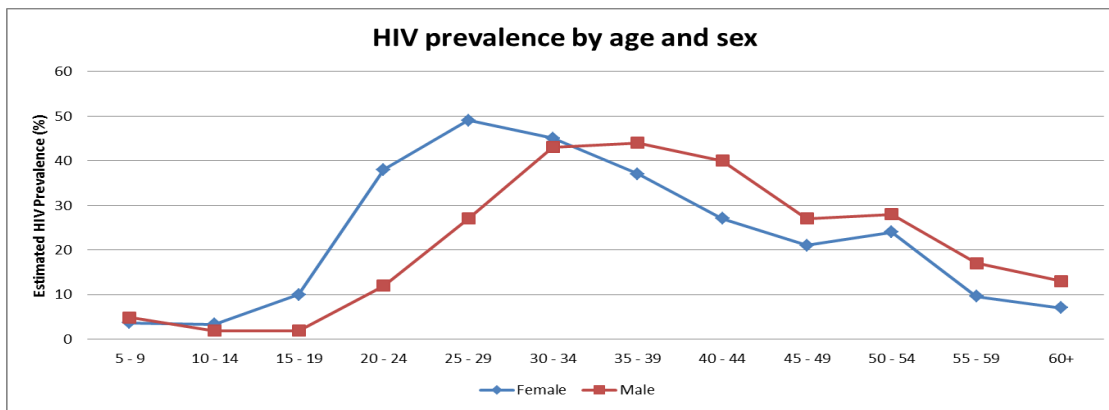


Figure 17: HIV prevalence (Source: DHS 2007)

From figures 15 and 16 it seems that very few children have smear-confirmed TB. This is consistent with the natural history and epidemiology of TB, and in part reflects the fact that children can't produce sputum whereas Swaziland diagnoses cases according to sputum smear-positivity. The following graph shows the extent of TB among children.

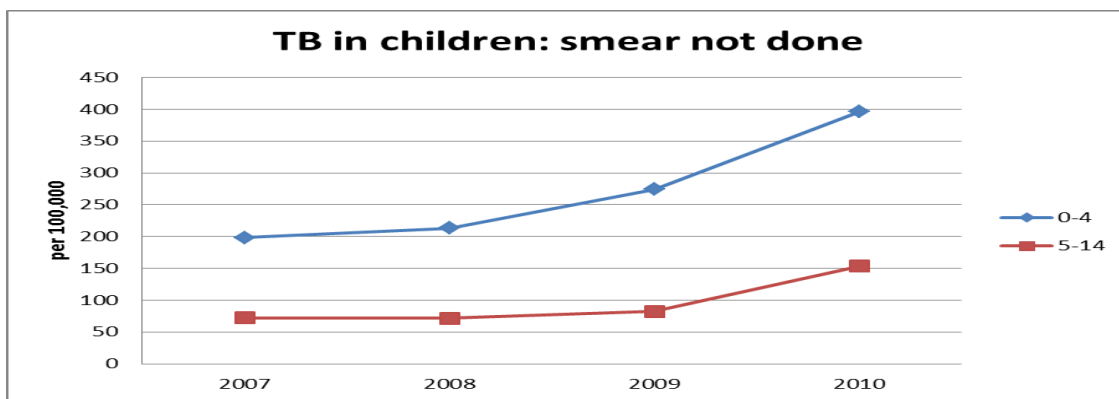


Figure 18: TB case notification for smear not done, per 100,000.

A rapid increase in the burden of TB disease is observed among children, specially the ages 0 to 4. This could be as a result of active case finding where contact tracing using adult TB patients as the index case is done since 2009 [7]. The percentage of all TB cases who are children increased from around 10% in 2009 to 16% in 2010. [7]

### **Trends in TB case notifications by age and sex**

**Conclusion:** The trends in smear positive TB show that TB is most prevalent for the age groups at which HIV prevalence is highest, for both sexes. TB notification rates are higher for men than for women. Smear positive TB cases have shown declines in 2009-10 and this can partly be attributed to the positive impact of ART and partly to the increase in unknown/smear not done cases in 2010. TB notifications in children 0-14 are showing rapid increases due to active case finding and contact tracing.

**Limitation:** Age/sex breakdown is only available for smear positive TB cases. This is dependent on a smear being done and is therefore not completely representative of TB in children and in other cases where smears cannot be done.

### 3.6 Rate of MDR-TB since 2007

The 2009 TB Drug Resistance Survey revealed that about 7.7% of all new TB cases and 33.9% of retreatment cases are drug resistant from which it is estimated that annually about 1,000 cases of MDR-TB will be diagnosed in the next 3-5 years. This has stressed the need to strengthen MDR-TB systems to manage effectively and report accurately. Table 4 shows the number of drug resistant cases diagnosed in the last 4 years.

Year	2007	2008	2009	2010
Number of new MDR cases	114	183	206	243
New MDR cases per 100,000	9.8	15.5	17.3	20.1
MDR as a proportion of all cases	1.2%	1.9%	1.9%	2.2%

Table 4: Drug Resistance

The high incidence of MDR-TB has been fuelled by the long time lapse between suspicion of MDR-TB and day of diagnosis, lack of proper follow-ups mechanisms for diagnosed MDR-TB patients, poor adherence to treatment by patients and poor infection control measures at household level. The rapid increase can also be explained by improved case diagnosis and laboratory capacity. According to the latest TB Drug Resistance Survey (2009), Swaziland is expected to diagnose about 6,000 MDR-TB cases by 2015 and 971 by end of 2011.

#### How has the rate of MDR-TB changed since 2007

Conclusion: Notified MDR-TB cases have doubled from 2007 to 2010. The impact of this is increased TB death rates in spite of the expected declines in death rates due to the uptake of ART.

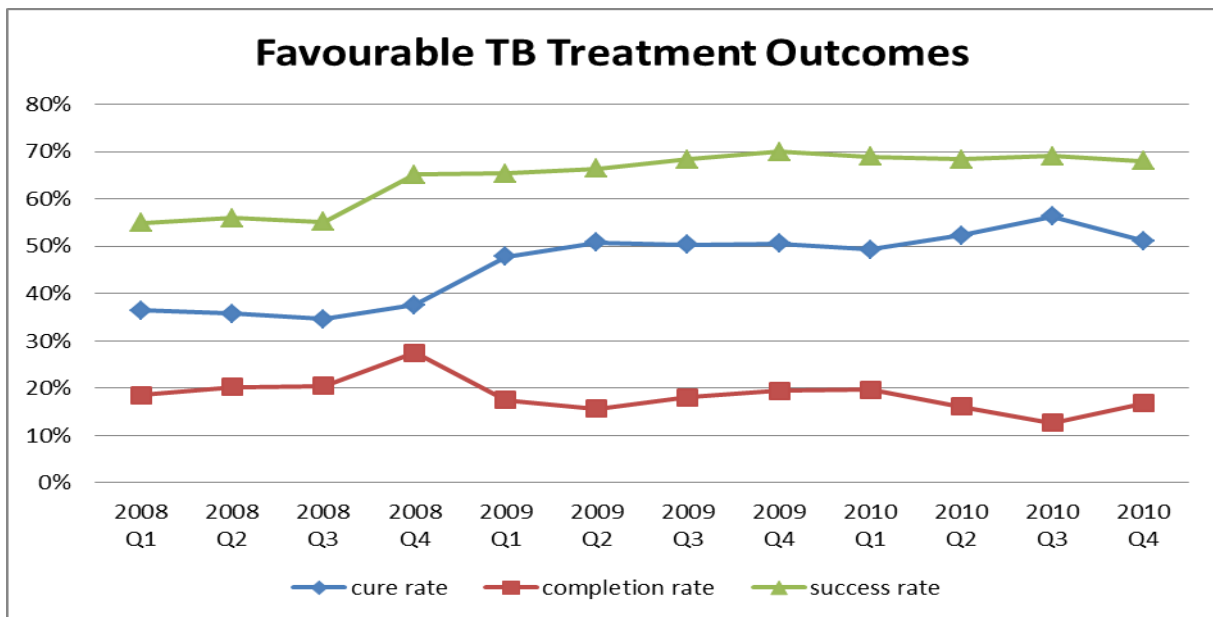
### 3.7 The impact of ART uptake on TB outcomes

In addition to the scale up of ART, the improvement in TB outcomes may be attributed to the following reasons:

- The national TB programme implemented recommendations made by various missions to Swaziland for technical support on TB control.
- Improvement in drug management
- Support supervision for health facilities from TB regional coordinators
- Introduction of quarterly review meetings between focal people from health facilities resulted in improved recording, reporting and sharing of best practices.
- More consistent training of health care workers on TB management.
- Improved default tracing mechanism.

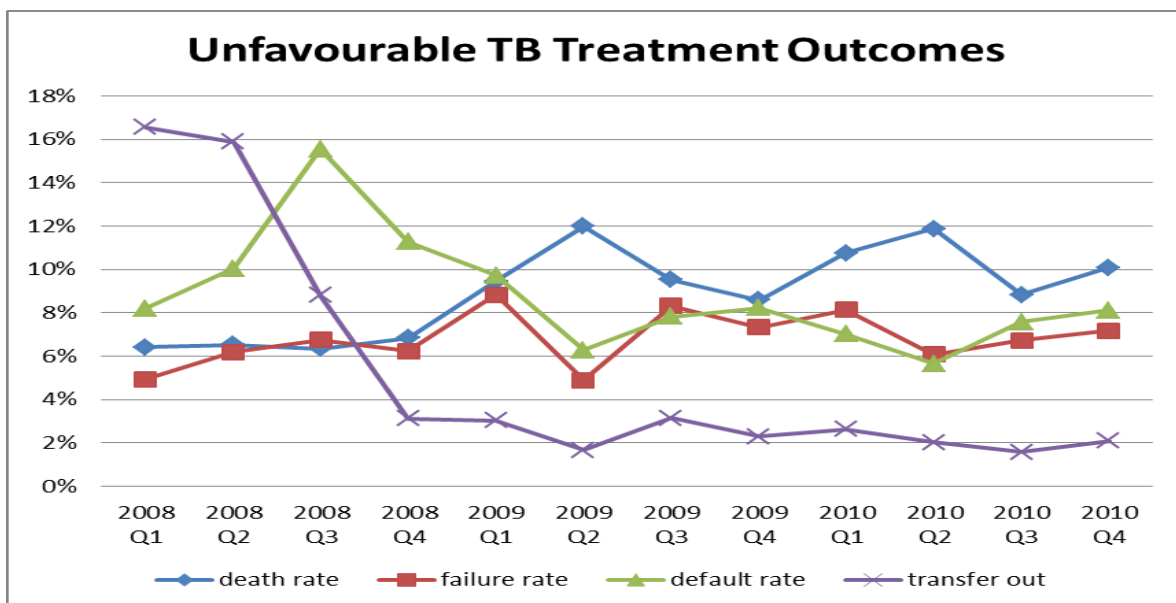
As shown in figure 23, TB/HIV co-infection is very high. Since 2009 all TB/HIV co-infected patients are started on ART. Therefore another way to assess the impact of ART on TB cases is to see whether TB outcomes are improving.

Figures 19 and 20 illustrate TB treatment outcomes



**Figure 19: Favourable TB treatment outcomes**

The cure rate among new sputum smear positive cases has been consistently increasing since 2008. The completion rate has been going down due to the emphasis on sputum analysis at the end of treatment. The drop in cure rate and increase in completion rate in the fourth quarter of 2010 can be explained by the fact that during the quarter there were more cases that did not have follow up sputums done at 2/3 months. These cases did not satisfy the definition for cured (2 negative sputum smears) when evaluated at end of treatment period, thus could only be said to have completed treatment. Overall the treatment success rate (cured and completed) has been stable around 70% since 2009 which is still well below the WHO target of 85%.



**Figure 20: Unfavourable TB treatment outcomes**

Transfer out in the TB outcome definition means that treatment is transferred to another facility and the outcome is not communicated and therefore not recorded by the initiating facility. The transfer out rate has been going down consistently due to the fact that, since 2008, TB patients are encouraged to register and complete treatment at the same facility. On a yearly basis default rate has been going down with some seasonal fluctuation. This downward trend is due to improved tracking and follow-up of patients since 2008. The apparent increase



in death rate might be explained by the decrease in default rate – patients that were previously assumed to have defaulted are tracked and notified as dead. The relative stability in failure rate could be due to the balance of drug resistance increasing and the DOTS programme improving adherence to medication.

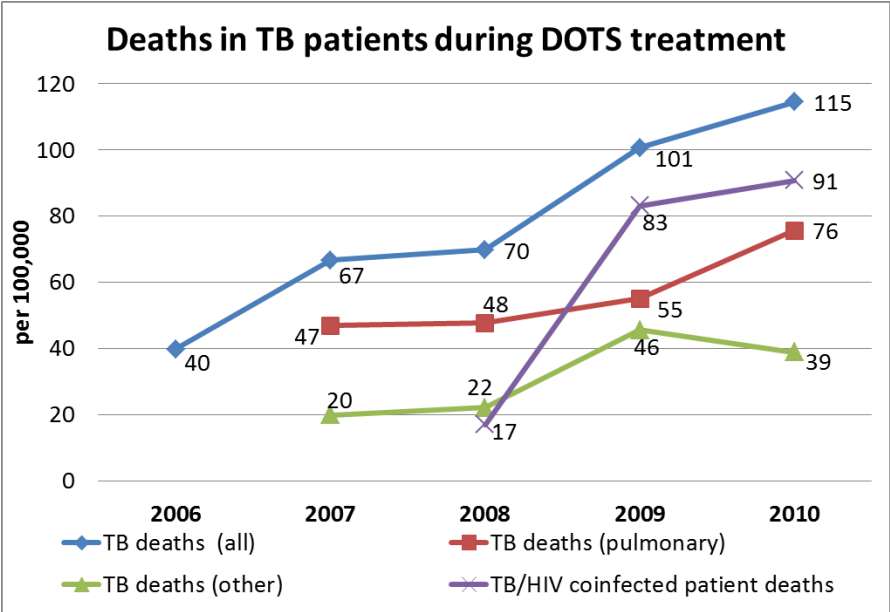
**The impact of ART uptake on TB outcomes**

Conclusion: Data on TB outcomes are reliable since 2008. The *success rate* has increased from 55% at the beginning of 2008 to a stable level of around 70% in 2010. This is still well below the WHO target of 85%. The rate of *deaths* among DOTS patients has apparently not decreased, but this can be attributable to the fact that defaulters are now tracked and therefore more deaths are discovered. The doubling of MDR-TB from 2007 to 2010 may also have an impact on death rate.

Limitation: We do not know the levels of TB outcomes before the scale-up of ART and therefore do not have a clear picture of trends before and after ART.

**3.8 Death trends in DOTS patient cohorts**

The actual numbers of deaths recorded among TB patients during DOTS in the country are presented in the figure 21.



**Figure 21: Deaths in TB patients during DOTS treatment.**

Generally TB deaths have continued to increase over the years with a marked increase in the deaths of co-infected patients. This could be explained by the low ART uptake among co-infected patients (shown in Figure 23) which however is beginning to rise with the integration and scaling up of TB/HIV services in clinics. The screening of all HIV patients for TB since 2009 and the planned implementation of intensified case finding and contact tracing from 2011 [7] may result in TB cases being found early enough and co-infected patients being started on ART in time to have a positive impact on death rates.

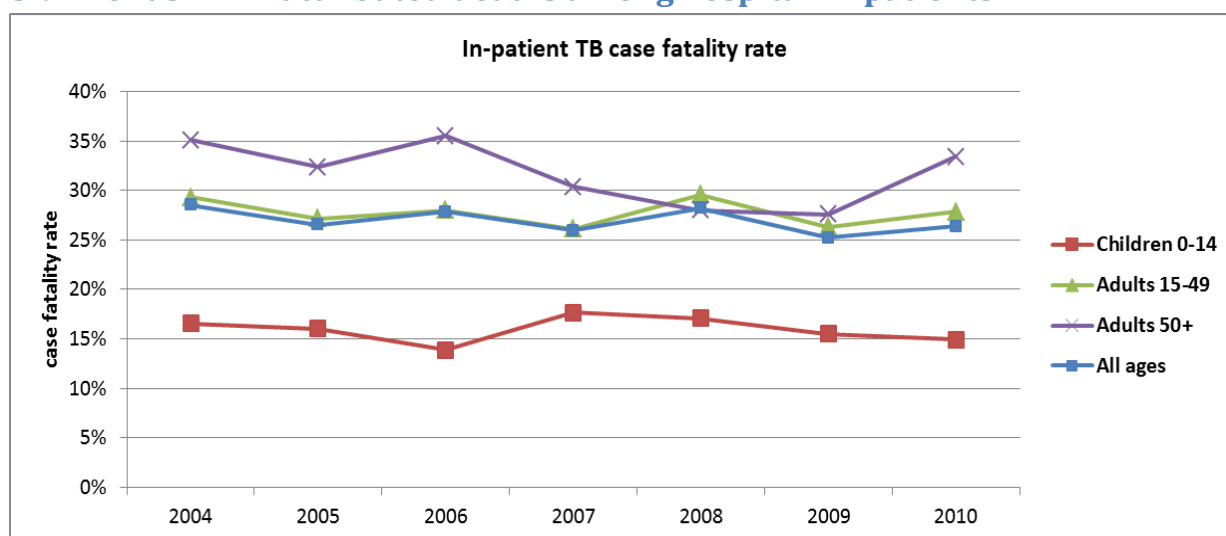


### Death trends in DOTS patient cohorts

Conclusion: Overall deaths during DOTS have been increasing due to active case finding, tracking defaulters and increasing MDR-TB cases. A possible positive impact of ART may be inferred from the decrease of deaths during DOTS among patients with extra-pulmonary TB ('TB deaths other') from 2009-10. The sharp increase of TB/HIV co-infected deaths in 2008-9 could be attributable to the fact that all HIV patients are screened for TB since 2009.

Limitation: These trends only represent deaths among TB patients during DOTS, and do not represent population level TB deaths. Deaths recorded on DOTS may also be attributable to any other causes. Therefore these deaths may be an under- or over-estimate of population level TB deaths. [9]

### 3.9 Trends in TB attributed deaths among hospital in-patients



**Figure 22: TB-attributed case fatality rate among hospital in-patients, by age group**

Figure 22 shows in-patient TB case fatality rate per age group, representing, for all TB admissions, the percentage of people who died in hospital. On average 75% of all TB deaths are in the age group 15-49 (in parallel to the general population of HIV with earlier infections in the younger age groups) and therefore the overall TB case fatality rate is driven by the rate in this age group. There is a slight decrease in the all ages case fatality rate since 2004 from 28.5% to 26.4%. This lack of significant decline (p-value=0.208) in case fatality rate could be a result of increasing prevalence of MDR-TB which is associated with very high mortality even in presence of ART.

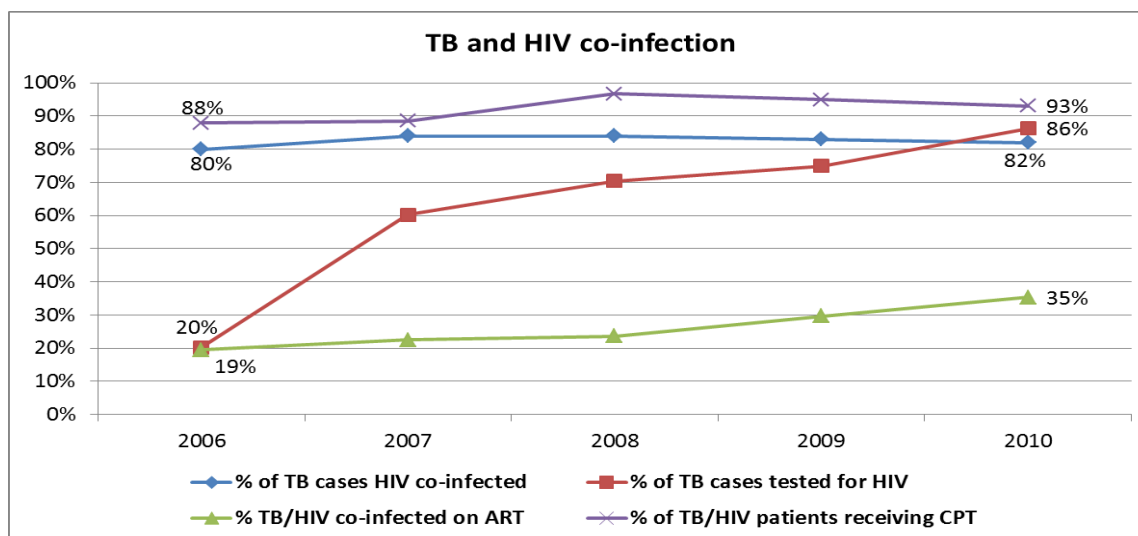
In addition this graph indicates the inconsistencies in data collection systems over the years where in the early years in-patient TB deaths were not adequately captured thereby causing the sudden declines and increases year after year as observed in figure 22. However, in 2010 WHO recommended that AIDS related deaths be separated from TB deaths and this is likely to give a more accurate picture about TB deaths globally and in-country.

### Trends in TB attributed deaths among hospital in-patients

Conclusion: There has been a decline in the in-patient TB case fatality rate since 2007 for children aged 0-14. The rate for patients aged 15-49 has not significantly declined.

### 3.10 Trends of TB/HIV co-infected cases

TB/HIV co-infection continues to pose a huge challenge in the fight to control TB in Swaziland. More than 80% of all TB cases notified to NTCP are HIV positive and thus their bodies are compromised in their response to TB treatment. Figure 23 shows the TB and HIV co-infection rate over the last four years.



**Figure 23: TB and HIV co-infection outcomes**

The percentage of TB/HIV co-infected patients remains stable, but very high at around 80% as a direct result of the high HIV prevalence in the country.

Integration of HTC into TB management by ensuring that TB patients are provided HTC within the TB clinics has increased the percentage of TB cases tested for HIV from 20% in 2006 to 86% in 2010.

The very low percentage (35%) of TB/HIV co-infected on ART might be an under-reporting due to the fact that information about ART for patients on TB treatment is not recorded and vice versa. This does not reflect recent rapid uptake in ART provision for TB/HIV co-infected cases due to implementation of revised guidelines in 2009. An electronic data collection system is being developed that will integrate the TB and HIV modules and will allow for improved recording and reporting of accurate statistics on HIV positive TB patients on ART. The percentage of co-infected patients receiving co-trimoxazole has been consistently high.

#### **Trends of TB/HIV co-infected cases**

**Conclusion:** The proportion of co-infected patients has been consistently high at around 80% since 2006. The percentage of TB/HIV co-infected patients on ART has increased from 19% in 2006 to 35% in 2010. This is still an under-reporting since, according to 2009 ART guidelines, all TB/HIV patients should be started on ART. This number will improve as data collection systems improve. The percentage of co-infected patients receiving CPT has been consistently high and at 93% in 2010. The percentage of TB patients tested for HIV sharply increased to about 86% in 2010 and this number should reach 100% in future due to recent policy changes.

**Limitation:** Slow improvement of reporting systems and collaboration between programmes are showing slow increases in treatment of TB/HIV patients in spite of policy changes.

## 4. PMTCT

### 4.1 Introduction

With an HIV prevalence of 41.1% [10] among pregnant women attending ANC services, it is estimated that around 11,000 infants were exposed to HIV in 2010. The PMTCT program is one of the priority interventions in the fight against HIV/AIDS. In the absence of PMTCT interventions, 30% to 45% of HIV exposed infants will be HIV positive with continued breastfeeding [11]. This is improved if pregnant women are given ARVs for PMTCT. Studies done through WHO have shown that if women were given Single Dose NVP (SD-NVP), the risk of transmission is reduced to about 25% and if these women are given SD-NVP together with AZT initiated early in pregnancy, the risk of transmission is further reduced to about 15% and to less than 2% if women are on HAART before delivery [12].

Swaziland started implementing PMTCT services within its maternal, new-born and child health services in 2003 and since then, there has been progressive increase in coverage of PMTCT services from 3 clinics initially to 150 Health facilities (88%) by 2010. Advantages of providing PMTCT in Swaziland is the high antenatal care attendance, where 97% make at least one ANC visit and 79.3% make at least 4 ANC visits [2].

To determine the HIV status among exposed infants, the country established DNA PCR testing using dried blood spot (DBS) in 2007, allowing for early infant diagnosis of HIV from as early as 6 weeks of age. Currently, there are 127 (81%) facilities capable of collecting DBS samples for HIV testing using DNA PCR [4]. At the moment all DBS samples are sent to the National Reference Laboratory for DNA PCR tests and on average, about 860 tests are done per month.

### 4.2 Uptake of ART for HIV positive pregnant women and children diagnosed with DNA PCR

The Figures 24 and 25 below show PMTCT interventions in relation to infant and child mortality.

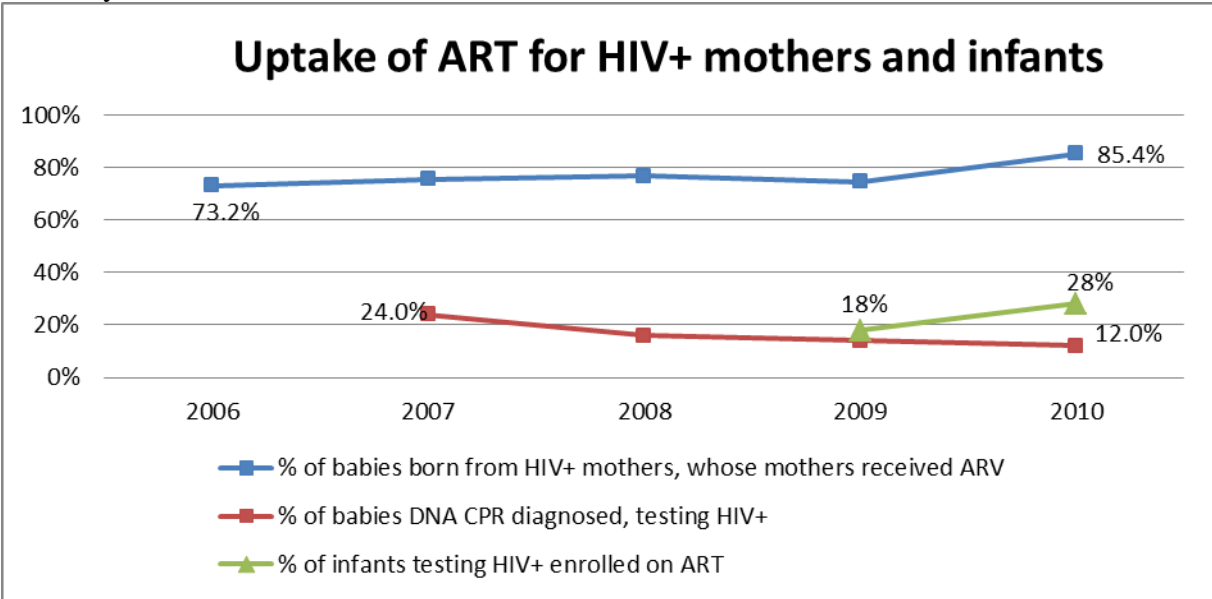


Figure 24: Uptake of ARV's for HIV positive mothers and infants.

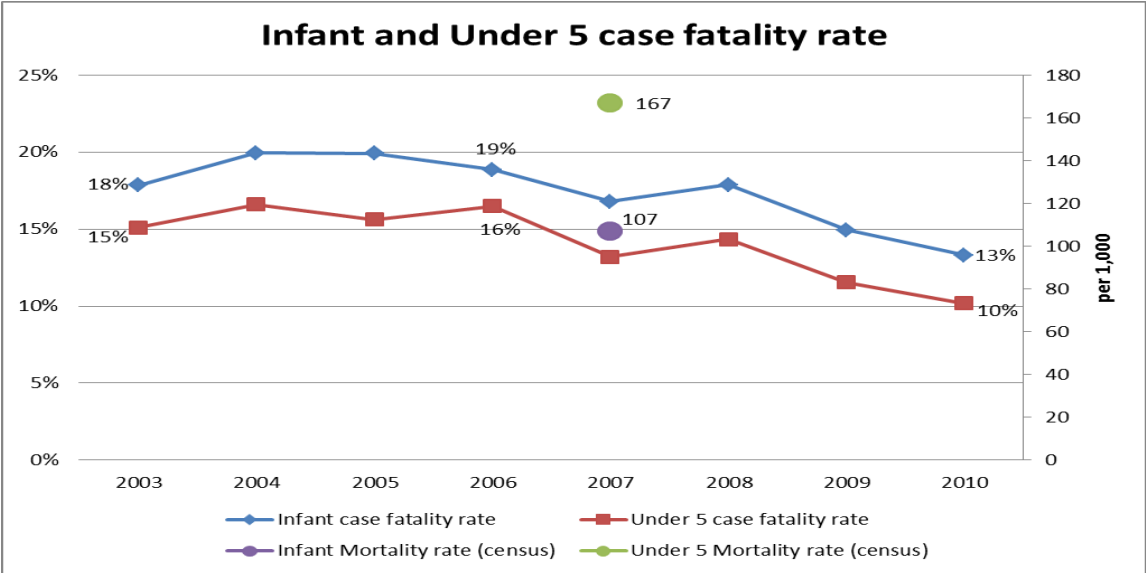
Over the years, Swaziland has made tremendous progress in ART uptake among HIV infected pregnant women, from 4% in 2004 [13] to about 85% by end of 2010 as depicted in Figure 24 . It is therefore expected that this improvement has led to the reduction of HIV infection among infants. This is further explained by the decline in the proportions of infants testing HIV positive through DNA PCR as shown above, from 24% in 2007 to 12% by the end of 2010. The decline from 2008 can be further explained by the change in the type of ARVs given to mothers during pregnancy. There was a complete shift from SD-NVP to initiation of AZT from as early as 28 weeks of pregnancy. Further improvement is due to the focus that has been put on “regimen appropriateness”, where pregnant women in need of chronic ART for their own health are initiated on ART as soon as they are identified as HIV positive. The proportion of HIV positive pregnant women on ART has increased from 5% in 2007 to 35% by 2010 [7]. In 2009 as shown in figure above, only 18% of infants diagnosed with HIV were initiated on ART and this percentage increased to 28% in 2010.

**Uptake of ART for HIV positive pregnant women and children diagnosed with DNA PCR**

Conclusion: The provision of PMTCT has increased from 4% of HIV positive pregnant women in 2004 to 85% in 2010. This increase may have contributed to the drop in proportion of infants born HIV-positive, among infants born to HIV-infected mothers and DNA-PCR-tested, from 24% in 2007 to 12% in 2010. The proportion of HIV positive babies who are enrolled on ART has increased from 18% in 2009 to 28% in 2010.

Limitation: Swaziland has a system for vital registration of deaths in place, but under-reporting in child deaths makes this an under-representative source.

**4.3 The trends in infant (less than 1 year) and child mortality (under 5 years) in response to the increase of PMTCT**



**Figure 25: Infant and under-5 case fatality rate**

Figure 25 shows the impact of PMTCT on child mortality, where in-patient death rates among infants and children under five are declining. Available data also shows the small percentage of infants diagnosed with HIV who are initiated on ART. The under-5 mortality rate estimated in the 2007 census is 167 per 1,000 live births as shown in figure 25. The number of

deaths registered at the BMD for the same year was only 2.53 per 1,000. This shows an extreme under-estimation of the real mortality of children under-5 based on registered deaths. The first DHS in Swaziland estimated infant and under-5 mortality for the 15 years preceding the survey. The estimates (per 1,000) are given in table 5.

Years preceding the survey	Approximate calendar period	Infant mortality	Under 5 mortality
0-4	2002-2006	85	120
5-9	1997-2001	67	90
10-14	1992-1996	39	60

**Table 5: Estimates of infant and under-5 mortality (per 1,000). (Source: DHS 2007)**

Infant and under-5 mortality estimated for the 15 years preceding the DHS doubled from the period 1992-96 to the period 2002-2006. This increase can be attributed to the rapid increase of HIV prevalence in the same period. These estimates were obtained early in the scale up of ART and future estimates from similar surveys will hopefully show positive impact of ART and HIV prevention.

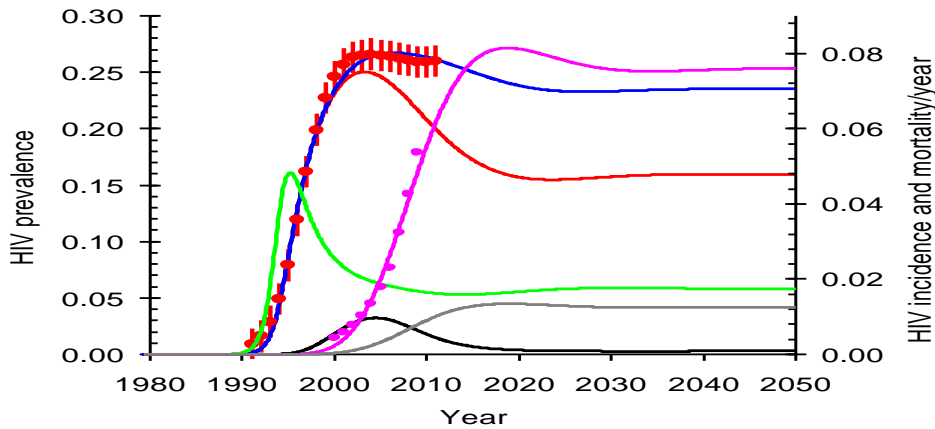
**The trends in infant (less than 1 year) and child mortality (under 5 years) in response to the increase of PMTCT**

Conclusion: In-patient case fatality rates for both infants and children under 5 are showing downward trends.

Limitation: The 2007 Swaziland DHS was done very early in the roll out of ART and therefore provides no measure of the impact of ART on mortality.

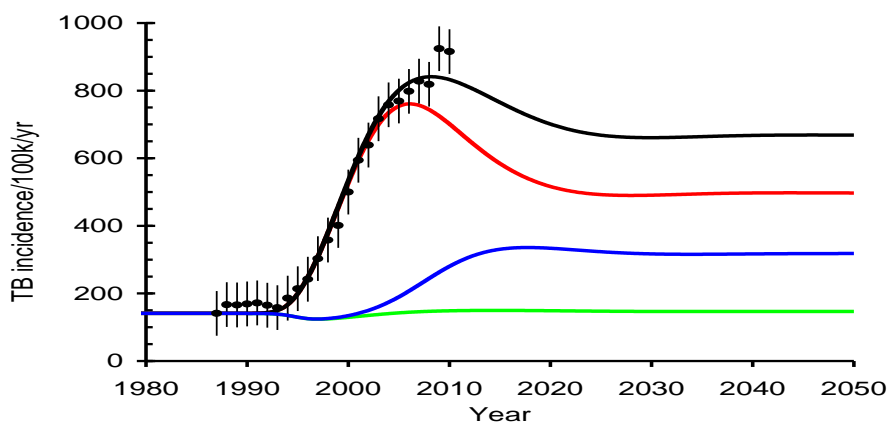
## 5. Modelling HIV and TB

Epidemiological models [14] provide a biological basis for the interpretation of trend data and this is especially important in cases such as this where we need to interpret different but related series of data.



**Figure 16: Model fitted to the HIV-prevalence data for Swaziland. Left axis: Red dots: prevalence data; blue line: fitted prevalence; red line: prevalence of people not on ART; pink line: prevalence of people on ART. Right axis: green line: incidence; black line: mortality of people not on ART; grey line: mortality of people on ART**

There is no evidence of early behaviour change or impact of HIV prevention before the roll-out of the ART programme, as ART was introduced at about the same time that the prevalence peaked. Therefore, we cannot fully attribute impact since 2005 to ART, HIV prevention or the natural dynamics of the epidemic. However, it is almost certainly the case that the scale-up of ART has already had a substantial impact on the prevalence of HIV among those not on ART (red line) and more importantly on AIDS related mortality (black line). HIV prevalence (pink line) for those on ART will stay high at around 25% and overall HIV prevalence (blue line) will stabilise at around 23% in future.



**Figure 27: Model fitted to the TB data for Swaziland. Green line\*: notifications among HIV-negative people; blue line: \* and notifications among HIV-positive people on ART; red line: \* and notifications among HIV-positive people not on ART; Black line: all TB notifications.**

In Figure 27 we see that the TB notifications for patients on ART (blue line) will increase as the number of people on ART increases and then stabilise at a level of around 300 notifications per 100,000. The number of TB notifications for HIV positive patients not on

ART (red line) will decrease as number of patients on ART increases, but will stabilise at around 500 per 100,000 people. We see that the modelled trend for all TB notifications (black line) will decline in future and stabilise in 2025.

## 6. Conclusion

HIV Prevalence in Swaziland peaked and stabilized at around 26% since 2004, the same year that the Swaziland Ministry of Health launched the ART programme. The programme has since been scaled up and at the end of 2010 around 60,000 people were actively enrolled on ART with an estimated coverage of 70% (based on a CD4 count of 350/mm<sup>3</sup>). TB is the most common opportunistic infection in HIV patients in Swaziland and the number of notifications has increased similarly to the HIV epidemic and the national TB programme started to gain importance with the rapid increase of HIV. Since 2007, collaboration between the national HIV and TB programmes was established to facilitate sharing of information and consolidate efforts in the management of TB/HIV patients. Swaziland started implementing PMTCT services within its maternal, new-born and child health services in 2003 and coverage has increased from 4% in 2004 to 85% in 2010.

The **3 main outcomes** expected (ref. Introduction) in measuring outcome and impact using triangulation in Swaziland are the following:

1. There appears to be some relationship between expanding ART coverage and HIV and TB transmission, morbidity, and mortality, for example:
  - AIDS case fatality rates have declined since the large scale-up of the total number of patients on ART, and linked to this finding
  - the success rate for TB treatment improved from around 55% in 2008 to 70% in 2010. This is still well below the WHO target of 85% and can possibly be explained by the increase of MDR-TB or that patients present with symptoms too late. The doubling of MDR-TB from 2007 to 2010 is a concern and this might influence future TB outcome trends.
2. The trends in retention on ART and related deaths supporting this evidence show the following:
  - in-patient case fatality rate has decreased since the scale-up of ART.
  - quarterly death rate for patients on ART have dropped by 60% and quarterly lost-to-follow-up rate have decreased by 50% since the first quarter of 2005 to the last quarter of 2010.
  - the biggest proportion of ART patients is still lost in the first year of treatment, but the proportion retained on treatment after the first year has increased from 75% for the 2007 cohort to 84% for the 2009 cohort.
  - in-patient case fatality rate have declined since 2004-5 for both infants and children under 5 and this could be attributed to prevention of transmission and healthier pregnancies due to ARV's.
3. Unfortunately, it may be too early to determine if there is population level evidence of declining adult, maternal, infant deaths in parallel to the scale-up of ART because of scarce census data and lack of comparative data points.

Beyond beginning to answer some questions related to the measurement of outcome and impact, the report also sets a basis to improve the monitoring and evaluation system, and fill in some of the **data gaps**, the most important points to be addressed being in particular:

- emphasis on obtaining/recording the HIV status of hospital in-patients to better understand morbidity and mortality of AIDS patients
- similarly, obtain/record the TB status of in-patients irrespective of reason for admission



- to record whether patients on DOTS died of TB or other causes, as attributing all deaths on treatment to TB may be an over-estimate
- improve reporting systems and collaboration between programmes to reflect the policy that all TB and HIV co-infected patients should be started on ART
- scale up the importance of vital registration

## **7. Recommendations**

### **1. Strengthen Collaboration between TB and HIV programmes with the perspective of integration in the future**

TB/HIV co-infection remains a huge public issue in the country. Currently more than 80% of all TB cases notified to NTCP are HIV positive. Despite the existence of collaboration measures between the TB and HIV programmes more still need to be done in this regard.

### **2. Establish mechanisms of collaboration between BMD (Recording and Reporting Systems) and M&E in the Health Sector**

There should collaboration between the BMD and SID to ensure easy access to information sharing between the two departments. This will ensure a virtually accurate reporting of deaths as classified by the conditions (Case-fatalities).

### **3. ART program should strengthen follow of patients enrolled on ARVs with emphasis to the first six months of enrolment**

Strengthen ART adherence measures such as, intensive patient care especially during the first 6 months into care to reduce lost to follow up.

### **4. The HMIS should be reviewed in order that it is able to generate data that will inform periodic program reviews (Specifically HIV/TB related programs)**

There needs to be extensive diagnosis of patients in the facilities to allow for identification of the primary and secondary causes of disease in patients seen in the health facilities. In this regard the HMIS needs to review the current disease coding version (International Classification of Diseases Version-ICD 9),

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## Appendix A

Data source	Variables	Disaggregation	Limitation
1. TB programme	<ul style="list-style-type: none"> <li>• TB notification data (sputum smear positive, negative, extra-pulmonary TB and relapse cases.)</li> <li>• TB/HIV co-infection data (smear positive and negative cases, smear not done, HIV tests, number receiving ART and CTX, co-infected deaths)</li> <li>• TB outcome data (cured, completed, died, defaulted, stopped, transfer out)</li> <li>• MDR-TB cases</li> </ul>	Sex, age	TB data were not kept in a consistent manner before 2008. Reliable programme data is only available from 2008.
2. ART information system	<ul style="list-style-type: none"> <li>• People newly enrolled on ART</li> <li>• People currently on ART</li> <li>• People ever enrolled on ART</li> <li>• Cohort data (alive and on ART, died, stopped, lost to follow up, restarted)</li> </ul>	Sex, age	Age disaggregation for children is only available from 2009.
3. Health Management Information Systems (HMIS)	<ul style="list-style-type: none"> <li>• Patients' age</li> <li>• Diagnosis</li> <li>• Discharge status</li> <li>• Region</li> <li>• Gender</li> </ul>	N/A	
4. HIV Sentinel surveillance	<ul style="list-style-type: none"> <li>• HIV prevalence in pregnant women</li> </ul>	N/A	
5. PMTCT database	<ul style="list-style-type: none"> <li>• Women receiving ARV prophylaxis to reduce MTCT</li> <li>• Infants diagnosed with DNA PCR</li> <li>• Infants (&lt;1) testing HIV+</li> </ul>	N/A	Data on the number of infants enrolled on ART is only available since 2009. Prior to 2009 all children (0-14) on ART were aggregated.
6. Spectrum modelling	<ul style="list-style-type: none"> <li>• Population projections</li> <li>• HIV Prevalence and Incidence</li> <li>• People living with HIV/AIDS</li> <li>• People in need of ART</li> <li>• HIV+ pregnant women</li> <li>• Mothers in need of PMTCT</li> </ul>	Sex, age	
7. HIV Testing and Counselling database	<ul style="list-style-type: none"> <li>• HIV tests</li> </ul>	Sex, age	
8. Swaziland DHS and Census of 1997 and 2007	<ul style="list-style-type: none"> <li>• Estimates for mortality</li> <li>• HIV prevalence on general population</li> </ul>	Age	

