

# **Youth mortality due to HIV/AIDS in South Africa, 2006- 2009: An analysis of the levels of mortality using life table techniques**

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## **Introduction:**

According to a report from Statistics South Africa (Stats SA) in 2011, the total number of persons living with HIV in South Africa increased from an estimated 4.21 million in 2001 to 5.38 million by 2011. In the early days of the epidemic, HIV was seen as a disease affecting mainly males. Further, young people aged 15 to 24 years old make up the largest proportion of HIV infected people in the country. Out of the thousands of new HIV infections each year, 58% are to the youth.

Approximately 50% of the developing world population consist of youth and children(Leclerc-Madlala, 2008). This dominance of the youth population represents both a challenge and an opportunity for economic and social development. The youth are a crucial segment of a nation's development and their contribution is highly needed. They are the social actors of change as they are not only leaders of tomorrow but also present day caregivers and consumers.

According to the 2011 mid-year population estimate, South Africa can be described as a youthful country as the people between ages 14-34 represent 41.2% of the total population (Statssa, 2011). Challenges facing the youth in South Africa include high levels of poverty and unemployment, low levels of literacy, skills and educational attainment. Additional challenges are societal alienation and substance abuse, high rate of teenage pregnancy and HIV/AIDS vulnerability.

The Youth Development Program aims to reduce by a third (30%) the number of vulnerable youth in poverty pockets which complements the government's envisioned goals in achieving the Millennium Development Goals (NYDA, 2012). The programme's intention is to promote positive and healthy value systems amongst the youth and endorse social cohesion amongst young people and youth organisations. In doing so the programme hopes to alleviate the challenges South African youth face, one such challenge being their vulnerability to HIV/AIDS.

In an attempt to assist with reaching these goals, the objectives of this paper are threefold. Firstly to estimate the levels of HIV/AIDS among males and females aged 15- 35 years old in South Africa from 2006 to 2009. Secondly, to examine the extent to which life expectancy lost can be enhanced if HIV/AIDS was absent in the mortality experience of the country and finally to illustrated the number of years of potential life due to the disease among South Africa's youth.

## **Data and Methods**

Data on causes of death from death notification records for 2006- 2009 are here used (Stats SA). Youth, between the ages of 15 and 34 years old are studied. Both males and females have been included in the analysis. The total youth population for 2006 was 8,909,100 and this increased to 9,060,600 in 2009. General, all- cause mortality among adolescents in the period, however fluctuated with a decline to 62,969 deaths in 2008 followed by an increase in 2009, to 56,335 deaths.

Apart from generating frequency distributions, cause- specific mortality rates are calculated for males and females separately. Cause- specific mortality rates show the number of deaths from a particular cause of death, per 10,000 population at risk. The formula used for this is:

$$CSMR = \frac{{}_nD_x^i}{{}_nP_x}$$

where  ${}_nD_x^i$  is the number of deaths from a cause and  ${}_nP_x$  is the total number of adolescents in the population.

Proportional Mortality Ratios (PMR) which specifies the contribution of each selected cause of death to overall mortality is used. The ratios are expressed as percentages (%) and the formula used is as follows:

$$PMR = \frac{{}_nD_x^i}{{}_nD_x}$$

Where  ${}_nD_x^i$  is the number of deaths from a particular cause and  ${}_nD_x$  is the total number of deaths from all causes.

Multiple and associated single decrement life table techniques are used to display probability of death ( ${}_nq_x$ ) and years of potential life lost due to specific causes of death. Probability of dying from a cause ( ${}_nq_x^i$ ) has been derived as follows:

$${}_nq_x^i = {}_nq_x \left( \frac{{}_nD_x^i}{{}_nD_x} \right)$$

where  ${}_nq_x$  is the probability of dying from age x to x+n;  ${}_nD_x^i$  is the observed total number of deaths from a particular cause; and  ${}_nD_x$  is the observed total number of deaths from all causes.

Years of potential life lost measures the incidence of 'premature' mortality that occurs in a population at ages at which a death may be regarded as untimely. In this paper, deaths occurring before age 60 are considered untimely. As such the formula used to calculate YPLL is:

$$YPLL = \sum ({}_nd_x^i) \times (60 - (n \times 2.5))$$

where  ${}_nd_x^i$  is the life table number of deaths due to a particular cause and  $n$  is the width of the age-interval (in this study 5 year age intervals were used). The number of years and the percentage of years lost are here displayed.

## Results

Graph 1 illustrates the percentage distribution of youth deaths by age- group and year for the years under review in South Africa. Youths of the ages 30-34 have the highest death rates in all four years. In addition, in 2006 mortality was slightly higher in this age group compared to other years. This is followed by youths of the ages 25-29 with 2009 having a higher percentage of youth deaths. Ages 20-24 have relatively lower youth deaths when compared to older age- groups. The highest youth deaths for this age group occurred in 2008. The ages 15-19 have the lowest youth deaths in all four years. The year 2009 has slightly higher youth deaths for the ages 15-19. It is important to note that the increases in youth deaths for each age group are very slight.

Graph 2 shows the percentage distribution of youth HIV/AIDS deaths by sex and year in South Africa for the years 2006-2009. This graph clearly shows that female youth deaths due to HIV/AIDS are higher than males in all four years in the country. However, male deaths have increased in 2009 when compared to the previous years while female deaths have declined in 2009 when compared to the previous years.

### Cause- specific mortality rates and proportional mortality ratios

For cause- specific mortality rates, deaths due to HIV/AIDS are seen to increase with age among the youth, with male and female rates being highest in the 30- 34 age group. In particular, in 2006, male

rates were almost 7 deaths per 1,000 youth population and in 2009 male mortality rates were approximately 8 deaths per 1,000 youth population. Of notable importance is that in 2007 male youth CSMRs were a low 4 deaths per 1,000 youth population. For females cause specific mortality rates were higher in comparison to male rates across the period. In 2006, there were about 9 female deaths due to HIV/AIDS per 1,000 youth population and this declined to approximately 8 deaths in 2008 before increasing marginally to 8.5 deaths to 30-34 year old youth females in 2009. Overall for the youth population, since 2006, male mortality due to HIV/AIDS has remained approximately 2 deaths per 1,000 youth population compared to female deaths at about 4 per 1,000 population over the period.

According to the proportional mortality ratios across the period the proportion of female deaths due to HIV/AIDS have been consistently higher than male deaths over the period. In particular, for 2006, HIV/AIDS contributed 5% of all female mortality to women aged 25-34 years old. Within the overall age-group the proportion of deaths attributable to HIV/AIDS increased from about 5% for 20-24 year olds to 5.38% in 30-34 year olds. In 2007, the proportion remains highest for females aged 30-34 years old at 5.35% of all-cause mortality. This changed in 2008, where it is seen that the highest proportion of deaths from HIV/AIDS is to women aged 25-29 years old at almost 6%. In addition, the proportional mortality ratio for young females due to this cause in 2008 is higher than in 2007. Finally in 2009, the contribution of HIV/AIDS mortality to overall or all-cause mortality increased again, with an overall contribution of approximately 7% among young females. In this year, the highest proportional mortality ratio was to 30-34 year old females at 7.23% of all mortality to these youth.

For males, in 2006, the proportion of HIV/AIDS deaths was highest in the 30-34 year old age-group at 4.7% of all male mortality for that year. In 2007, deaths to males aged 15-34 years old, contributed 3.02% of all youth male mortality. This figure is marginally less than the overall contribution of 3.5% in 2006. Similar to 2006, however, the proportion of deaths is highest in the 30-34 year old age group in both 2007 (4.07%) and 2008 (4.88%). For 2008, the contribution of overall HIV/AIDS mortality to all-cause mortality increased to 3.55%. Further in 2009, the proportional mortality ratio for young males increased again to an overall 4.5% contribution for the entire age group.

#### **Probability of dying, life expectancy and years of potential life lost**

The probability of dying from HIV/AIDS is the highest in the age group 30-34 for males with the highest being for the year 2009 (0.5%), followed by 2006 (0.49%), 2008 (0.46%) and the lowest probability is for the year 2007 (0.18%). This means that the probability of dying decreased from the year 2006 to 2007 and increased again until 2009. The probability of dying from HIV/AIDS is the highest in the age group 30-34 for females with the highest being for the year 2006 (0.67%), followed by 2007 (0.59%) and 2008 (0.49%) and the lowest probability is for the year 2007 (0.48%). This means that the probability of dying from HIV/AIDS for females is decreasing while for males the probability of dying from HIV/AIDS is increasing in the country over the period.

Table 4 shows the years of life gained by sex and age-group with the eradication of HIV/AIDS in the population. Across the period, as much as 6 years can be gained for the younger fraction of the youth population (15-24 years old) and up to approximately 3 additional years of life can be gained for the older fraction of this population (25-34 years old). Further the table shows that the years gained in life expectancy for males are the higher than females. For example, in 2009, where males aged 15-19 years old could gain about 6 additional years of life, females of the same age could expect to gain approximately 3 additional years in the absence of HIV/AIDS. For 30-34 year olds in the same year, males could gain about 4 additional years of life compared to the low 2 years gained by females of the same age.

The years of potential life lost (YPLL) and the percentage contribution of each cause to 'premature' death is given in Table 5. The YPLL for youth are highest amongst 30-34 year olds (in the ten thousands for both males and females) and lowest for 15- 19 years old, especially among males (less than 400 years). However, this has increased over the period from 115 years in 2006 to 397 years in 2009. The YPLL for males remained lower than that for females for all years under review. Of notable importance, the YPLL for males declined rapidly in 2007 before increasing from 2008 to 2009. For females however, the YPLL reached its lowest in 2008, but similarly increased thereafter in 2009.

#### **Discussion and Conclusion:**

Youth mortality due to HIV/AIDS has remained consistently higher among older youths compared to younger ones. By sex, mortality due to this cause has also remained consistent over the period, with mortality due to HIV/AIDS being higher among females than males. Cause- specific mortality rates and proportional mortality ratios also reflect the increased mortality of older youth (especially 30- 34 years old) and females within the South African population. Probability of dying from HIV/AIDS shows that over the period, fluctuations in likelihood of mortality have occurred, but for both males and females (of all age- groups) the chances of dying from this cause have increased in 2009.

These findings are worrisome and interesting for two reasons. Since South Africa's national roll-out of Anti-Retroviral Treatment (ARVs) in 2006, mortality among youth populations should be declining and not increasing in later years. Second, with policy and programmes focussing on the plight of women being affected with HIV/AIDS, female mortality should not be this much higher than male mortality in the population. Females, who have gained special attention with regard to the disease in both national and international research for years, are widely known as demographic who are 'at most risk' of contracting and dying from HIV/AIDS. Shisana and others (2009) estimated that approximately one-fifth of South African women in their reproductive ages are HIV positive. According to Parker (2011), females account for 55 percent of all new infections in South Africa, of all the infections in persons aged 15 to 24 years, 77 percent are women. Since this is known, the mortality differentials between sexes should not be as stark as the findings of this paper have presented.

More is needed with regard to HIV/AIDS mortality among the youth of South Africa. Investigations into demographic and socioeconomic determinants of infection and mortality are warranted as this will provide contextual information regarding why females, in particular, are still at higher risk compared to males. This paper, however, provides important foundational findings, from which greater in- depth examination of the disease can be made.

*“Youths are a valued possession of the nation. Without them, there is no future. Their needs are immense and urgent.” – Nelson Mandela*

**References:**

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Shisana, O., Rehle, T., Simbayi, L., Parker, W., Zuma, K., Bhana, A., Pillay, V. (2005) *South African national HIV prevalence, HIV incidence, behaviour and communication survey, 2005*. Cape Town.

**Appendices:**

Figure 1: Levels of HIV/AIDS among South African Youth

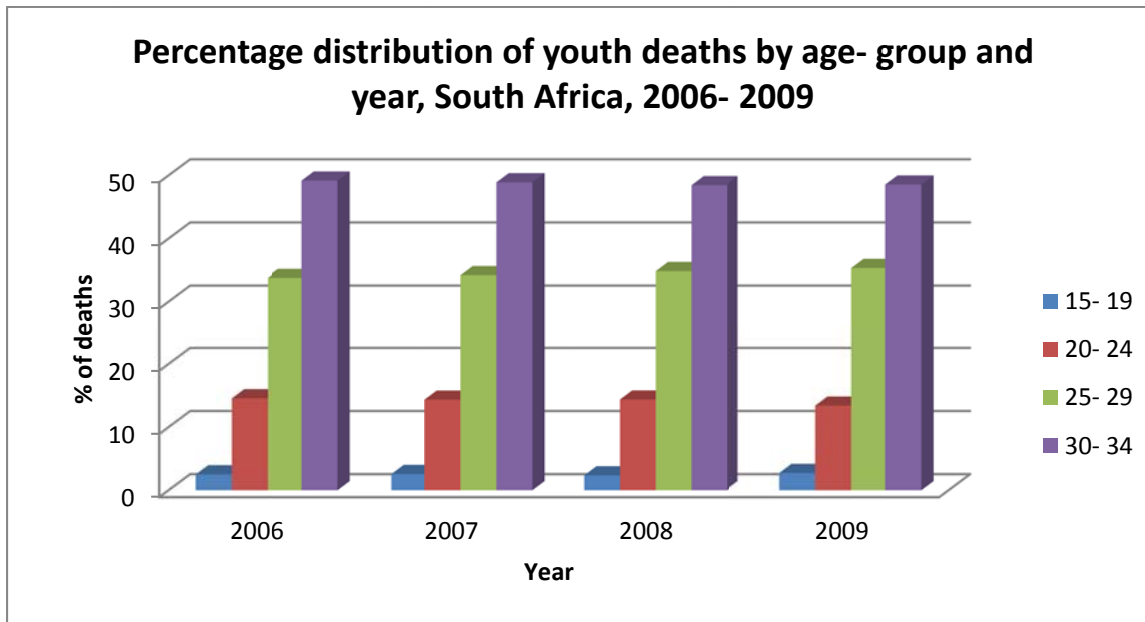


Figure 2: Percentage distribution of youth HIV/AIDS deaths by sex and year, South Africa, 2006- 2009

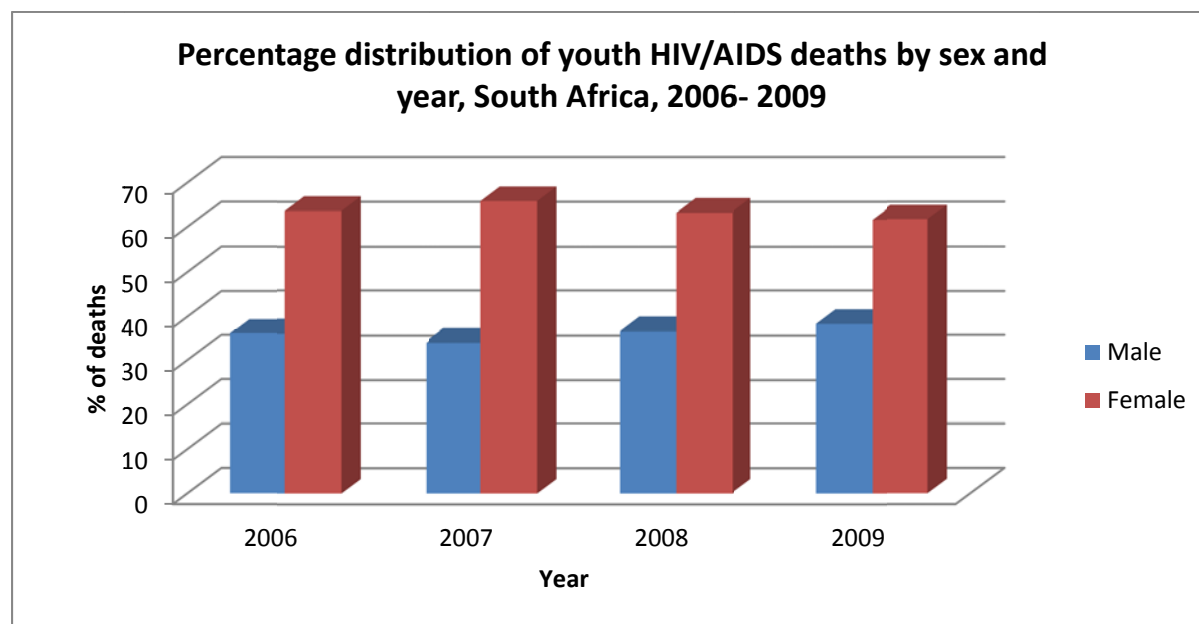


Table 1: Cause- specific mortality rates among youth (15- 34 years old) for deaths from HIV/AIDS, 2006 - 2009

| Age-Group     | CSMR 2006 |         | CSMR 2007 |         | CSMR 2008 |         | CSMR 2009 |         |
|---------------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|
|               | Males     | Females | Males     | Females | Males     | Females | Males     | Females |
| <b>15- 19</b> | 0.0525    | 0.5689  | 0.0601    | 0.5122  | 0.0732    | 0.4616  | 0.1794    | 0.5165  |
| <b>20-24</b>  | 0.6602    | 3.1452  | 0.5670    | 2.8244  | 0.6880    | 2.8040  | 0.7471    | 2.8485  |
| <b>25-29</b>  | 3.2120    | 6.4728  | 2.6451    | 6.1178  | 3.1197    | 6.1281  | 3.8051    | 6.6771  |
| <b>30-34</b>  | 6.9340    | 8.6537  | 3.8884    | 8.1253  | 6.8663    | 7.5983  | 8.0161    | 8.5059  |
| <b>Total</b>  | 2.4728    | 4.4160  | 1.8803    | 4.1122  | 2.3872    | 4.0125  | 2.7967    | 4.3606  |

Table 2: Proportional Mortality Ratios by age- group and sex, South Africa, 2006- 2009

| Age-<br>Group | PMR- 2006 |         | PMR- 2007 |         | PMR- 2008 |         | PMR- 2009 |         |
|---------------|-----------|---------|-----------|---------|-----------|---------|-----------|---------|
|               | Males     | Females | Males     | Females | Males     | Females | Males     | Females |
| <b>15- 19</b> | 0.27      | 3.08    | 0.31      | 3.05    | 0.39      | 2.89    | 1.02      | 3.29    |
| <b>20-24</b>  | 1.43      | 4.99    | 1.22      | 4.82    | 1.53      | 5.28    | 1.87      | 6.07    |
| <b>25-29</b>  | 3.70      | 5.27    | 3.17      | 5.34    | 3.61      | 5.88    | 4.66      | 7.18    |
| <b>30-34</b>  | 4.69      | 5.38    | 4.07      | 5.35    | 4.88      | 5.66    | 6.09      | 7.23    |
| <b>Total</b>  | 3.50      | 5.13    | 3.02      | 5.11    | 3.55      | 5.50    | 4.50      | 6.73    |

**Table 3 (a): Age- Specific mortality rates, probability of dying and probability of dying from HIV/AIDS for males by age group, 2006- 2009**

| Age- Groups   | Age- Specific Mortality Rates HIV/AIDS |        |        |        | Probability of dying |        |        |        | Probability of dying from HIV/AIDS |         |         |         |
|---------------|--|--------|--------|--------|----------------------|--------|--------|--------|------------------------------------|---------|---------|---------|
|               | 2006                                   | 2007   | 2008   | 2009   | 2006                 | 2007   | 2008   | 2009   | 2006                               | 2007    | 2008    | 2009    |
| <b>15- 19</b> | 0.0000                                 | 0.0000 | 0.0000 | 0.0000 | 0.009658             | 0.0097 | 0.0092 | 0.0087 | 0.00000                            | 0.00001 | 0.00001 | 0.00002 |
| <b>20-24</b>  | 0.0001                                 | 0.0001 | 0.0001 | 0.0001 | 0.022804             | 0.0229 | 0.0222 | 0.0198 | 0.00023                            | 0.00013 | 0.00015 | 0.00015 |
| <b>25-29</b>  | 0.000321                               | 0.0003 | 0.0003 | 0.0004 | 0.042537             | 0.0409 | 0.0423 | 0.0401 | 0.00137                            | 0.00108 | 0.00132 | 0.00152 |
| <b>30-34</b>  | 0.000693                               | 0.0004 | 0.0007 | 0.0008 | 0.071418             | 0.0467 | 0.0681 | 0.0638 | 0.00495                            | 0.00182 | 0.00468 | 0.00512 |

**Table 3 (b): Age- Specific mortality rates, probability of dying and probability of dying from HIV/AIDS for females by age group, 2006- 2009**

| Age- Groups   | Age- Specific Mortality Rates HIV/AIDS |        |        |        | Probability of dying |        |        |        | Probability of dying from HIV/AIDS |         |         |         |
|---------------|--|--------|--------|--------|----------------------|--------|--------|--------|------------------------------------|---------|---------|---------|
|               | 2006                                   | 2007   | 2008   | 2009   | 2006                 | 2007   | 2008   | 2009   | 2006                               | 2007    | 2008    | 2009    |
| <b>15- 19</b> | 0.0001                                 | 0.0001 | 0.0000 | 0.0001 | 0.0092               | 0.0084 | 0.0080 | 0.0078 | 0.00005                            | 0.00004 | 0.00004 | 0.00004 |
| <b>20-24</b>  | 0.0003                                 | 0.0003 | 0.0003 | 0.0003 | 0.0310               | 0.0289 | 0.0262 | 0.0232 | 0.00098                            | 0.00082 | 0.00073 | 0.00066 |
| <b>25-29</b>  | 0.0006                                 | 0.0006 | 0.0006 | 0.0007 | 0.0596               | 0.0557 | 0.0508 | 0.0454 | 0.00386                            | 0.00341 | 0.00311 | 0.00303 |
| <b>30-34</b>  | 0.0009                                 | 0.0008 | 0.0008 | 0.0009 | 0.0774               | 0.0733 | 0.0650 | 0.0572 | 0.00670                            | 0.00596 | 0.00494 | 0.00487 |



**Table 4: Life expectancy, life expectancy without HIV/AIDS present in the population and years gained in life expectancy with the eradication of HIV/AIDS**

| Sex    | Age -Group | 2006  |         |                       | 2007  |         |                       | 2008  |         |                       | 2009  |         |                       |
|--------|------------|-------|---------|-----------------------|-------|---------|-----------------------|-------|---------|-----------------------|-------|---------|-----------------------|
|        |            | $e_x$ | $e^i_x$ | Years gained in $e_x$ | $e_x$ | $e^i_x$ | Years gained in $e_x$ | $e_x$ | $e^i_x$ | Years gained in $e_x$ | $e_x$ | $e^i_x$ | Years gained in $e_x$ |
| Male   | 15-19      | 43.1  | 48.70   | <b>5.60</b>           | 45.0  | 50.42   | <b>5.44</b>           | 42.8  | 48.69   | <b>5.86</b>           | 44.1  | 49.75   | <b>5.61</b>           |
|        | 20-24      | 38.5  | 43.90   | <b>5.40</b>           | 40.4  | 45.62   | <b>5.22</b>           | 38.2  | 43.88   | <b>5.67</b>           | 39.5  | 44.95   | <b>5.44</b>           |
|        | 25-29      | 34.3  | 39.28   | <b>4.94</b>           | 36.3  | 41.02   | <b>4.73</b>           | 34.0  | 39.24   | <b>5.23</b>           | 35.3  | 40.30   | <b>5.05</b>           |
|        | 30-34      | 30.7  | 35.08   | <b>4.33</b>           | 32.7  | 36.86   | <b>4.14</b>           | 30.4  | 35.02   | <b>4.61</b>           | 31.6  | 36.02   | <b>4.40</b>           |
| Female | 15-19      | 45.8  | 50.87   | <b>5.03</b>           | 46.8  | 51.70   | <b>4.86</b>           | 48.5  | 53.23   | <b>4.75</b>           | 48.7  | 51.51   | <b>2.78</b>           |
|        | 20-24      | 41.2  | 46.05   | <b>4.80</b>           | 42.2  | 46.87   | <b>4.66</b>           | 43.8  | 48.41   | <b>4.56</b>           | 44.1  | 46.89   | <b>2.79</b>           |
|        | 25-29      | 37.5  | 41.43   | <b>3.94</b>           | 38.4  | 42.23   | <b>3.84</b>           | 40.0  | 43.76   | <b>3.80</b>           | 40.1  | 42.39   | <b>2.30</b>           |
|        | 30-34      | 34.7  | 37.60   | <b>2.90</b>           | 35.5  | 38.34   | <b>2.84</b>           | 37.0  | 39.81   | <b>2.84</b>           | 36.9  | 38.48   | <b>1.61</b>           |

**Table 5: Years of Potential Life Lost (YPLL) before age 60, by sex and age- group, 2006- 2009, South Africa**

| Age -Group   | YPLL (10 -19) |        |        |        |         |        |        |        |
|--------------|---------------|--------|--------|--------|---------|--------|--------|--------|
|              | Males         |        |        |        | Females |        |        |        |
|              | 2006          | 2007   | 2008   | 2009   | 2006    | 2007   | 2008   | 2009   |
| 15-19        | 115           | 131    | 161    | 397    | 1,260   | 1,132  | 1,023  | 1,155  |
| 20-24        | 1,423         | 1,219  | 1,486  | 1,631  | 6,827   | 6,125  | 6,107  | 6,271  |
| 25-29        | 6,701         | 5,507  | 6,523  | 8,061  | 13,421  | 12,712 | 12,838 | 14,200 |
| 30-34        | 13,665        | 7,746  | 13,585 | 16,123 | 16,739  | 15,817 | 15,014 | 17,178 |
| <b>Total</b> | 21,904        | 14,604 | 21,754 | 26,212 | 38,247  | 35,787 | 34,982 | 38,804 |