Assessing the Triple Burden of HIV, TB and Pneumonia in South Africa Using Multiple-cause Life Table Analysis, 1997-2001.

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Abstract

In countries where HIV/AIDS is stigmatized, it is problematic to use only underlying causes-of-death statistics to assess the size of deaths due to HIV/AIDS. This problem can be partially addressed using multiple causes of death statistics. The data analyzed in the paper are the first set of multiple-causes data for South Africa, and based on all registered deaths over the period, 1997-2001. The paper starts off with constructing adjusted life tables for the intercensal period 1996-2001 and proceeds by analyzing the quality of causes-of-death statistics (partly based on a 12% sample of all registered deaths in the study period). The paper makes use the pattern-of-failure model to study trends in multiple causes of death and to construct multiple-cause life tables for South Africa, with emphasis on HIV, TB and influenza and pneumonia. The paper draws conclusions about the triple burden of these three causes of death in the light of the quality of causes of death data in South Africa.

1. Introduction

While many innovative uses have been made of multiple-cause mortality data in developed countries, their production in developing countries have been extremely limited. There are several reasons for this. The first is the customary emphasis on underlying cause of death statistics which deprives multiple-cause data of their rightful place in mortality statistics. The second is that more resources are needed for producing multiple-cause data than that for underlying-cause data. The third is the perception that multiple-cause data are of more relevance in low mortality countries than in high mortality ones. The last reason is low priority being given to the production of causes-of-death data in developing countries.

In countries where HIV/AIDS is emerging as a serious public health threat and in which the disease is highly stigmatized, the underlying cause statistics for such countries are highly suspect. This is because of the misreporting of HIV/AIDS either to named causes or to unnamed ones. In such situations, multiple-cause data have a new important role to play in helping unearth the pattern of misreporting present in the data. This paper uses the first set of multiple-cause data for Africa to study the linkages between HIV and its two

associated opportunistic infections, TB and influenza and pneumonia. Unlike many multiple-cause analyses which have stopped at the level of 'counts', this paper utlises a rich but under-utilised model that was developed for constructing multiple-cause life tables and analysing multiple cause data. However, before the model is applied, the reality of the shortcomings in African data is first addressed.

2. Methods and materials

The primary dataset used in this research is the unit record mortality data for all registered deaths in South Africa for the period, 1997-2002. This came to a total of little under 2.5 million records (2 486 452). This dataset was provided by the National Statistical Agency, Statistics South Africa (Stats SA) and only includes the minimum demographic and multiple-cause information, coded using ICD-10 (the tenth revision of the WHO International Classification of Diseases). The main variables included are age, gender and multiple causes of death. In this dataset, the underlying cause of death was automatically selected using the ACME (Automatic Classification of Medical Entities) program of the NCHS (National Centre for Health Statistics). To the best of our knowledge, this is the first set of national multiple-cause data for Africa and the first case of the use of ACME on national data in Africa. Full detailed information on the deceased; the demographic characteristics, the place of death and the certification of the deaths are not included in this dataset but could be obtained from a subset of these data, a 12% sample (n= 279 581). One point worth noting is that the death registration form that was used in 1997 and in earlier years was changed during 1998. The change introduced two new forms, one for use in remote areas (BI-1680) and the main one, which is more detailed, to be used in all other areas (BI-1663). This use of several forms (with some more detailed than others) will have some effect on the quality of the causes of death data. The sample data are partly used to analyse the quality of causes of death reporting while the full deaths data are used for the multiple-cause analysis. In addition to the deaths data, population data from the 1996 and 2001 censuses are used to provide the necessary population denominators.

Construction of multiple cause life tables requires two basic inputs, a parent life table and a multiple cause adjustment model. For the parent life tables, we constructed intercensal life tables for the period, 1996-2001, based on registered intercensal deaths and the census figures. Since there is incompleteness in death registration in South Africa as well as incompleteness in census coverage, we estimated the adjustment factors for relative census coverage and the coverage of death registration relative to the second census. For this task we used the method of Hill (1987) and, practically, through the CENCT program in MORTPAK. The adjusted census and death registration figures were used to construct male and female life tables for the intercensal period, through the application of LIFTB program in MORTPAK. For the multiple-cause adjustment, we used the lethal defect pattern of failure model of Manton *et al.* (1976). Under this model, 'any mention' of a cause of death anywhere on the death certificate is considered rather than just the 'underlying cause of death'. While we make use of the pattern of failure model, we do not focus our analysis on the comparison between the effects of cause elimination versus pattern elimination as done in Manton *et al.* (1976). We also do not focus our analysis on

the comparison between the effects of the elimination of ACME-selected underlying cause versus that of the elimination of physician-selected underlying cause versus pattern elimination as done in Manton *et al.* (1980). Lastly, we do not focus our analysis on the comparisons between the effects of the elimination of underlying cause versus that of associated cause versus that of pattern elimination as done in Manton *et al*. (1982). In our case, we are looking at the two possibilities of a) a 'lethal defect' actually manifesting itself in a certain of pattern of failure and b) a pattern of failure resulting from a 'false lethal defect' which has been caused by misreporting of causes of death. In the paper, we are looking at three causes of death, HIV (B20-B24), tuberculosis (A15-A19), influenza and pneumonia (J10-J18) and the residual category, 'Other Causes'. For these four groups of causes of deaths (k=4), there are 15 (2^k-1) patterns. The coding used in these 15 patterns is given in Appendix A. We constructed these patterns by age and sex for each year of the study period and studied their trends. This assisted in the narrowing down the patterns for the construction of multiple cause life tables. For the failure patterns selected we computed multiple-cause life tables and compared the resulting gains in life expectancies resulting from pattern elimination.

Since the pattern of failure model is directly related to Chiang's (1968) method for constructing life table with cause elimination (with 'underlying cause' used instead of 'patterns'), we constructed multiple-cause life tables drawing upon that body of knowledge as presented in Preston *et al.* (2001), but replacing specific causes with patterns of failure. This approach starts off with proportionality assumption between cause-specific deaths and overall deaths. Specifically, the proportion of all deaths in an age group, i, that is due to cause α, $R_{i\alpha}$, is defined as,

$$R_{i\alpha} = \frac{D_{i\alpha}}{\sum_{\delta=1}^{r} D_{i\delta}} = \frac{D_{i\alpha}}{D_i} \quad \ldots\ldots (1)$$

Where, $D_{i\alpha}$ is the number of deaths in age group i, from cause, α, from a total of r causes of death.

In terms of patterns of failure, one has that the proportion of all deaths in an age group, i, that is due to failure pattern δ, $K_{i\delta}$, is defined as,

$$K_{i\delta} = \frac{F_{i\delta}}{\sum_{\delta=1}^{m} F_{i\delta}} = \frac{F_{i\delta}}{F_i} \quad \ldots\ldots (2)$$

Where, $F_{i\delta}$ is number of in age group i, under the pattern of failure, δ, from a total of m possible patterns of failure.

Under the pattern of failure model, multiple-cause elimination for a particular disease b, belonging to a set B of failure patterns is defined as 'the elimination of all patterns which contain b as an element, i.e. the set B' (Manton *et al.*, 1980:87).

The proportion of deaths in a age group, *i*, with pattern of failure, δ, eliminated is given as:

$$K^*_{i\delta} = 1 - K_{i\delta} = 1 - \frac{F_{i\delta}}{\sum_{\delta=1}^{m} F_{i\delta}} \quad \text{.....(3)}$$

We then proceed in a manner parallel to that outlined in Spiegelman (1973) and subsequently in Preston *et al.* (2001) as follows:

$$p^*_{i\delta} = (p_i)^{K^*_{i\delta}} \quad \text{.....(4)}$$

$$l^*_{(i+1)\delta} = l^*_{i\delta} * p^*_{i\delta} \quad \text{.....(5)}$$

$$d^*_{i\delta} = l^*_{i\delta} - l^*_{(i+1)\delta} \quad \text{.....(6)}$$

$$L^*_{i\delta} = n * l^*_{i\delta} - a^*_{i\delta} * d^*_{i\delta} \quad \text{.....(7)}$$

Instead of using the assumption made in Spiegelman (1973) that $a^*_{i\delta}$ (in the underlying cause sense) has the same value in the life table in which cause, δ has been eliminated as in the parent life table, we compute the value for $a^*_{i\delta}$ from the $d^*_{i\delta}$ values as suggested by Preston *et al.* (2001:83):

$$a^*_{i\delta} = \frac{\frac{5}{24} d^*_{(i-1)\delta} + 2.5 d^*_{i\delta} + \frac{5}{24} d^*_{(i+1)\delta}}{\frac{5}{24} d^*_{i\delta}} \quad \text{.....(8)}$$

This formula is used for the five-year age groups from 10-14 to 75-79 (*i*=4 to *i*=17).

For the age groups 0-1, 1-4, 5-9 (*i*=1 to 3) and 80-84 (i=18), we use the formula:

$$a^*_{i\delta} = n + K_{i\delta} \frac{q_i}{q^*_{i\delta}} (a_i - n) \quad \text{.....(9)}$$

For the last age group 85+ (*i*=19), the following approximation was used:

$$a^*_{i\delta} = e^*_i = \frac{e_i}{K^*_{i\delta}} \quad \text{.....(10)}$$

(Preston *et al.*, 2001).

From the $L^*_{i\delta}$ values, the life expectancies with pattern-elimination were obtained in the similar manner as in the ordinary life table.

In pursuing the aims of the paper, the results section is divided into five parts. The first part derives adjusted intercensal life tables for the period 1996-2001 to serve as the 'parent' life table for the rest of the paper. The second part analyses the quality of causes of death certification in South Africa using a sample data for the same study period. The third part analyses the trends in the 15 patterns of failure by age and sex. The fourth part looks at the aggregate patterns of failure and the last part deals with the construction of

multiple-cause life tables. These results are collectively discussed in the discussion section followed by the conclusion.

3. Results

3.1 Completeness of death registration and intercensal life table

Over the study period, 1997-2001, the number of registered deaths in South Africa was a little over a million for males (1 038 927) and a little under a million for females (886 504). While the completeness of death registration has improved remarkably from the late 1990s to present, it is still incomplete in South Africa. While census coverage in 1996 and 2001 were both inclusive rather than exclusive, there is some evidence to suggest that both censuses had some coverage problems. For these reasons, it is necessary to seek adjustment factors for incompleteness in the first census (k_1), the second census (k_2) and in death registration (k_3). The application of the Hill's (1987) generalized growth balance method to the data (via the CENCT program of MORTPAK and using regression points ages 5-70) yielded the values for the coverage of the first census relative to the second (k_1/k_2) to be 0.97 and 0.963 for males and females respectively and values for the quantity $\frac{\sqrt{k_1 * k_2}}{k_3}$ to be 1.1305 and 1.0723 for males and females respectively. The fitting of the model shown in Figs 1a and 1b for males and females respectively gave good linear fits with R^2 being over 98% for both males and females. Using UN's (2002) suggestion, we put k_2 to be 1.0 and estimate the relative completeness of the death registration to be 87.1% for males and 91.5% for females.

===Figs 1a and 1b about here=====

Using these adjustment factors, we adjusted the reported deaths and census figures and computed adjusted life tables using the LIFTB program in MORTPAK. The Resulting life tables are shown in Tables 1a and 1b and the plot of the ${}_nq_x$ on log scale is shown in Fig 2. The Figure shows a large female advantage in mortality for ages over 40 but small female advantage for ages less than 30 years. This female advantage translates into a large sex differential in life expectancy at birth of little over 8 years (56.3 years for males and 64.6 years for females).

===Tables 1a and 1b about here=====

===Fig 2 about here=====

These life tables for the intercensal period, 1996-2001 serve as the parent life table used in constructing the multiple-cause life tables.

3.2 Quality of causes of death certification

3.2.1 Certification and the ascertainment of death

The results in this sub-section are based on the 12% sample of registered deaths for the same study period, 1997-2001 (n=279 581) as this dataset contains more information beyond the basic demographic information on age, sex and cause of death. One is specifically interested on where the death took place, whether in an institution or not, who ascertained the death and who the informant was. These shed some light on the some aspects of the quality of the data.

According to the new death registration form and the accompanying instructions, information on the certifier of the cause of death can be obtained from three parts. First is the certificate by the attending medical practitioner/professional nurse that the death is due to natural causes (top part of section D in page 1). Second is the certificate by the district surgeon/forensic pathologist (after a post-mortem) that the death is either due to unnatural cause, or is under investigation or is due to natural cause (bottom part of section D in page 1). Third is the statement of the ascertainment of death in the section of the medical certificate of death (Section G in page 2). With regard to the first two parts (section D), the information used were the initials, surnames and licence number for both the medical practitioner and the district surgeon. Cross-tabulation revealed all kinds of combinations- one with initial written only, others with only license number written and others with only surnames written etc. In total, the deaths for which Section D was not certified by a medical practitioner (hence no initials, surname or license number) were 47 587 (17,0%) and those not certified by a district surgeon were 21 923 (7,8%). With regards to the last part (section G), Table 2 shows the distribution of the different ascertainers of the death with breakdown by selected causes of death. Overall, deaths ascertained by physicians and forensic pathologists account for little under 50% while those with unspecified ascertainment account for 38.4%. For TB and influenza and pneumonia, ascertainment is unspecified in about a third of the reported cases while for HIV it is under a third. For all the three diseases of interest, the percentage of unspecified ascertainment of death is lower than the overall percentage.

===Table 2 about here =====

Table 3 shows that overall, 43.4 % of deaths take place in hospitals, about a quarter of the deaths take place in homes and for about a quarter, the place of death is not specified. For HIV, over two-thirds of the deaths take place in hospitals. For TB, a little under two-thirds of the deaths take place in hospitals while for influenza and pneumonia it is 42.0%. In short, the majority of reported TB and HIV deaths take place in hospitals and correspondingly, the percentage of unspecified place of death among these two causes of death are lower, less than 20%.

===Table 3 about here=====

3.2.2 Ill-defined causes of death as multiple causes of death

The results in this sub-section and the rest of the paper are based on the full registered deaths data for the same study period, 1997-2001 (N= 1 967 140).

One commonly measure of the quality of causes of death data is the percentage of (age specific or total) of deaths with 'ill-defined' causes (R95-R99). The age-specific numbers of ill-defined deaths by position of mention are given in Tables 4a and 4b for males and females respectively. Overall, of the 1 061 950 registered deaths for males over the period, 1997-2001, records with 'any mention' of ill-defined cause were 105 857 (10.27%) and of the 905 190 deaths for females, the number of such records was 107 946 (12.28%). For both males and females, ill-defined causes were the most often the first mentioned cause which ended up being the underlying causes of death. For these three aspects, first mentioned cause, underlying cause and 'any mention', the age profile of the percentage of ill-defined causes are shown in Fig 3a and 3b for males and females respectively. For Fig 3a, the age-specific percentages for the three measurers are largely parallel and show a gradual rise with age from 20-25 to 60-64, after which the percentages increase slightly more rapidly. For females, the age-specific percentage lie between 10% and 12% for most of the adult ages and start increasing with age from age 60-64 onwards.

===Tables 4a and 4b about here=====

===Fig 3a and 3b about here=====

3.2.3 General symptoms and signs as multiple causes of death

Another commonly used measure of the quality of cause of death data is the percentage of deaths coded as 'general symptoms and signs' (R50-R69). These results are shown in Tables 5a and 5b for males and females respectively. As done above, the graphs of the age-specific percentages are shown Figs 4a and 4b for males and females respectively. The two profiles show remarkable similarity. For ages below 60-64, the age-specific percentages are generally below 5% while for ages above 60-64, the percentages increase rapidly with age.

===Tables 5a and 5b about here =====

===Figs 4a and 4b about here===

3.3 Trends in patterns of failure involving HIV, TB, influenza and pneumonia and other causes (single years in the study period)

For the 15 configurations involving the different combinations of HIV, TB, influenza and pneumonia and 'others', the percentages in the age-specific patterns of failure by age and sex for each year of the study period are shown in Tables 6 up to 20 and the corresponding Figures are shown in Figs 5a up to 19b.

===Tables 6 to 20 about here=====

===Figs 5a to 19b about here==

A close look at the Figures shows that they can be grouped into eight profiles. These are as follows:

- M-shape with adult peak higher than children peak
- M-shape with adult peak lower than children peak
- Subdued M-shape with broad adult plateau
- Mixed M-shape with changing peaks
- Reverse N-shape with peak centering on adults
- Single childhood peak and rise with age above 50 years
- Typical mortality profile
- Random with no apparent pattern

These have been summarised in Table 21 and in Figure 20. The Figure shows that the dominant patterns are the first two: the M-shape with adult peak higher than children peak and the M-shape with adult peak lower than children peak. The former comprise of patterns with mostly HIV and TB while the latter comprises of pattern with mostly HIV and influenza and pneumonia. Interestingly, the typical mortality profile is only evident in the pattern with 'other causes' beside HIV, TB and influenza and pneumonia. With the exception of the slight hump in mortality in the adult ages, the failure pattern with influenza/pneumonia and 'others' (pattern 12) would fit the profile of a 'true lethal defect pattern'. It shows influenza and pneumonia affecting children aged under five years old the most, subsequently declining with age till the early twenties and gradually rising with age thereafter. This conforms to the epidemiology of influenza and pneumonia, which in the absence of immune suppression, affects the elderly and the very young more than it affects adults. In contrast, the failure pattern of only influenza and pneumonia (pattern 11) and that of only TB (pattern 8), showing clear rise in proportion of deaths in the adult ages may be representing a 'false lethal defect' pattern. This pattern is a combination of pneumonia/TB actually appearing as lethal opportunistic infections of HIV and as misreported cases of HIV.

===Table 21 about here=====
===Fig 20 about here==

3.4 Aggregate patterns of failure involving HIV, TB, influenza and pneumonia and other causes (grouped years)

Since the numbers in the different patterns of failure are small, it has been necessary to aggregate at two levels. Firstly, all the years in the study period are grouped. The resulting absolute numbers are shown in Tables 22a and 22b for males and in Tables 23a and 23b for females.

===Tables 22a and 22b=====
===Tables 23a and 23b=====

At the second level of aggregation, the different patterns are combined to yield the following aggregate patterns:

- Any mention of HIV (patterns 1-7,15)
- Any mention of TB (patterns, 2-4, 8-10,14-15)
- Any mention of inluenza and pneumonia (patterns 3-6,9-12)
- Any mention of HIV and TB
- Any mention of HIV and inluenza and pneumonia
- Any mention of TB and inluenza and pneumonia
- Any mention of HIV, TB and inluenza and pneumonia
- Any mention of HIV and partial mention of TB and partial mention of inluenza and pneumonia

It is the age-specific proportions in these aggregate patterns that are used with the adjusted intercensal life tables to produce multiple cause life tables for the intercensal period, 1997-2001.

3.5 Multiple cause life tables for South Africa, 1997-2001

As outlined in the methodology, multiple cause life tables for males and females were constructed for each of the eight aggregate patterns mentioned above. From these multiple cause life tables, the values of life expectancy resulting from the elimination of each of these patterns were extracted and shown in Tables 24a and 24b for males and females respectively. From these values of life expectancy, the relative gains (using the elimination of 'any mention of HIV' as the reference) were obtained and shown in Figs 21a and 21b for males and females respectively

===Tables 24a and 24b about here=====
===Figs 21a and 21b about here =====

As a result of stigmatization, HIV is so underreported that the elimination of the failure pattern due to HIV would not result in gain in life expectancy at birth of even up to a year. Of the two HIV-opportunistic infections, TB has greater impact on males than females while influenza and pneumonia has greater impact on females than males. The Tables show that life expectancy at birth for males would increase from 56.3 years to 59.2 years with the elimination of HIV and TB failure patterns. For females, life expectancy at birth for would increase from 64.6 years to 67.5 years with the elimination of HIV and influenza and pneumonia failure patterns. With the elimination of the TB and influenza failure patterns, life expectancy at birth would increase to 60.9 for males and 69.0 for females. If it is hypothetically assumed that half of the TB and influenza and pneumonia failure pattern is actually due to HIV, then the elimination of this hypothetical failure pattern would increase the life expectancy at birth to 59 years for males and 67.3 years for females. For the different aggregate patterns of failure, the gains in life expectancy with pattern elimination relative to the HIV pattern elimination are parallel for ages below 30, as shown in Figures 21a and 21b. According to the Figures, the

highest gain in life expectancy are achieved with the elimination of the failure pattern with of any mention of TB and influenza/pneumonia and the elimination of the failure pattern with any mention of all three causes, HIV, TB and influenza/pneumonia.

4. Discussion

Because of the nature of the paper, we separate the discussion into two parts. In the first part we deal with some of the technical issues addressed in the paper and in the second part we discuss the substantive and interpretative aspects of the findings.

4.1 Technical

Some of the questions we wish to addresses in this sub-section is the appropriateness of the Hill method for estimating relative coverage figures and the plausibility of the adjusted intercensal life tables constructed. One of the ways of assessing the appropriateness of the Hill method is the goodness of fit of the regression lines. Marked departures from the assumptions of the method would be reflected in poor fit of the regression lines. In our case, the R^2 value was over 98% for both males and females. We are aware of further developments in generalized growth balance methods such as the one by Bhat (2002) and Hill and Quiroz (2004) which have sought to address the migration element of growth balance methods. We are also aware of methods such as those of Bennet-Horuichi (1981, 1984) that have sought to estimate age-specific completeness of registration instead of overall coverage figures. We have not applied the former set of methods partly because the migration figures in South Africa are problematic, with unmeasured levels of hidden immigration and high undeclared out-migration. Official migration data for 1997-2001 show net out-migration of over 13 000 for males and over 15 000 for females. Adjustment of the 2001 census figures for declared net migration still resulted in some intercensal survivorship ratios being greater than unity. Related to this problem, initial application of the Bennet-Horuichi method gave age-specific death registration coverage figures to be over 100% and hence was not used further. In short, the nature of the data does not allow for the easy application of more refined methods.

Regarding the plausibility of the life tables, the completeness of death registration relative to the completeness of the second census (2001) being 87.1% for males and 91.5% for females seem credible. Prior research leading on to this work yielded relative completeness figures of the (less complete) population register to be 85% for males and 90% for females.

4.2 Substantive and interpretative

The quality of causes of death data in South Africa is moderate, neither being poor nor as being excellent. The percentage of deaths due to ill-defined causes, at about 11% is rather high. Part of the reason for this is structural since about a quarter of deaths take place in homes and another quarter take place in unspecified places. As less than half the deaths take place in hospitals, physicians and pathologist end up ascertaining the deaths in only about half the cases. From the reported causes of death, the pattern of failure Figures

show that mortality patterns in South Africa have become 'atypical' of standard mortality patterns. The patterns are only 'typical' of mortality patterns for the residual group of all other causes beside the three causes of HIV, TB and influenza and pneumonia. The aggregate patterns of failure yielded two dominant profiles both of which are M-shaped. In one of these profiles, the adult peak is higher than the children peak (the TB-HIV complex) and in the other, the children peak is higher than the adult peak (the Pneumonia-HIV complex). The fact that the profile of the pattern of failure of HIV is M-shaped and both these two dominant profiles are M-shaped suggests strongly that HIV is playing a dominant role in both profiles. We see both of these profiles as largely exhibiting 'false lethal defect' resulting from the misreporting of HIV as either TB or influenza and pneumonia. We see something close to a true lethal defect pattern emerging from the failure pattern with any mention of influenza/pneumonia and 'others'. As a result of this close overlap between these three causes of death, official reporting of the leading causes of death in South Africa should be referring to the HIV-TB-Pneumonia complex in addition to their separate reporting. This complex is clearly the leading cause of death when considering either the underlying cause or multiple cause statistics.

5. Conclusion

While the use of multiple-cause statistics was initially found to be appropriate in low mortality settings where several diseases contribute to old age mortality, the paper has argued for the appropriateness of such statistics in situations affected by emerging and re-emerging infectious diseases. There are primarily two reasons for this. First, when HIV is the underlying cause of death, multiple-cause statistics would give more information about the other opportunistic infections that often accompany HIV infection. Secondly, when HIV is misreported or omitted from the death certificate but yet the physician states two or more opportunistic infections present, multiple cause statistics can provide some information about the effect of HIV. The method that allows for adequate exploitation of multiple cause data is the lethal defect pattern of failure model. Whilst it has been close to three decades since the model was first proposed, the model has been under-utilised in analysing multiple cause statistics in spite of such data being increasingly available. Part of the reason for this technical shortcoming is the approach used by the authors in moving from age-specific pattern of failure proportions to the multiple-cause life table. The authors used a biostatistical approach that made use of covariance matrices which are not part of the routine tools used by demographers. This paper has argued that standard demographic methods for analysing associated single decrement life tables can be applied to the age-specific pattern of failure proportions to obtain multiple-cause life tables. The paper has also demonstrated that multiple-cause life table methods can be successfully applied to African multiple-cause data. What is needed to do this is to first adjust the reported life tables for any deficiencies present in the censuses and/or the reported deaths and secondly to assess the quality of the multiple cause data. When the multiple cause data are accurately reported then the explanations can be sought to interpret the physiological processes generating the lethal defect patterns of failure. However, when there is misreporting of causes of death, the lethal defect pattern of failure observed may not be a true reflection of physiological processes taking place. Under such circumstances

the aim then is to search for similarities in the different 'false' lethal defect patterns of failure to get a better picture of the burden of the diseases under study.

The foundation for the way forward has been charted by the Statistics Agency, Stats SA. The agency has demonstrated that it is practically feasible for African countries to a) switch over to the latest ICD (ICD-10), b) resort to multiple-cause coding and c) use ACME to select the underlying cause of death and that this could be accomplished within a span of few years. If statistical agencies in African countries can be helped in making this 'quantum leap' in processing of causes of death statistics and their officers trained in multiple-cause analysis, a lot would be achieved from defective causes of death data. The immediate steps ahead is the launching of a master's level course in collection and analysis of causes of death data and the production of software to analyse South African multiple-cause data. This is the 'soft rock'. To push statistical agencies to overcome their inertia and make moves in the direction suggested above is the 'hard rock'. However with persistence and constructive collaborations, the way forward would be achieved within the near future.

Appendix 1

Dummy coding of presence (1) or absence (0) of specific causes of death in the different patterns of failure

Pattern of failure	HIV	TB	Influenza and pneumonia	Other causes
1	1	0	0	0
2	1	1	0	0
3	1	1	1	0
4	1	1	1	1
5	1	0	1	0
6	1	0	1	1
7	1	0	0	1
8	0	1	0	0
9	0	1	1	0
10	0	1	1	1
11	0	0	1	0
12	0	0	1	1
13	0	0	0	1
14	0	1	0	1
15	1	1	0	1

References

Bhat, Mari (2002). General growth balance method: a reformulation for populations open to migration. *Population Studies,* 56 (2002), 23-34.

Bennet, N.G. and S. Horiuchi (1981). Estimating the completeness of death registration in a closed population. *Population Studies*, vol. 47, No. 2, pp 207-221.

Bennet, N.G. and S. Horiuchi (1984). Mortality estimation from registered deaths in less developed countries. *Demography*, vol. 21, No. 2, pp 217-233.

Hill, K. (1987). Estimating census and death registration completeness. *Asian and Pacific Population Forum,* Vol 1, No. 3, pp 8-13

Hill, K. and Queiroz, B. (2004). Adjusting general growth balance method for migration. Unpublished paper.

Manton, K., E. Stallard (1982). Temporal trends in U.S. multiple cause of death mortality data: 1968 to 1977. *Demography*, Vol. 19, No 4. (Nov., 1982), 527-547.

Manton, K., E. Stallard and S.S. Poss (1980). Estimates of U.S. Multiple cause life tables. *Demography*, Vol. 17, No 1. (Feb., 1980), 85-102.

Manton, K., H. TD. Tolley and S.S. Poss (1976). Life table techniq ues for multiple cause mortality. *Demography*, Vol. 13, No 4. (Nov. 1976), 541-564.

Preston, S., P. Heuveline and M. Guillot (2001). *Demography: Measuring and Modeling Population Processes.* Blackwell Publishers, Malden, Massachusetts.

Spiegelman, M. (1973). *Introduction to Demography.* Harvard University Press, Cambridge, Mass.

United Nations (2002). *Methods for Estimating Adult Mortality.* United Nations, New York.

Table 1a: Adjusted intercensal life table, South Africa, Males, 1996-2001

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.03936	.03809	100000.	3809.	96770.	.95698 /A/	5629742.	56.297	0.152
1	.00324	.01286	96191.	1237.	381720.	.99000 /B/	5532972.	57.521	1.538
5	.00090	.00449	94954.	426.	473706.	.99581	5151252.	54.250	2.500
10	.00078	.00389	94528.	368.	471720.	.99360	4677546.	49.483	2.500
15	.00211	.01050	94160.	989.	468701.	.98332	4205826.	44.667	2.878
20	.00488	.02414	93171.	2249.	460882.	.96646	3737125.	40.110	2.789
25	.00885	.04336	90922.	3942.	445426.	.94850	3276243.	36.034	2.670
30	.01207	.05863	86980.	5099.	422484.	.93732	2830817.	32.546	2.565
35	.01366	.06606	81881.	5409.	396001.	.93024	2408333.	29.413	2.522
40	.01541	.07423	76471.	5677.	368377.	.91791	2012332.	26.315	2.538
45	.01908	.09113	70795.	6452.	338136.	.90022	1643954.	23.221	2.545
50	.02319	.10971	64343.	7059.	304396.	.87597	1305818.	20.295	2.547
55	.03010	.14011	57284.	8026.	266643.	.84551	1001421.	17.482	2.536
60	.03724	.17044	49258.	8396.	225449.	.81084	734778.	14.917	2.518
65	.04755	.21272	40862.	8692.	182803.	.75195	509329.	12.465	2.526
70	.06775	.28949	32170.	9313.	137458.	.67745	326526.	10.150	2.488
75	.08847	.36043	22857.	8238.	93121.	.60053	189068.	8.272	2.431
80	.11783	.45075	14619.	6589.	55923.	.41715 /C/	95946.	6.563	2.394
85	.20062	.....	8029.	8029.	40024.	.....	40024.	4.985	4.985

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(80+,5)=T(85)/T(80)

Table 1b: Adjusted intercensal life table, South Africa, Females, 1996-2001

AGE	M(X,N)	Q(X,N)	I(X)	D(X,N)	L(X,N)	S(X,N)	T(X)	E(X)	A(X,N)
0	.03420	.03323	100000.	3323.	97174.	.96240 /A/	6463417.	64.634	0.150
1	.00276	.01096	96677.	1059.	384027.	.99186 /B/	6366243.	65.851	1.470
5	.00067	.00337	95618.	322.	477283.	.99688	5982216.	62.564	2.500
10	.00057	.00287	95296.	273.	475794.	.99550	5504933.	57.767	2.500
15	.00147	.00733	95022.	697.	473652.	.98689	5029139.	52.926	2.907
20	.00411	.02035	94325.	1920.	467443.	.97192	4555487.	48.295	2.821
25	.00714	.03512	92406.	3245.	454319.	.96200	4088043.	44.240	2.625
30	.00802	.03932	89160.	3506.	437055.	.96075	3633724.	40.755	2.505
35	.00792	.03884	85655.	3327.	419902.	.96112	3196669.	37.320	2.484
40	.00804	.03941	82328.	3244.	403578.	.95803	2776767.	33.728	2.516
45	.00927	.04531	79083.	3583.	386640.	.95041	2373189.	30.009	2.551
50	.01127	.05485	75500.	4141.	367466.	.93693	1986549.	26.312	2.577
55	.01502	.07249	71359.	5173.	344290.	.91804	1619083.	22.689	2.583
60	.01948	.09304	66186.	6158.	316073.	.89013	1274793.	19.261	2.587
65	.02773	.12996	60028.	7801.	281346.	.84617	958720.	15.971	2.591
70	.03972	.18104	52227.	9455.	238067.	.79116	677375.	12.970	2.560
75	.05507	.24250	42772.	10372.	188349.	.71254	439308.	10.271	2.541
80	.08367	.34660	32400.	11230.	134207.	.46522 /C/	250959.	7.746	2.525
85	.18133	.....	21170.	21170.	116752.	.....	116752.	5.515	5.515

/A/ VALUE GIVEN IS FOR SURVIVORSHIP OF 5 COHORTS OF BIRTH TO AGE GROUP 0-4 = L(0,5)/500000
/B/ VALUE GIVEN IS FOR S(0,5)=L(5,5)/L(0,5)
/C/ VALUE GIVEN IS S(80+,5)=T(85)/T(80)

Table 2: Percentage distribution of 'ascertainment of death' by selected causes of death as reflected in the sample Data (n=279 581), Males and Females, South Africa, 1997-2001

	N	Physician or pathologist	Nurse	Family member	Other	Unspecified	Total
TB (A15-A19)	22347	52.1%	2.7%	9.9%	1.1%	34.3%	100.0%
HIV (B20-B24)	20679	62.8%	3.5%	4.8%	0.8%	28.2%	100.0%
Pneu (J10-J18)	17672	48.2%	1.7%	16.7%	0.9%	32.6%	100.0%
All other causes	218883	46.6%	1.6%	10.3%	1.3%	40.3%	100.0%
Total	279581	48.3%	1.8%	10.2%	1.2%	38.4%	100.0%

Table 3: Percentage distribution of 'institution and non-institution deaths' by selected causes of death as reflected in the sample Data (n=279 581), Males and Females, South Africa, 1997-2001

	N	Hospital	Nursing Home	Home	Other	Unspecified	Total
TB (A15-A19)	22347	59.7%	0.6%	19.9%	1.1%	18.7%	100.0%
HIV (B20-B24)	20679	67.6%	1.2%	16.0%	1.0%	14.2%	100.0%
Pneu (J10-J18)	17672	42.0%	1.7%	34.3%	1.5%	20.4%	100.0%
All other causes	218883	39.5%	2.0%	26.1%	4.4%	27.9%	100.0%
Total	279581	43.4%	1.8%	25.4%	3.7%	25.7%	100.0%

Table 4a: Mentions of specific cause by position of mention and age group, South Africa, Males, 1997-2001

Total number of records read= 2486452 :Number of records for selected years= 1061950

Causes considered: ILL-DEFINED CAUSES (ICD10: R95-R99)

Age grp	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5	Und.cause	Any mention of cause
0 - 1	751	50	7	2	6	5233	5393
1 - 4	2789	110	27	1	12	3078	3143
5 - 9	825	38	10	0	6	949	975
10 -14	644	46	11	2	4	763	788
15 -19	969	73	12	4	5	1197	1241
20 -24	1961	101	16	4	14	2401	2482
25 -29	4563	220	40	5	20	5241	5414
30 -34	6406	270	59	6	34	7142	7360
35 -39	7307	286	45	7	50	8022	8236
40 -44	7357	273	49	15	50	7957	8217
45 -49	7599	300	68	3	43	8230	8469
50 -54	7249	244	65	7	44	7798	8066
55 -59	7223	260	67	7	43	7714	7984
60 -64	6768	238	51	9	43	7238	7477
65 -69	6991	234	48	8	53	7508	7725
70 -74	7155	286	65	5	45	7761	7984
75 -79	6224	251	46	11	45	6765	6970
80 -84	4691	192	43	4	23	5112	5266
85 +	4379	212	34	9	30	4721	4876
Unknown	691	31	5	0	10	1027	1044
Total	92542	3715	768	109	580	105857	109110

Table 4b: Mentions of specific cause by position of mention and age group, South Africa, Females, 1997-2001

Total number of records read= 2486452 : Number of records for selected years= 905190

Causes considered: ILL-DEFINED CAUSES (ICD10: R95-R99)

Age grp	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5	Und.cause	Any mention of cause
0 - 1	714	53	6	1	2	4502	4654
1 - 4	2696	89	23	2	13	2901	2966
5 - 9	692	47	11	2	5	812	829
10 -14	652	56	10	1	5	743	771
15 -19	1417	82	17	1	8	1597	1637
20 -24	4248	193	54	11	17	4695	4820
25 -29	7049	310	79	13	42	7664	7891
30 -34	7023	295	67	12	54	7597	7793
35 -39	6017	254	69	7	29	6499	6697
40 -44	5100	180	51	6	37	5430	5602
45 -49	4577	163	43	4	22	4889	5015
50 -54	4132	134	32	2	26	4360	4498
55 -59	4421	175	30	3	25	4676	4846
60 -64	5619	196	42	9	42	5996	6200
65 -69	7347	256	52	6	56	7892	8136
70 -74	7935	328	57	14	39	8598	8811
75 -79	7924	302	61	10	59	8549	8789
80 -84	8043	362	62	12	49	8701	8968
85 +	10146	487	82	12	63	10989	11327
Unknown	592	23	7	3	6	856	876
Total	96344	3985	855	131	599	107946	111126

Table 5a: Mentions of specific cause by position of mention and age group, South Africa, Males, 1997-2001

Total number of records read= 2486452 : Number of records for selected years= 1061950

Causes considered: General symptoms an (ICD10: R50-R69)

Age grp	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5	Und.cause	Any mention of cause
0 - 1	451	418	230	71	20	64	1171
1 - 4	333	272	143	41	10	69	772
5 - 9	127	85	32	12	2	37	245
10 -14	136	76	28	9	2	33	240
15 -19	328	165	42	6	4	59	517
20 -24	571	381	78	13	1	98	1004
25 -29	869	767	187	41	13	177	1791
30 -34	979	940	221	59	16	206	2123
35 -39	974	930	243	70	19	219	2158
40 -44	828	754	241	72	16	160	1839
45 -49	908	660	240	54	15	153	1802
50 -54	768	589	229	52	21	143	1602
55 -59	717	610	199	47	15	132	1541
60 -64	950	821	271	82	31	321	2086
65 -69	1119	1021	324	94	30	573	2522
70 -74	1872	1641	518	170	43	1564	4142
75 -79	1984	1859	587	186	49	1855	4532
80 -84	1876	1997	630	186	53	1998	4640
85 +	2464	2424	717	193	71	2599	5720
Unknown	123	111	56	6	5	63	290
Total	18377	16521	5216	1464	436	10523	40737

Table 5b: Mentions of specific cause by position of mention and age group, South Africa, Females, 1997-2001

Total number of records read= 2486452 Number of records for selected years= 905190

Causes considered: General symptoms an (ICD10: R50-R69)

Age grp	Cause 1	Cause 2	Cause 3	Cause 4	Cause 5	Und.cause	Any mention of cause
0 - 1	459	411	196	47	17	77	1106
1 - 4	292	286	119	31	10	72	723
5 - 9	127	81	40	4	1	47	237
10 -14	123	65	22	6	1	29	208
15 -19	237	169	43	17	4	61	455
20 -24	590	549	158	40	14	145	1299
25 -29	878	945	240	59	18	242	2077
30 -34	851	882	269	72	14	227	2014
35 -39	704	758	214	51	14	179	1673
40 -44	569	521	148	47	14	121	1258
45 -49	460	376	164	32	17	90	1015
50 -54	408	351	100	33	19	79	880
55 -59	475	365	125	38	13	74	982
60 -64	751	645	239	68	34	288	1685
65 -69	1159	1000	387	97	45	706	2609
70 -74	2260	1669	559	183	58	1883	4602
75 -79	2733	2342	765	220	71	2558	5992
80 -84	3553	3376	1037	288	115	3754	8158
85 +	6083	5839	1729	475	157	6678	13878
Unknown	109	106	39	13	7	46	262
Total	22821	20736	6593	1821	643	17356	51113

Table 6: Trends in age-specific patterns of failure from pattern 1, South Africa, 1997-2001.

Panel A-Males

Pattern 1 (HIV=1, TB=0, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.15%	0.13%	0.11%	0.21%	0.21%	0.19%
1-4	0.82%	0.46%	0.90%	0.78%	0.66%	0.75%
5-9	0.19%	0.00%	0.45%	0.38%	0.66%	0.73%
10-14	0.00%	0.06%	0.13%	0.00%	0.00%	0.52%
15 -19	0.14%	0.13%	0.12%	0.17%	0.14%	0.11%
20 -24	0.35%	0.47%	0.70%	0.69%	0.51%	0.43%
25 -29	0.87%	0.98%	1.42%	1.57%	1.24%	1.18%
30 -34	1.42%	1.39%	1.72%	1.75%	1.43%	1.33%
35 -39	1.15%	1.17%	1.38%	1.70%	1.35%	1.32%
40 -44	0.83%	0.79%	1.07%	1.33%	1.13%	0.92%
45 -49	0.62%	0.51%	0.85%	0.78%	0.59%	0.61%
50 -54	0.32%	0.32%	0.39%	0.49%	0.45%	0.44%
55 -59	0.10%	0.20%	0.18%	0.20%	0.19%	0.20%
60 -64	0.07%	0.11%	0.05%	0.08%	0.14%	0.10%
65 -69	0.02%	0.02%	0.05%	0.04%	0.04%	0.06%
70 -74	0.01%	0.05%	0.03%	0.02%	0.02%	0.01%
75 -79	0.01%	0.02%	0.01%	0.00%	0.01%	0.04%
80 -84	0.03%	0.00%	0.03%	0.03%	0.01%	0.01%
85 +	0.04%	0.03%	0.02%	0.00%	0.04%	0.06%

Panel B- Females

Pattern 1 (HIV=1, TB=0, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.13%	0.13%	0.11%	0.21%	0.21%	0.19%
1-4	0.74%	0.46%	0.90%	0.78%	0.66%	0.75%
5-9	0.25%	0.00%	0.45%	0.38%	0.66%	0.73%
10-14	0.09%	0.06%	0.13%	0.00%	0.00%	0.52%
15 -19	1.19%	0.13%	0.12%	0.17%	0.14%	0.11%
20 -24	2.28%	0.47%	0.70%	0.69%	0.51%	0.43%
25 -29	2.61%	0.98%	1.42%	1.57%	1.24%	1.18%
30 -34	2.21%	1.39%	1.72%	1.75%	1.43%	1.33%
35 -39	1.67%	1.17%	1.38%	1.70%	1.35%	1.32%
40 -44	1.10%	0.79%	1.07%	1.33%	1.13%	0.92%
45 -49	0.37%	0.51%	0.85%	0.78%	0.59%	0.61%
50 -54	0.27%	0.32%	0.39%	0.49%	0.45%	0.44%
55 -59	0.13%	0.20%	0.18%	0.20%	0.19%	0.20%
60 -64	0.05%	0.11%	0.05%	0.08%	0.14%	0.10%
65 -69	0.05%	0.02%	0.05%	0.04%	0.04%	0.06%
70 -74	0.01%	0.05%	0.03%	0.02%	0.02%	0.01%
75 -79	0.00%	0.02%	0.01%	0.00%	0.01%	0.04%
80 -84	0.00%	0.00%	0.03%	0.03%	0.01%	0.01%
85 +	0.00%	0.03%	0.02%	0.00%	0.04%	0.06%

Table 7: Trends in age-specific patterns of failure from pattern 2, South Africa, 1997-2001.

Panel A-Males

Pattern 2 (HIV=1, TB=1, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.22%	0.23%	0.31%	0.21%	0.20%	0.22%
5-9	0.12%	0.18%	0.17%	0.60%	0.26%	0.18%
10-14	0.00%	0.00%	0.07%	0.13%	0.12%	0.12%
15 -19	0.05%	0.15%	0.17%	0.10%	0.09%	0.09%
20 -24	0.42%	0.44%	0.76%	0.61%	0.42%	0.46%
25 -29	0.90%	1.06%	1.14%	1.24%	0.88%	1.14%
30 -34	1.27%	1.42%	1.66%	1.55%	1.20%	1.39%
35 -39	1.32%	1.15%	1.52%	1.46%	1.07%	1.12%
40 -44	0.95%	0.97%	1.20%	1.11%	1.09%	1.01%
45 -49	0.73%	0.48%	0.90%	0.70%	0.57%	0.72%
50 -54	0.38%	0.30%	0.46%	0.49%	0.42%	0.37%
55 -59	0.24%	0.23%	0.25%	0.24%	0.20%	0.16%
60 -64	0.09%	0.11%	0.10%	0.10%	0.09%	0.08%
65 -69	0.01%	0.02%	0.05%	0.05%	0.03%	0.01%
70 -74	0.00%	0.03%	0.01%	0.00%	0.02%	0.03%
75 -79	0.01%	0.01%	0.03%	0.03%	0.02%	0.00%
80 -84	0.02%	0.01%	0.00%	0.01%	0.00%	0.00%
85 +	0.04%	0.03%	0.02%	0.02%	0.00%	0.01%

Panel 2- Females

Pattern 2 (HIV=1, TB=1, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.15%	0.37%	0.25%	0.21%	0.41%	0.18%
5-9	0.34%	0.07%	0.29%	0.35%	0.13%	0.96%
10-14	0.09%	0.17%	0.08%	0.17%	0.15%	0.22%
15 -19	0.68%	0.96%	0.74%	0.84%	1.06%	0.54%
20 -24	1.79%	1.51%	1.87%	1.44%	1.23%	1.21%
25 -29	1.86%	1.66%	1.82%	1.47%	1.34%	1.19%
30 -34	1.58%	1.72%	1.75%	1.43%	1.18%	1.26%
35 -39	1.12%	1.05%	1.53%	1.27%	1.00%	0.93%
40 -44	0.74%	0.72%	0.97%	1.05%	0.81%	0.69%
45 -49	0.48%	0.43%	0.60%	0.64%	0.56%	0.42%
50 -54	0.22%	0.25%	0.27%	0.33%	0.23%	0.26%
55 -59	0.13%	0.10%	0.16%	0.16%	0.15%	0.14%
60 -64	0.08%	0.06%	0.13%	0.03%	0.04%	0.06%
65 -69	0.04%	0.02%	0.01%	0.04%	0.03%	0.03%
70 -74	0.00%	0.02%	0.01%	0.01%	0.01%	0.00%
75 -79	0.01%	0.01%	0.00%	0.02%	0.01%	0.01%
80 -84	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%
85 +	0.01%	0.01%	0.02%	0.00%	0.00%	0.00%

Table 8: Trends in age-specific patterns of failure from pattern 3, South Africa, 1997-2001.

Panel A-Males

Pattern 3 (HIV=1, TB=1, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.00%	0.07%	0.02%	0.06%	0.04%	0.02%
5-9	0.00%	0.18%	0.00%	0.06%	0.00%	0.14%
10-14	0.00%	0.00%	0.00%	0.00%	0.00%	0.06%
15 -19	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20 -24	0.00%	0.00%	0.00%	0.04%	0.02%	0.02%
25 -29	0.02%	0.06%	0.08%	0.02%	0.01%	0.05%
30 -34	0.04%	0.08%	0.10%	0.10%	0.02%	0.06%
35 -39	0.07%	0.06%	0.04%	0.07%	0.06%	0.02%
40 -44	0.04%	0.03%	0.07%	0.05%	0.03%	0.05%
45 -49	0.02%	0.05%	0.03%	0.02%	0.02%	0.03%
50 -54	0.02%	0.01%	0.05%	0.00%	0.01%	0.02%
55 -59	0.00%	0.02%	0.01%	0.00%	0.01%	0.00%
60 -64	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%
65 -69	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
70 -74	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
75 -79	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80 -84	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
85 +	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Panel B- Females

Pattern 3 (HIV=1, TB=1, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.00%	0.10%	0.05%	0.00%	0.00%	0.02%
5-9	0.00%	0.00%	0.07%	0.00%	0.00%	0.06%
10-14	0.00%	0.00%	0.00%	0.08%	0.00%	0.07%
15 -19	0.04%	0.04%	0.03%	0.06%	0.06%	0.08%
20 -24	0.10%	0.11%	0.05%	0.01%	0.00%	0.02%
25 -29	0.04%	0.06%	0.04%	0.05%	0.03%	0.02%
30 -34	0.03%	0.07%	0.08%	0.06%	0.04%	0.06%
35 -39	0.03%	0.12%	0.09%	0.06%	0.02%	0.02%
40 -44	0.02%	0.01%	0.08%	0.03%	0.03%	0.03%
45 -49	0.07%	0.04%	0.03%	0.03%	0.05%	0.00%
50 -54	0.02%	0.03%	0.00%	0.01%	0.00%	0.00%
55 -59	0.00%	0.00%	0.00%	0.04%	0.02%	0.01%
60 -64	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
65 -69	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70 -74	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
75 -79	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80 -84	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
85 +	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 9: Trends in age-specific patterns of failure from pattern 4, South Africa, 1997-2001.

Panel A-Males

Pattern 4 (HIV=1, TB=1, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.08%	0.00%	0.00%	0.04%	0.02%	0.02%
5-9	0.00%	0.00%	0.06%	0.00%	0.05%	0.00%
10-14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15 -19	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20 -24	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
25 -29	0.01%	0.00%	0.02%	0.01%	0.01%	0.00%
30 -34	0.04%	0.02%	0.03%	0.00%	0.01%	0.01%
35 -39	0.02%	0.02%	0.01%	0.02%	0.02%	0.01%
40 -44	0.02%	0.01%	0.03%	0.01%	0.02%	0.00%
45 -49	0.01%	0.00%	0.01%	0.02%	0.01%	0.00%
50 -54	0.00%	0.00%	0.00%	0.01%	0.01%	0.00%
55 -59	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
60 -64	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
65 -69	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70 -74	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
75 -79	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80 -84	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
85 +	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Panel B- Females

Pattern 4, (HIV=1, TB=1, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.06%	0.03%	0.03%	0.00%	0.00%	0.00%
5-9	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%
10-14	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15 -19	0.04%	0.00%	0.00%	0.03%	0.03%	0.00%
20 -24	0.00%	0.02%	0.03%	0.01%	0.00%	0.01%
25 -29	0.04%	0.02%	0.04%	0.01%	0.02%	0.01%
30 -34	0.02%	0.04%	0.01%	0.01%	0.01%	0.01%
35 -39	0.00%	0.05%	0.01%	0.02%	0.00%	0.00%
40 -44	0.00%	0.03%	0.04%	0.01%	0.00%	0.00%
45 -49	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
50 -54	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
55 -59	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
60 -64	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
65 -69	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
70 -74	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
75 -79	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
80 -84	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
85 +	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 10: Trends in age-specific patterns of failure from pattern 5, South Africa, 1997-2001.

Panel A-Males

Pattern 5 (HIV=1, TB=0, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.49%	0.71%	0.52%	0.53%	0.74%	0.75%
5-9	0.12%	0.06%	0.34%	0.44%	0.20%	0.45%
10-14	0.00%	0.25%	0.00%	0.13%	0.00%	0.12%
15 -19	0.03%	0.00%	0.02%	0.00%	0.12%	0.09%
20 -24	0.25%	0.33%	0.36%	0.23%	0.26%	0.27%
25 -29	0.59%	0.59%	0.77%	0.69%	0.47%	0.36%
30 -34	0.61%	0.88%	0.95%	0.92%	0.64%	0.58%
35 -39	0.54%	0.66%	1.06%	0.72%	0.55%	0.56%
40 -44	0.40%	0.37%	0.68%	0.52%	0.50%	0.39%
45 -49	0.38%	0.40%	0.45%	0.39%	0.39%	0.23%
50 -54	0.17%	0.19%	0.28%	0.20%	0.13%	0.20%
55 -59	0.08%	0.11%	0.07%	0.14%	0.09%	0.10%
60 -64	0.02%	0.02%	0.07%	0.05%	0.06%	0.05%
65 -69	0.02%	0.03%	0.03%	0.03%	0.04%	0.05%
70 -74	0.01%	0.01%	0.00%	0.02%	0.02%	0.00%
75 -79	0.00%	0.00%	0.03%	0.01%	0.00%	0.01%
80 -84	0.00%	0.00%	0.01%	0.00%	0.01%	0.00%
85 +	0.00%	0.02%	0.00%	0.03%	0.00%	0.04%

Panel B – Females

Pattern 5 (HIV=1, TB=0, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.58%	0.32%	0.84%	0.84%	0.85%	0.57%
5-9	0.17%	0.22%	0.36%	0.49%	0.32%	0.45%
10-14	0.00%	0.17%	0.00%	0.08%	0.22%	0.15%
15 -19	0.47%	0.66%	0.68%	0.47%	0.42%	0.44%
20 -24	1.11%	1.18%	1.43%	1.04%	0.57%	0.66%
25 -29	1.32%	1.09%	1.49%	1.05%	0.85%	0.65%
30 -34	1.08%	1.25%	1.56%	1.02%	0.82%	0.74%
35 -39	0.90%	1.09%	1.20%	1.08%	0.83%	0.71%
40 -44	0.54%	0.63%	0.79%	0.64%	0.48%	0.44%
45 -49	0.33%	0.29%	0.41%	0.38%	0.37%	0.32%
50 -54	0.05%	0.22%	0.19%	0.22%	0.18%	0.17%
55 -59	0.05%	0.14%	0.15%	0.11%	0.07%	0.10%
60 -64	0.05%	0.03%	0.04%	0.06%	0.04%	0.04%
65 -69	0.01%	0.03%	0.03%	0.01%	0.03%	0.03%
70 -74	0.01%	0.02%	0.05%	0.01%	0.01%	0.00%
75 -79	0.00%	0.00%	0.01%	0.00%	0.00%	0.01%
80 -84	0.01%	0.00%	0.00%	0.03%	0.00%	0.01%
85 +	0.01%	0.01%	0.01%	0.01%	0.01%	0.03%

Table 11: Trends in age-specific patterns of failure from pattern 6, South Africa, 1997-2001.

Panel A-Males

Pattern 6 (HIV=1, TB=0, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.55%	0.28%	0.54%	0.38%	0.47%	0.33%
5-9	0.00%	0.24%	0.06%	0.27%	0.05%	0.09%
10-14	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%
15 -19	0.03%	0.03%	0.00%	0.02%	0.02%	0.02%
20 -24	0.09%	0.11%	0.08%	0.07%	0.08%	0.10%
25 -29	0.25%	0.25%	0.20%	0.16%	0.06%	0.10%
30 -34	0.21%	0.25%	0.24%	0.23%	0.13%	0.13%
35 -39	0.16%	0.19%	0.30%	0.17%	0.17%	0.14%
40 -44	0.23%	0.19%	0.24%	0.21%	0.11%	0.10%
45 -49	0.17%	0.17%	0.19%	0.07%	0.07%	0.10%
50 -54	0.07%	0.09%	0.07%	0.07%	0.08%	0.09%
55 -59	0.03%	0.05%	0.03%	0.05%	0.02%	0.01%
60 -64	0.02%	0.01%	0.03%	0.05%	0.01%	0.02%
65 -69	0.02%	0.00%	0.00%	0.03%	0.00%	0.01%
70 -74	0.01%	0.00%	0.01%	0.01%	0.01%	0.00%
75 -79	0.00%	0.03%	0.01%	0.00%	0.02%	0.00%
80 -84	0.00%	0.01%	0.00%	0.01%	0.00%	0.01%
85 +	0.00%	0.02%	0.02%	0.00%	0.00%	0.01%

Panel B- Females

Pattern 6 (HIV=1, TB=0, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.37%	0.55%	0.44%	0.47%	0.31%	0.41%
5-9	0.00%	0.15%	0.21%	0.21%	0.13%	0.39%
10-14	0.09%	0.00%	0.00%	0.00%	0.00%	0.00%
15 -19	0.38%	0.18%	0.10%	0.25%	0.06%	0.10%
20 -24	0.41%	0.41%	0.34%	0.21%	0.22%	0.24%
25 -29	0.67%	0.53%	0.45%	0.40%	0.19%	0.16%
30 -34	0.53%	0.45%	0.33%	0.26%	0.17%	0.17%
35 -39	0.33%	0.38%	0.32%	0.20%	0.13%	0.18%
40 -44	0.18%	0.16%	0.25%	0.19%	0.13%	0.17%
45 -49	0.22%	0.15%	0.14%	0.09%	0.10%	0.13%
50 -54	0.10%	0.10%	0.15%	0.12%	0.04%	0.07%
55 -59	0.04%	0.04%	0.04%	0.01%	0.02%	0.03%
60 -64	0.00%	0.01%	0.05%	0.02%	0.03%	0.02%
65 -69	0.01%	0.01%	0.01%	0.02%	0.00%	0.03%
70 -74	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
75 -79	0.00%	0.01%	0.00%	0.02%	0.00%	0.00%
80 -84	0.00%	0.00%	0.00%	0.01%	0.00%	0.02%
85 +	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	0.13%	0.14%	0.13%	0.12%	0.08%	0.09%

Table 12: Trends in age-specific patterns of failure from pattern 7, South Africa, 1997-2001.

Panel A-Males

Pattern 7 (HIV=1, TB=0, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	1.68%	1.44%	1.68%	0.00%	1.26%	0.96%
1-4	1.07%	0.92%	1.34%	0.38%	1.09%	0.95%
5-9	0.19%	0.24%	0.74%	0.27%	0.51%	0.73%
10-14	0.07%	0.25%	0.00%	0.00%	0.25%	0.23%
15 -19	0.16%	0.08%	0.14%	0.02%	0.05%	0.09%
20 -24	0.39%	0.43%	0.48%	0.07%	0.45%	0.29%
25 -29	0.99%	0.88%	1.02%	0.16%	0.74%	0.79%
30 -34	1.35%	1.20%	1.23%	0.23%	0.89%	0.88%
35 -39	1.14%	1.05%	1.18%	0.17%	0.88%	0.82%
40 -44	0.92%	0.81%	1.20%	0.21%	0.69%	0.79%
45 -49	0.69%	0.56%	0.67%	0.07%	0.52%	0.61%
50 -54	0.41%	0.34%	0.42%	0.07%	0.37%	0.42%
55 -59	0.20%	0.30%	0.24%	0.05%	0.23%	0.20%
60 -64	0.12%	0.09%	0.10%	0.05%	0.07%	0.14%
65 -69	0.05%	0.09%	0.05%	0.03%	0.03%	0.06%
70 -74	0.02%	0.03%	0.03%	0.01%	0.03%	0.02%
75 -79	0.04%	0.03%	0.02%	0.00%	0.01%	0.03%
80 -84	0.03%	0.00%	0.03%	0.01%	0.04%	0.05%
85 +	0.00%	0.02%	0.00%	0.00%	0.03%	0.04%

Panel B- Females

Pattern 7 (HIV=1, TB=0, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 – 1	1.72%	1.48%	1.77%	0.00%	1.39%	1.21%
1-4	0.98%	1.44%	1.33%	0.47%	1.18%	0.92%
5-9	0.25%	0.52%	0.50%	0.21%	0.32%	0.68%
10-14	0.36%	0.17%	0.08%	0.00%	0.15%	0.15%
15 -19	1.32%	1.25%	1.03%	0.25%	0.59%	0.41%
20 -24	2.32%	1.60%	1.83%	0.21%	1.24%	1.03%
25 -29	2.61%	1.84%	1.95%	0.40%	1.21%	1.34%
30 -34	2.56%	1.79%	2.03%	0.26%	1.04%	1.23%
35 -39	1.53%	1.19%	1.71%	0.20%	0.90%	0.94%
40 -44	1.15%	0.84%	1.46%	0.19%	0.94%	0.66%
45 -49	0.66%	0.63%	0.60%	0.09%	0.57%	0.53%
50 -54	0.35%	0.48%	0.49%	0.12%	0.29%	0.35%
55 -59	0.08%	0.19%	0.36%	0.01%	0.23%	0.27%
60 -64	0.10%	0.09%	0.17%	0.02%	0.08%	0.08%
65 -69	0.07%	0.08%	0.09%	0.02%	0.02%	0.08%
70 -74	0.01%	0.04%	0.03%	0.00%	0.03%	0.03%
75 -79	0.03%	0.01%	0.02%	0.02%	0.01%	0.02%
80 -84	0.01%	0.02%	0.02%	0.01%	0.02%	0.02%
85 +	0.01%	0.02%	0.03%	0.00%	0.01%	0.04%

Table 13: Trends in age-specific patterns of failure from pattern 8, South Africa, 1997-2001.

Panel A-Males

Pattern 8 (HIV=0, TB=1, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
1-4	1.56%	2.32%	2.15%	2.80%	2.99%	4.05%
5-9	1.73%	1.54%	2.78%	3.27%	5.45%	6.85%
10-14	1.59%	1.73%	1.94%	2.32%	2.88%	4.06%
15 -19	1.68%	2.12%	2.35%	3.09%	3.69%	3.61%
20 -24	3.28%	4.18%	4.80%	6.15%	7.83%	8.24%
25 -29	6.38%	8.21%	9.37%	11.65%	14.16%	15.28%
30 -34	8.51%	10.25%	12.13%	14.39%	16.78%	17.89%
35 -39	9.31%	10.78%	13.11%	15.10%	17.61%	18.21%
40 -44	9.39%	11.04%	12.97%	14.61%	16.06%	17.80%
45 -49	8.86%	10.07%	11.18%	12.96%	14.62%	15.30%
50 -54	7.38%	8.34%	9.80%	10.56%	11.76%	12.14%
55 -59	7.02%	6.98%	8.27%	8.58%	9.24%	9.64%
60 -64	5.27%	5.42%	6.08%	6.45%	7.08%	7.47%
65 -69	4.30%	4.34%	4.59%	5.17%	5.44%	4.81%
70 -74	2.84%	3.47%	4.04%	3.86%	4.34%	4.28%
75 -79	2.75%	2.51%	2.83%	3.17%	3.35%	2.76%
80 -84	1.32%	1.67%	2.24%	2.68%	2.55%	2.20%
85 +	1.34%	1.18%	1.50%	1.73%	1.81%	1.36%

Panel B- Females

Pattern 8 (HIV=0, TB=1, INF/PNEU=0, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 – 1	0.00%	0.01%	0.01%	0.00%	0.00%	0.01%
1-4	2.15%	2.20%	2.12%	3.20%	3.40%	3.81%
5-9	1.43%	2.07%	2.64%	3.57%	4.70%	6.59%
10-14	2.24%	2.48%	2.78%	3.63%	5.31%	4.66%
15 -19	6.52%	6.78%	8.88%	11.46%	12.95%	13.51%
20 -24	9.77%	11.98%	12.51%	14.70%	16.55%	17.42%
25 -29	10.99%	11.46%	13.22%	15.77%	17.51%	18.40%
30 -34	10.43%	10.96%	12.46%	15.09%	16.69%	17.48%
35 -39	8.42%	10.02%	11.06%	13.50%	15.85%	16.56%
40 -44	6.60%	8.29%	9.35%	10.65%	13.33%	14.48%
45 -49	5.49%	5.97%	7.10%	8.91%	10.56%	11.29%
50 -54	4.05%	4.44%	5.24%	6.38%	7.16%	8.06%
55 -59	2.92%	3.19%	4.19%	4.58%	4.84%	5.39%
60 -64	2.50%	2.34%	3.02%	3.27%	3.50%	4.23%
65 -69	2.06%	1.89%	2.44%	2.62%	2.67%	2.42%
70 -74	1.26%	1.38%	1.64%	1.96%	1.90%	1.90%
75 -79	1.10%	0.93%	1.38%	1.39%	1.40%	1.41%
80 -84	0.60%	0.74%	0.96%	0.99%	1.00%	0.89%
85 +	0.50%	0.45%	0.47%	0.66%	0.70%	0.67%

Table 14: Trends in age-specific patterns of failure from pattern 9, South Africa, 1997-2001.

Panel A-Males

Pattern 9 (HIV=0, TB=1, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.11%	0.14%	0.27%	0.25%	0.43%	0.27%
5-9	0.12%	0.18%	0.17%	0.22%	0.26%	0.36%
10-14	0.00%	0.06%	0.07%	0.25%	0.25%	0.12%
15 -19	0.05%	0.08%	0.14%	0.10%	0.12%	0.09%
20 -24	0.06%	0.20%	0.16%	0.19%	0.22%	0.23%
25 -29	0.18%	0.19%	0.36%	0.37%	0.43%	0.42%
30 -34	0.29%	0.34%	0.47%	0.48%	0.49%	0.46%
35 -39	0.30%	0.47%	0.43%	0.46%	0.50%	0.30%
40 -44	0.22%	0.38%	0.41%	0.43%	0.49%	0.47%
45 -49	0.30%	0.24%	0.33%	0.51%	0.47%	0.43%
50 -54	0.15%	0.30%	0.40%	0.33%	0.34%	0.30%
55 -59	0.17%	0.29%	0.42%	0.33%	0.25%	0.22%
60 -64	0.17%	0.17%	0.31%	0.32%	0.25%	0.16%
65 -69	0.14%	0.13%	0.19%	0.16%	0.18%	0.15%
70 -74	0.07%	0.13%	0.17%	0.16%	0.19%	0.12%
75 -79	0.06%	0.08%	0.10%	0.17%	0.14%	0.08%
80 -84	0.13%	0.11%	0.17%	0.09%	0.09%	0.03%
85 +	0.04%	0.06%	0.03%	0.07%	0.07%	0.04%

Panel B- Females

Pattern 9 (HIV=0, TB=1, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.15%	0.17%	0.32%	0.26%	0.28%	0.37%
5-9	0.25%	0.15%	0.29%	0.28%	0.39%	0.28%
10-14	0.18%	0.25%	0.00%	0.17%	0.15%	0.22%
15 -19	0.21%	0.07%	0.26%	0.47%	0.25%	0.31%
20 -24	0.20%	0.39%	0.41%	0.54%	0.45%	0.46%
25 -29	0.20%	0.41%	0.45%	0.53%	0.54%	0.38%
30 -34	0.34%	0.55%	0.37%	0.38%	0.63%	0.39%
35 -39	0.19%	0.42%	0.40%	0.49%	0.46%	0.45%
40 -44	0.16%	0.23%	0.37%	0.44%	0.49%	0.29%
45 -49	0.22%	0.19%	0.31%	0.28%	0.48%	0.24%
50 -54	0.05%	0.17%	0.33%	0.24%	0.22%	0.29%
55 -59	0.05%	0.11%	0.17%	0.16%	0.25%	0.12%
60 -64	0.07%	0.12%	0.11%	0.12%	0.14%	0.08%
65 -69	0.07%	0.06%	0.11%	0.10%	0.07%	0.07%
70 -74	0.03%	0.04%	0.05%	0.09%	0.07%	0.08%
75 -79	0.04%	0.12%	0.06%	0.06%	0.08%	0.03%
80 -84	0.00%	0.04%	0.03%	0.06%	0.05%	0.05%
85 +	0.01%	0.05%	0.01%	0.02%	0.03%	0.02%

Table 15: Trends in age-specific patterns of failure from pattern 10, South Africa, 1997-2001.

Panel A-Males

Pattern 10 (HIV=0, TB=1, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.22%	0.23%	0.16%	0.32%	0.45%	0.24%
5-9	0.12%	0.18%	0.23%	0.27%	0.10%	0.23%
10-14	0.14%	0.06%	0.07%	0.19%	0.18%	0.06%
15 -19	0.00%	0.05%	0.00%	0.05%	0.02%	0.04%
20 -24	0.04%	0.04%	0.13%	0.07%	0.07%	0.08%
25 -29	0.06%	0.14%	0.23%	0.20%	0.17%	0.18%
30 -34	0.15%	0.24%	0.23%	0.28%	0.25%	0.18%
35 -39	0.19%	0.23%	0.27%	0.25%	0.24%	0.24%
40 -44	0.16%	0.20%	0.18%	0.15%	0.23%	0.19%
45 -49	0.17%	0.18%	0.24%	0.13%	0.13%	0.21%
50 -54	0.09%	0.16%	0.12%	0.18%	0.12%	0.13%
55 -59	0.08%	0.14%	0.17%	0.17%	0.07%	0.06%
60 -64	0.09%	0.08%	0.09%	0.10%	0.09%	0.06%
65 -69	0.05%	0.14%	0.04%	0.09%	0.10%	0.09%
70 -74	0.03%	0.10%	0.08%	0.03%	0.05%	0.05%
75 -79	0.07%	0.10%	0.09%	0.07%	0.05%	0.05%
80 -84	0.00%	0.03%	0.04%	0.04%	0.06%	0.00%
85 +	0.05%	0.09%	0.08%	0.02%	0.03%	0.03%

Panel B- Females

Pattern 10 (HIV=0, TB=1, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.22%	0.25%	0.25%	0.26%	0.57%	0.21%
5-9	0.08%	0.22%	0.29%	0.28%	0.32%	0.17%
10-14	0.27%	0.08%	0.16%	0.17%	0.22%	0.07%
15 -19	0.09%	0.22%	0.16%	0.13%	0.31%	0.21%
20 -24	0.16%	0.28%	0.22%	0.21%	0.30%	0.20%
25 -29	0.38%	0.26%	0.32%	0.33%	0.31%	0.17%
30 -34	0.25%	0.29%	0.34%	0.28%	0.25%	0.20%
35 -39	0.14%	0.24%	0.38%	0.29%	0.31%	0.21%
40 -44	0.23%	0.16%	0.16%	0.22%	0.18%	0.16%
45 -49	0.13%	0.17%	0.11%	0.07%	0.15%	0.11%
50 -54	0.10%	0.15%	0.11%	0.12%	0.12%	0.20%
55 -59	0.11%	0.10%	0.10%	0.02%	0.07%	0.03%
60 -64	0.07%	0.07%	0.12%	0.09%	0.03%	0.07%
65 -69	0.03%	0.06%	0.08%	0.07%	0.09%	0.03%
70 -74	0.03%	0.04%	0.04%	0.05%	0.05%	0.03%
75 -79	0.04%	0.03%	0.07%	0.05%	0.04%	0.03%
80 -84	0.02%	0.03%	0.03%	0.03%	0.02%	0.02%
85 +	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%

Table 16: Trends in age-specific patterns of failure from pattern 11, South Africa, 1997-2001.

Panel A-Males

Pattern 11 (HIV=0, TB=0, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.01%	0.00%	0.01%	0.00%	0.00%
1-4	8.52%	8.81%	10.90%	13.76%	15.08%	16.00%
5-9	3.02%	5.20%	5.96%	6.71%	7.54%	9.75%
10-14	3.19%	4.82%	4.78%	5.14%	5.09%	6.26%
15 -19	1.76%	2.37%	2.61%	2.85%	3.30%	3.43%
20 -24	1.69%	2.18%	2.87%	3.83%	4.71%	4.81%
25 -29	2.97%	3.97%	5.52%	6.81%	7.84%	8.92%
30 -34	3.78%	4.89%	6.54%	8.42%	9.18%	10.89%
35 -39	3.53%	4.89%	6.14%	8.26%	9.48%	10.44%
40 -44	3.82%	4.69%	6.06%	7.31%	8.90%	9.60%
45 -49	3.71%	4.64%	5.98%	6.45%	7.82%	8.33%
50 -54	3.18%	4.31%	4.59%	5.94%	6.77%	7.42%
55 -59	3.34%	3.99%	4.40%	5.12%	6.06%	6.13%
60 -64	2.98%	3.58%	4.07%	4.79%	5.64%	5.75%
65 -69	2.93%	4.17%	4.18%	4.36%	5.58%	5.58%
70 -74	3.00%	4.12%	4.38%	4.52%	5.09%	5.20%
75 -79	3.26%	4.41%	4.51%	4.97%	5.46%	5.13%
80 -84	3.61%	4.84%	4.60%	4.52%	6.05%	5.20%
85 +	3.80%	5.46%	5.64%	6.10%	7.17%	7.14%

Panel B- Females

Pattern 11 (HIV=0, TB=0, INF/PNEU=1, OTHERS=0)

	1997	1998	1999	2000	2001	2002
0 - 1	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%
1-4	9.30%	10.65%	11.96%	15.35%	16.91%	17.79%
5-9	6.66%	5.92%	6.21%	9.45%	10.69%	10.03%
10-14	5.19%	5.96%	6.20%	7.59%	6.73%	8.14%
15 -19	5.54%	6.30%	7.07%	7.90%	9.92%	11.28%
20 -24	6.09%	7.81%	9.01%	11.35%	13.40%	14.14%
25 -29	6.90%	8.79%	10.29%	12.07%	13.65%	15.19%
30 -34	6.04%	8.64%	10.20%	11.94%	13.80%	15.05%
35 -39	5.42%	7.07%	9.43%	10.85%	12.31%	14.23%
40 -44	3.45%	5.53%	6.72%	9.30%	10.83%	12.19%
45 -49	3.05%	4.55%	5.89%	6.61%	8.57%	9.14%
50 -54	2.34%	3.79%	4.34%	5.26%	5.97%	7.21%
55 -59	2.41%	3.41%	3.61%	3.94%	5.22%	5.41%
60 -64	2.11%	3.03%	3.16%	3.90%	4.59%	4.84%
65 -69	2.42%	3.05%	2.98%	3.50%	4.62%	4.64%
70 -74	2.07%	3.42%	3.18%	3.56%	4.29%	3.99%
75 -79	2.65%	3.55%	3.53%	3.55%	4.60%	3.98%
80 -84	2.61%	4.00%	4.06%	4.05%	4.80%	4.66%
85 +	3.66%	5.00%	4.53%	4.43%	5.79%	5.57%

Table 17: Trends in age-specific patterns of failure from pattern 12, South Africa, 1997-2001.

Panel A-Males

Pattern 12 (HIV=0, TB=0, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%
1-4	9.48%	10.23%	9.89%	10.98%	10.41%	10.40%
5-9	4.69%	4.73%	3.63%	5.67%	5.81%	5.81%
10-14	3.39%	3.58%	3.88%	4.52%	3.13%	3.88%
15 -19	1.38%	1.85%	2.31%	2.10%	2.14%	2.09%
20 -24	1.35%	1.98%	2.31%	2.84%	2.78%	2.52%
25 -29	1.79%	3.01%	3.24%	3.66%	4.37%	4.19%
30 -34	2.81%	3.69%	4.15%	4.68%	5.03%	4.90%
35 -39	2.92%	3.74%	4.25%	4.66%	4.84%	4.92%
40 -44	3.14%	3.57%	3.86%	4.43%	4.44%	4.69%
45 -49	3.87%	3.54%	3.88%	4.07%	3.98%	4.32%
50 -54	3.17%	4.02%	4.11%	4.20%	3.66%	4.15%
55 -59	4.03%	4.15%	4.01%	4.10%	4.08%	4.43%
60 -64	4.31%	4.95%	4.36%	4.47%	4.31%	4.39%
65 -69	4.35%	5.24%	5.17%	4.81%	4.75%	4.31%
70 -74	5.72%	5.82%	5.86%	5.55%	5.26%	5.29%
75 -79	6.33%	7.49%	6.59%	5.87%	6.14%	5.96%
80 -84	8.29%	9.21%	7.23%	7.12%	6.45%	6.42%
85 +	8.87%	9.06%	8.71%	8.38%	8.12%	7.89%

Panel B- Females

Pattern 12 (HIV=0, TB=0, INF/PNEU=1, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.01%	0.01%	0.00%	0.01%	0.01%
1-4	9.76%	11.02%	11.02%	10.80%	10.82%	11.06%
5-9	5.65%	5.70%	5.14%	6.79%	6.05%	6.70%
10-14	4.48%	4.80%	4.65%	4.37%	4.64%	3.55%
15 -19	3.37%	5.16%	4.82%	5.37%	4.76%	4.39%
20 -24	5.02%	5.26%	5.75%	6.51%	6.48%	6.12%
25 -29	4.63%	6.36%	6.42%	6.76%	6.53%	6.45%
30 -34	4.67%	5.97%	6.01%	6.42%	6.50%	6.19%
35 -39	4.56%	4.89%	5.57%	6.51%	6.05%	5.73%
40 -44	3.93%	4.80%	4.66%	5.22%	5.49%	5.59%
45 -49	3.65%	4.24%	4.23%	4.43%	4.63%	4.89%
50 -54	3.68%	4.54%	4.61%	4.29%	3.96%	4.63%
55 -59	4.01%	4.44%	4.12%	3.94%	4.33%	4.17%
60 -64	4.39%	4.72%	4.35%	4.14%	4.07%	4.56%
65 -69	4.27%	4.76%	4.22%	4.37%	4.04%	3.88%
70 -74	4.93%	5.47%	4.70%	4.61%	4.74%	4.44%
75 -79	5.80%	6.28%	5.79%	5.68%	5.70%	5.35%
80 -84	7.28%	7.49%	6.82%	5.79%	5.84%	5.45%
85 +	7.78%	8.99%	7.49%	7.14%	7.10%	6.83%

Table 18: Trends in age-specific patterns of failure from pattern 13, South Africa, 1997-2001.

Panel A-Males

Pattern 13 (HIV=0, TB=0, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	98.17%	98.40%	98.20%	98.20%	98.51%	98.84%
1-4	74.19%	73.36%	70.40%	65.44%	63.72%	62.45%
5-9	88.65%	84.94%	83.04%	78.78%	74.82%	69.75%
10-14	90.03%	88.02%	87.60%	85.76%	86.63%	82.49%
15 -19	93.57%	92.39%	91.46%	89.99%	88.93%	89.08%
20 -24	90.06%	87.44%	84.86%	81.81%	79.71%	79.19%
25 -29	80.97%	76.19%	71.23%	66.75%	64.00%	61.62%
30 -34	74.14%	69.27%	63.77%	59.39%	57.03%	54.00%
35 -39	73.60%	69.41%	63.63%	58.92%	56.68%	54.75%
40 -44	74.37%	70.94%	65.32%	62.23%	60.08%	57.29%
45 -49	75.31%	74.22%	69.60%	67.09%	65.80%	63.19%
50 -54	80.07%	77.32%	74.79%	72.40%	71.64%	69.28%
55 -59	80.94%	79.45%	78.14%	77.06%	76.13%	75.27%
60 -64	83.62%	82.48%	81.65%	80.58%	79.41%	79.26%
65 -69	85.34%	83.25%	83.10%	82.89%	81.91%	82.90%
70 -74	86.42%	84.32%	83.50%	84.10%	83.48%	83.46%
75 -79	85.11%	83.53%	84.09%	84.37%	83.56%	84.74%
80 -84	85.28%	82.49%	84.28%	84.16%	83.79%	84.98%
85 +	84.64%	83.15%	83.05%	82.80%	82.04%	82.70%

Panel B- Females

Pattern 13 (HIV=0, TB=0, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	98.14%	98.32%	98.04%	98.10%	98.29%	98.63%
1-4	73.05%	69.32%	68.04%	63.07%	61.56%	60.71%
5-9	83.47%	82.61%	80.44%	73.90%	72.83%	68.28%
10-14	85.14%	83.95%	83.02%	81.04%	79.06%	79.94%
15 -19	75.71%	72.62%	69.68%	66.88%	63.98%	62.54%
20 -24	63.68%	59.84%	56.84%	52.60%	50.62%	49.69%
25 -29	59.89%	57.08%	52.81%	49.39%	48.37%	46.43%
30 -34	63.34%	59.12%	54.69%	51.65%	49.92%	47.72%
35 -39	69.53%	65.94%	60.10%	55.48%	54.06%	51.81%
40 -44	77.39%	72.49%	68.31%	64.71%	60.63%	58.55%
45 -49	81.77%	78.60%	75.58%	72.28%	68.99%	67.45%
50 -54	86.31%	82.20%	80.56%	78.44%	77.79%	74.46%
55 -59	87.87%	85.76%	84.34%	83.96%	82.24%	81.44%
60 -64	88.74%	87.58%	86.92%	86.42%	85.75%	84.16%
65 -69	89.52%	88.34%	88.52%	87.75%	87.13%	87.34%
70 -74	90.20%	88.41%	89.25%	88.50%	87.95%	88.44%
75 -79	89.27%	88.17%	88.36%	88.53%	87.41%	88.49%
80 -84	88.89%	87.18%	87.54%	88.33%	87.79%	88.36%
85 +	87.39%	84.98%	87.04%	87.29%	86.10%	86.38%

Table 19: Trends in age-specific patterns of failure from pattern 14, South Africa, 1997-2001.

Panel A-Males

Pattern 14, Males (HIV=0, TB=1, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
1-4	2.58%	2.18%	2.33%	3.05%	3.59%	3.34%
5-9	0.93%	2.36%	2.10%	2.62%	3.93%	4.72%
10-14	1.59%	1.11%	1.36%	1.44%	1.47%	2.09%
15 -19	1.14%	0.77%	0.66%	1.42%	1.37%	1.23%
20 -24	1.88%	2.06%	2.25%	2.91%	2.84%	3.30%
25 -29	3.57%	4.23%	5.04%	5.54%	5.39%	5.46%
30 -34	5.04%	5.60%	6.32%	6.23%	6.65%	6.91%
35 -39	5.35%	5.79%	6.19%	6.56%	6.23%	6.82%
40 -44	5.24%	5.69%	6.26%	6.50%	6.02%	6.36%
45 -49	4.94%	4.77%	5.41%	5.66%	4.86%	5.60%
50 -54	4.51%	4.15%	4.41%	4.55%	4.17%	4.88%
55 -59	3.72%	4.03%	3.74%	3.67%	3.36%	3.53%
60 -64	3.21%	2.95%	3.06%	2.83%	2.85%	2.48%
65 -69	2.77%	2.56%	2.54%	2.30%	1.92%	1.96%
70 -74	1.86%	1.91%	1.89%	1.73%	1.49%	1.54%
75 -79	2.37%	1.80%	1.70%	1.31%	1.24%	1.20%
80 -84	1.29%	1.63%	1.38%	1.30%	0.94%	1.10%
85 +	1.17%	0.90%	0.94%	0.81%	0.70%	0.68%

Panel B- Females

Pattern 14 (HIV=0, TB=1, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
1-4	2.30%	2.68%	2.22%	3.10%	2.90%	2.93%
5-9	1.35%	1.78%	2.57%	2.94%	3.28%	4.00%
10-14	1.61%	1.74%	2.61%	2.31%	2.77%	2.37%
15 -19	4.05%	4.75%	4.82%	3.93%	4.49%	5.05%
20 -24	6.54%	6.94%	6.78%	7.06%	6.65%	6.65%
25 -29	7.06%	7.50%	7.38%	7.15%	7.11%	7.36%
30 -34	6.26%	6.88%	7.16%	7.07%	6.77%	7.17%
35 -39	5.63%	5.63%	5.67%	6.47%	6.20%	6.18%
40 -44	4.27%	4.73%	5.04%	4.76%	5.11%	5.21%
45 -49	3.46%	4.16%	4.03%	4.31%	3.90%	4.61%
50 -54	2.46%	3.34%	3.23%	3.33%	3.42%	3.58%
55 -59	2.17%	2.33%	2.49%	2.58%	2.30%	2.62%
60 -64	1.84%	1.86%	1.79%	1.70%	1.63%	1.72%
65 -69	1.47%	1.70%	1.48%	1.42%	1.28%	1.40%
70 -74	1.45%	1.14%	1.00%	1.17%	0.93%	1.04%
75 -79	1.06%	0.90%	0.78%	0.68%	0.74%	0.67%
80 -84	0.58%	0.50%	0.53%	0.70%	0.48%	0.54%
85 +	0.63%	0.49%	0.39%	0.43%	0.24%	0.39%

Table 20: Trends in age-specific patterns of failure from pattern 15, South Africa, 1997-2001.

Panel A-Males

Pattern 15 (HIV=1, TB=1, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.11%	0.09%	0.29%	0.28%	0.12%	0.22%
5-9	0.12%	0.00%	0.28%	0.16%	0.36%	0.23%
10-14	0.00%	0.06%	0.07%	0.00%	0.00%	0.00%
15 -19	0.03%	0.00%	0.02%	0.05%	0.02%	0.04%
20 -24	0.15%	0.16%	0.25%	0.09%	0.11%	0.07%
25 -29	0.46%	0.25%	0.37%	0.40%	0.22%	0.31%
30 -34	0.37%	0.49%	0.47%	0.40%	0.28%	0.40%
35 -39	0.43%	0.41%	0.49%	0.44%	0.31%	0.32%
40 -44	0.28%	0.32%	0.45%	0.27%	0.23%	0.37%
45 -49	0.23%	0.17%	0.27%	0.29%	0.15%	0.32%
50 -54	0.09%	0.16%	0.13%	0.14%	0.08%	0.15%
55 -59	0.06%	0.08%	0.07%	0.08%	0.07%	0.06%
60 -64	0.02%	0.03%	0.03%	0.05%	0.01%	0.05%
65 -69	0.01%	0.01%	0.01%	0.01%	0.00%	0.02%
70 -74	0.02%	0.01%	0.02%	0.00%	0.00%	0.02%
75 -79	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%
80 -84	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
85 +	0.02%	0.00%	0.00%	0.02%	0.00%	0.00%

Panel B- Females

Pattern 15 (HIV=1, TB=1, INF/PNEU=0, OTHERS=1)

	1997	1998	1999	2000	2001	2002
0 - 1	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
1-4	0.18%	0.22%	0.07%	0.05%	0.15%	0.16%
5-9	0.08%	0.15%	0.07%	0.28%	0.26%	0.34%
10-14	0.27%	0.08%	0.08%	0.00%	0.15%	0.07%
15 -19	0.38%	0.30%	0.13%	0.19%	0.03%	0.18%
20 -24	0.56%	0.50%	0.55%	0.39%	0.33%	0.31%
25 -29	0.78%	0.68%	0.49%	0.49%	0.30%	0.45%
30 -34	0.67%	0.45%	0.53%	0.45%	0.36%	0.31%
35 -39	0.54%	0.42%	0.42%	0.38%	0.23%	0.21%
40 -44	0.25%	0.31%	0.31%	0.28%	0.17%	0.25%
45 -49	0.12%	0.22%	0.18%	0.28%	0.14%	0.16%
50 -54	0.02%	0.13%	0.07%	0.12%	0.13%	0.10%
55 -59	0.03%	0.06%	0.02%	0.05%	0.05%	0.03%
60 -64	0.00%	0.01%	0.01%	0.08%	0.02%	0.05%
65 -69	0.01%	0.00%	0.00%	0.00%	0.03%	0.00%
70 -74	0.00%	0.00%	0.01%	0.00%	0.00%	0.01%
75 -79	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
80 -84	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
85 +	0.01%	0.01%	0.00%	0.01%	0.01%	0.00%

Table 21: Summary of profiles of patterns of failure, South Africa, 1997-2001

Patterns	M-shape with adult peak higher than children peak	Subdued M-shape with broad adult plateau	M-shape with adult peak lower than children peak	Mixed M-shape with changing peaks	Reverse N-shape with peak centring on adults	Single childhood peak and rise with age above 50 years	Typical mortality profile	Random with no apparent pattern
Pattern 1								
Male	✓							
Female	✓							
Pattern 2								
Male	✓							
Female	✓							
Pattern 3								
Male			✓					
Female								✓
Pattern 4								
Male			✓					
Female								✓
Pattern 5								
Male	✓							
Female	✓							
Pattern 6								
Male			✓					
Female				✓				
Pattern 7								
Male					✓			
Female					✓			
Pattern 8								
Male	✓							
Female	✓							
Pattern 9								
Male		✓						
Female		✓						
Pattern 10								
Male			✓					
Female				✓				
Pattern 11								
Male			✓					
Female			✓					
Pattern 12								
Male						✓		
Female						✓		
Pattern 13								
Male							✓	
Female							✓	
Pattern 14								
Male	✓							
Female	✓							
Pattern 15								
Male	✓							
Female	✓							

Table 22a: Patterns of mentions of specific causes by sex and age group, South Africa, Males, 1997-2001

Total number of records read= 2486452: Number of records for selected years= 1061950

Cause 1 (cs1): HIV (ICD10: B20-B24)
Cause 2 (cs2): TB (ICD10: A15-A19)
Cause 3 (cs3): INF AND PHEU. (ICD10: J10-J18)
Cause 4 (cs4): OTHER CAUSES

	Pat 1	Pat 2	Pat 3	Pat 4	Pat 5	Pat 6	Pat 7	Pat 8	Pat 9	Pat 10	Pat 11	Pat 12	Pat 13	Pat 14	Pat 15
	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=1
	cs2=0	cs2=1	cs2=1	cs2=1	cs2=0	cs2=0	cs2=0	cs2=1	cs2=1	cs2=1	cs2=0	cs2=0	cs2=0	cs2=1	cs2=1
	cs3=0	cs3=0	cs3=1	cs3=1	cs3=1	cs3=1	cs3=0	cs3=0	cs3=1	cs3=1	cs3=1	cs3=1	cs3=0	cs3=0	cs3=0
Age grp	cs4=0	cs4=0	cs4=0	cs4=1	cs4=0	cs4=1	cs4=1	cs4=0	cs4=0	cs4=1	cs4=0	cs4=1	cs4=1	cs4=1	cs4=1
0 - 1	167	0	0	0	0	0	1525	8	0	0	3	2	98776	2	0
1 - 4	161	52	9	6	135	98	247	539	56	63	2603	2285	15403	621	40
5 - 9	31	24	4	2	21	11	40	270	17	16	513	438	7251	217	17
10 -14	3	5	0	0	6	1	11	165	10	10	363	290	6860	109	2
15 -19	28	23	0	0	7	4	20	534	20	5	531	402	18617	219	5
20 -24	230	224	5	0	120	36	188	2226	70	29	1297	954	35736	1010	64
25 -29	825	697	26	8	411	118	602	6850	210	109	3756	2209	47281	3220	221
30 -34	1201	1100	50	12	621	161	889	10018	331	183	5359	3260	49264	4698	306
35 -39	1069	1010	46	14	551	153	844	10667	344	186	5326	3270	49301	4739	319
40 -44	769	781	31	11	363	138	644	9613	289	136	4691	2889	47959	4368	224
45 -49	477	478	20	8	285	92	466	8360	269	119	4178	2755	49710	3646	156
50 -54	263	273	10	3	125	51	265	6436	205	90	3373	2541	49376	2868	78
55 -59	114	150	4	1	63	23	160	5202	191	82	2981	2636	50660	2396	45
60 -64	56	60	2	0	27	14	64	3754	152	55	2636	2746	49952	1822	18
65 -69	21	19	1	0	17	5	34	2859	96	51	2548	2921	49985	1451	4
70 -74	15	6	0	0	7	4	15	2241	87	33	2555	3377	50515	1060	5
75 -79	5	10	0	0	4	6	14	1490	55	39	2305	3329	43086	869	0
80 -84	7	3	0	0	2	2	10	800	43	13	1797	2850	31464	487	0
85 +	8	6	0	0	3	2	6	495	18	17	1853	2792	26952	289	2
Unsp	56	64	2	1	29	11	93	725	16	18	437	361	7003	393	20
Total	5506	4985	210	66	2797	930	6137	73252	2479	1254	49105	42307	785151	34484	1526

Table 22b: Any mention of specific causes (derived from patterns above, by sex and age group, South Africa, 1997-2001

	Any mention of cause 1	Any mention of cause 2	Any mention of cause 3	Any mention of other causes
0 - 1	1692	10	5	100305
1 - 4	748	1386	5255	18763
5 - 9	150	567	1022	7992
10 -14	28	301	680	7283
15 -19	87	806	969	19272
20 -24	867	3628	2511	38017
25 -29	2908	11341	6847	53768
30 -34	4340	16698	9977	58773
35 -39	4006	17325	9890	58826
40 -44	2961	15453	8548	56369
45 -49	1982	13056	7726	56952
50 -54	1068	9963	6398	55272
55 -59	560	8071	5981	56003
60 -64	241	5863	5632	54671
65 -69	101	4481	5639	54451
70 -74	52	3432	6063	55009
75 -79	39	2463	5738	47343
80 -84	24	1346	4707	34826
85 +	27	827	4685	30060
Unsp	276	1239	875	7900
Total	22157	118256	99148	871855

Table 23a: Patterns of mentions of specific causes by sex and age group, South Africa, Females, 1997-2001

Total number of records read= 2486452: Number of records for year= 905190

Cause 1 (cs1): HIV (ICD10: B20-B24)
Cause 2 (cs2): TB (ICD10: A15-A19)
Cause 3 (cs3): INF AND PHEU. (ICD10: J10-J18)
Cause 4 (cs4): OTHER CAUSES

	Pat 1	Pat 2	Pat 3	Pat 4	Pat 5	Pat 6	Pat 7	Pat 8	Pat 9	Pat 10	Pat 11	Pat 12	Pat 13	Pat 14	Pat 15
	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=1	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=0	cs1=1
	cs2=0	cs2=1	cs2=1	cs2=1	cs2=0	cs2=0	cs2=0	cs2=1	cs2=1	cs2=1	cs2=0	cs2=0	cs2=0	cs2=1	cs2=1
	cs3=0	cs3=0	cs3=1	cs3=1	cs3=1	cs3=1	cs3=0	cs3=0	cs3=1	cs3=1	cs3=1	cs3=1	cs3=0	cs3=0	cs3=0
Age grp	cs4=0	cs4=0	cs4=0	cs4=1	cs4=0	cs4=1	cs4=1	cs4=0	cs4=0	cs4=1	cs4=0	cs4=1	cs4=1	cs4=1	cs4=1
0 - 1	187	0	0	0	0	0	1401	2	0	0	10	5	86557	1	1
1 - 4	176	58	6	4	141	86	251	538	49	64	2653	2170	13470	539	27
5 - 9	42	16	1	1	22	10	31	206	19	17	547	407	5420	169	12
10 -14	17	8	1	0	6	1	10	204	9	11	388	280	5023	136	7
15 -19	174	130	7	3	80	27	146	1445	39	28	1130	712	10354	661	28
20 -24	826	580	17	4	390	114	637	5158	158	91	3827	2250	21099	2580	170
25 -29	1438	928	25	15	657	236	1050	8567	270	186	6517	3716	30713	4253	293
30 -34	1222	860	31	8	643	178	983	8048	275	163	6354	3536	31502	3994	269
35 -39	920	612	31	8	521	129	680	6417	214	147	4982	2927	30584	3085	192
40 -44	588	381	16	6	267	78	464	4440	160	82	3394	2158	29491	2115	112
45 -49	291	222	17	0	145	53	257	3192	125	50	2440	1729	30096	1611	76
50 -54	152	100	4	0	68	38	165	2144	80	45	1725	1606	30671	1216	37
55 -59	74	57	5	1	43	12	97	1630	61	32	1540	1715	34851	977	17
60 -64	41	32	0	0	22	11	57	1479	56	36	1714	2160	43488	878	12
65 -69	18	14	0	0	11	5	35	1350	46	38	1923	2498	50876	848	4
70 -74	9	6	0	0	11	1	19	1006	36	26	2052	2944	53669	677	1
75 -79	4	5	0	0	1	3	9	706	42	25	2048	3357	50667	480	1
80 -84	2	2	0	0	4	1	9	485	20	14	2207	3623	48539	306	1
85 +	5	4	0	0	5	0	10	372	16	2	3131	5077	57268	280	4
Unsp	78	51	0	2	24	8	86	461	9	11	370	280	5193	286	21
Total	6264	4066	161	52	3061	991	6397	47850	1684	1068	48952	43150	669531	25092	1285

Table 23b: Any mention of specific causes (derived from patterns above, by sex and age group, South Africa, 1997-2001

	Any mention of cause 1	Any mention of cause 2	Any mention of cause 3	Any mention of other causes
0 - 1	1589	4	15	87965
1 - 4	749	1285	5173	16611
5 - 9	135	441	1024	6067
10 -14	50	376	696	5468
15 -19	595	2341	2026	11959
20 -24	2738	8758	6851	26945
25 -29	4642	14537	11622	40462
30 -34	4194	13648	11188	40633
35 -39	3093	10706	8959	37752
40 -44	1912	7312	6161	34506
45 -49	1061	5293	4559	33872
50 -54	564	3626	3566	33778
55 -59	306	2780	3409	37702
60 -64	175	2493	3999	46642
65 -69	87	2300	4521	54304
70 -74	47	1752	5070	57337
75 -79	23	1259	5476	54542
80 -84	19	828	5869	52493
85 +	28	678	8231	62641
Unsp	270	841	704	5887
Total	22277	81258	99119	747566

Table 24a: Life expectancies at different ages with pattern elimination, South Africa, Males, 1997-2001

	Any mention of HIV	Any mention of TB	Any mention of Inf and pneu	Any mention of HIV and TB	Any mention of HIV and Inf and pneu	Any mention of TB and Inf and pneu	Any mention of HIV and TB and Inf and pneu	Any mention of HIV and partial mention of TB and Inf and pneu
0	56.75	58.69	58.25	59.18	58.74	60.91	61.44	58.95
1	57.95	60.01	59.55	60.48	60.02	62.31	62.82	60.24
5	54.66	56.72	56.13	57.18	56.57	58.87	59.36	56.87
10	49.89	51.95	51.35	52.4	51.79	54.08	54.56	52.09
15	45.07	47.14	46.52	47.59	46.96	49.25	49.74	47.27
20	40.52	42.59	41.96	43.04	42.4	44.7	45.19	42.71
25	36.43	38.49	37.87	38.93	38.3	40.59	41.07	38.61
30	32.9	34.83	34.3	35.22	34.68	36.83	37.25	34.94
35	29.68	31.4	31.01	31.69	31.3	33.21	33.53	31.49
40	26.5	27.97	27.77	28.17	27.96	29.61	29.82	28.06
45	23.34	24.57	24.54	24.69	24.67	26.05	26.18	24.67
50	20.36	21.35	21.5	21.42	21.57	22.69	22.76	21.49
55	17.52	18.3	18.59	18.33	18.63	19.52	19.56	18.47
60	14.93	15.52	15.95	15.54	15.97	16.65	16.67	15.74
65	12.47	12.91	13.43	12.92	13.44	13.96	13.97	13.17
70	10.16	10.48	11.07	10.49	11.08	11.47	11.48	10.77
75	8.28	8.52	9.15	8.52	9.16	9.46	9.47	8.82
80	6.57	6.74	7.42	6.74	7.43	7.65	7.65	7.07
85	4.99	5.12	5.83	5.12	5.83	6.01	6.01	5.45

Table 24b: Life expectancies at different ages with pattern elimination, South Africa, Females, 1997-2001

	Any mention of HIV	Any mention of TB	Any mention of Inf and pneu	Any mention of HIV and TB	Any mention of HIV and Inf and pneu	Any mention of TB and Inf and pneu	Any mention of HIV and TB and Inf and pneu	Any mention of HIV and partial mention of TB and Inf and pneu
0	65.17	66.57	66.95	67.13	67.52	69.04	69.63	67.31
1	66.36	67.85	68.25	68.39	68.79	70.4	70.98	68.58
5	63.05	64.54	64.8	65.06	65.32	66.92	67.47	65.18
10	58.25	59.74	59.98	60.25	60.49	62.1	62.64	60.36
15	53.41	54.89	55.12	55.4	55.64	57.24	57.78	55.51
20	48.77	50.21	50.46	50.71	50.96	52.52	53.05	50.83
25	44.65	45.97	46.27	46.41	46.71	48.13	48.59	46.55
30	41.06	42.15	42.54	42.48	42.86	44.04	44.38	42.66
35	37.52	38.39	38.85	38.6	39.07	40	40.23	38.82
40	33.85	34.53	35.06	34.66	35.2	35.93	36.07	34.92
45	30.08	30.62	31.21	30.7	31.28	31.87	31.95	30.98
50	26.35	26.78	27.41	26.82	27.45	27.92	27.96	27.12
55	22.71	23.04	23.71	23.06	23.73	24.1	24.13	23.39
60	19.27	19.53	20.22	19.54	20.23	20.52	20.53	19.87
65	15.98	16.17	16.88	16.18	16.88	17.11	17.12	16.52
70	12.97	13.12	13.83	13.12	13.84	14	14.01	13.46
75	10.27	10.37	11.1	10.38	11.1	11.22	11.23	10.72
80	7.75	7.82	8.54	7.82	8.54	8.63	8.63	8.16
85	5.52	5.57	6.3	5.57	6.3	6.37	6.38	5.92

Fig 1a: Fitting Hill's generalised growth balance model, SA Males, 1996-2001

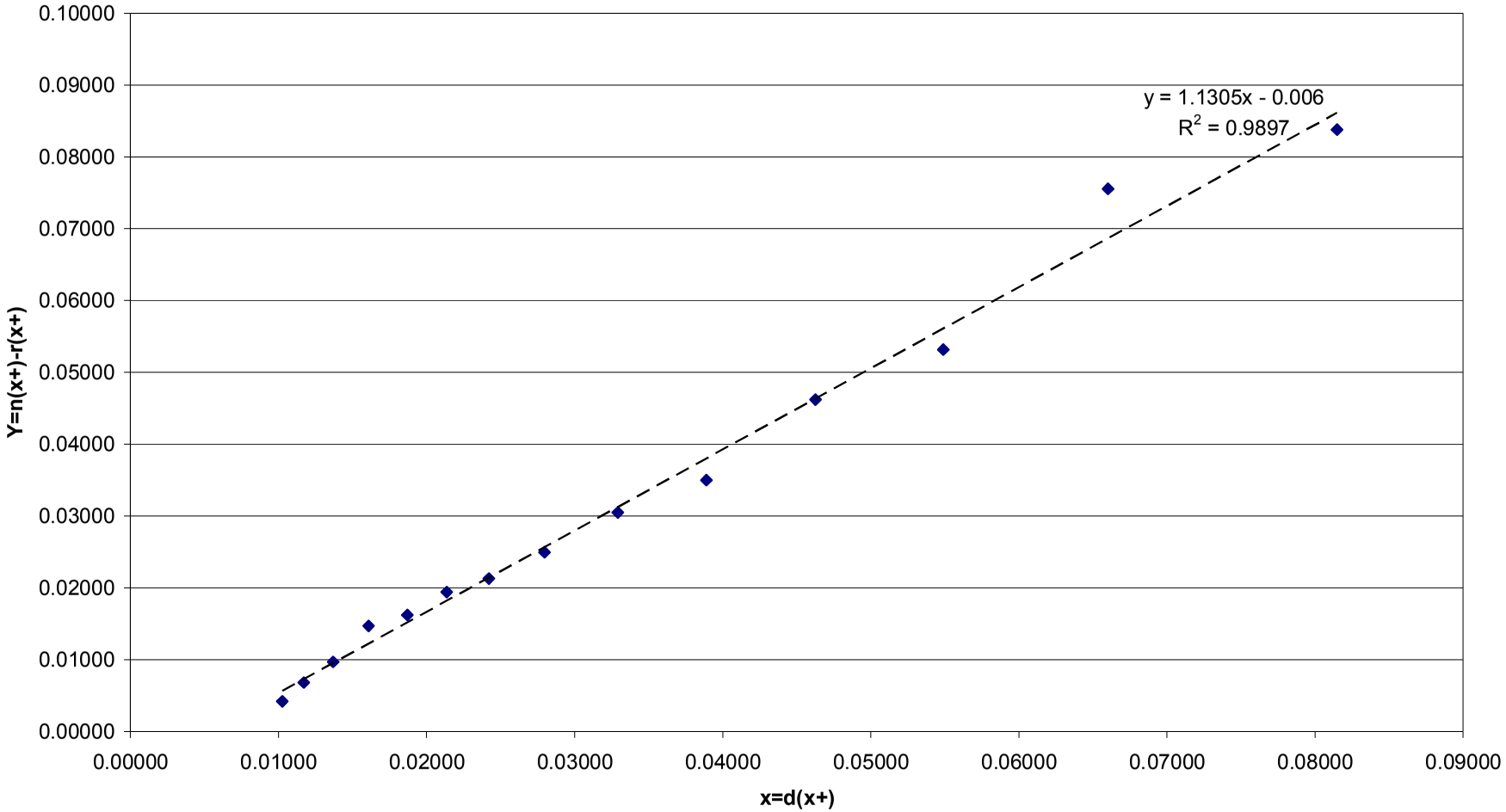

Fig 1b: Fitting Hill's generalised growth balance model, SA Females, 1996-2001

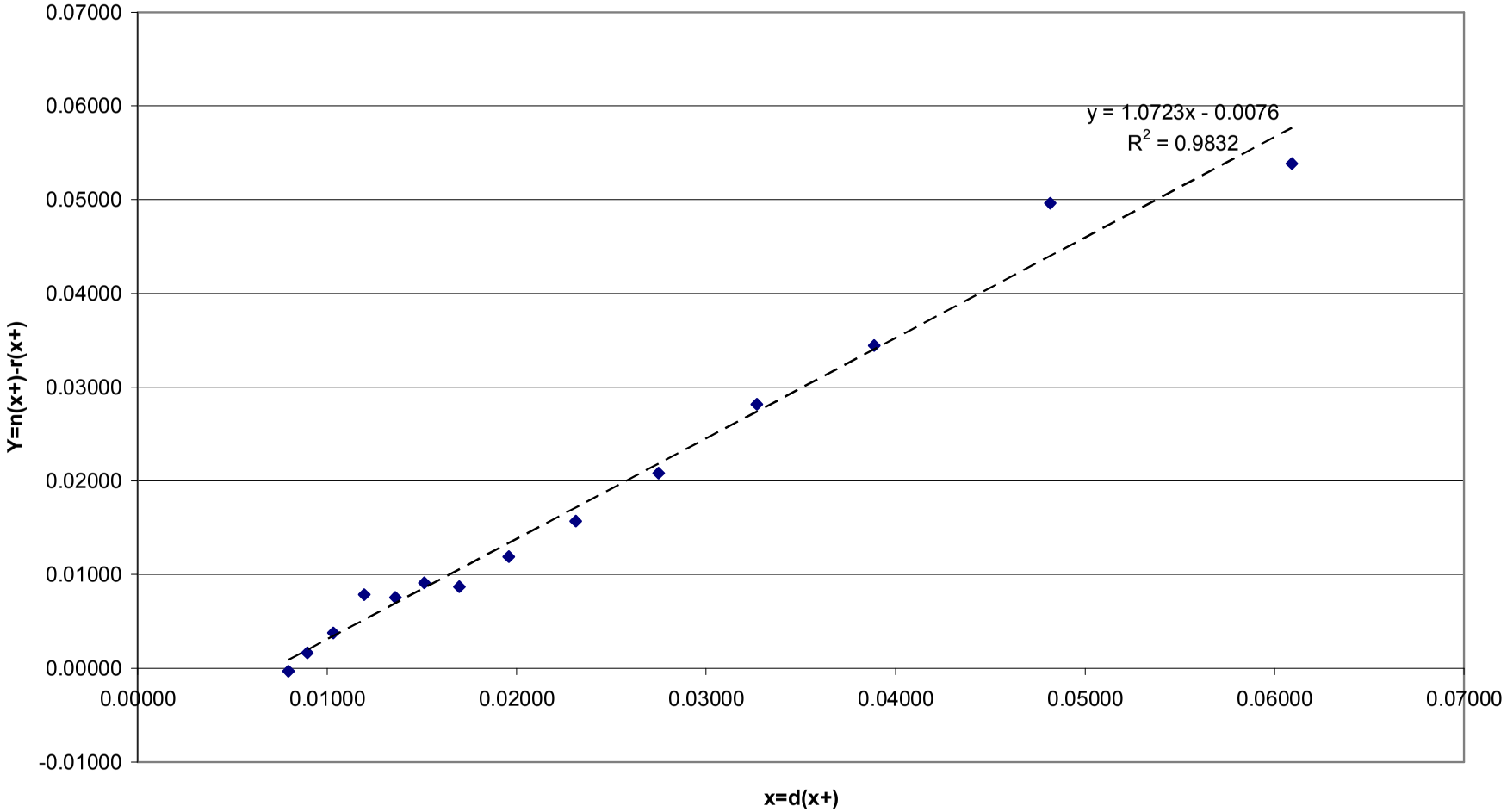

Fig 2: Adjusted life table for South Africa for the intercensal period, 1996-2001, males and females (100 000* nqx)

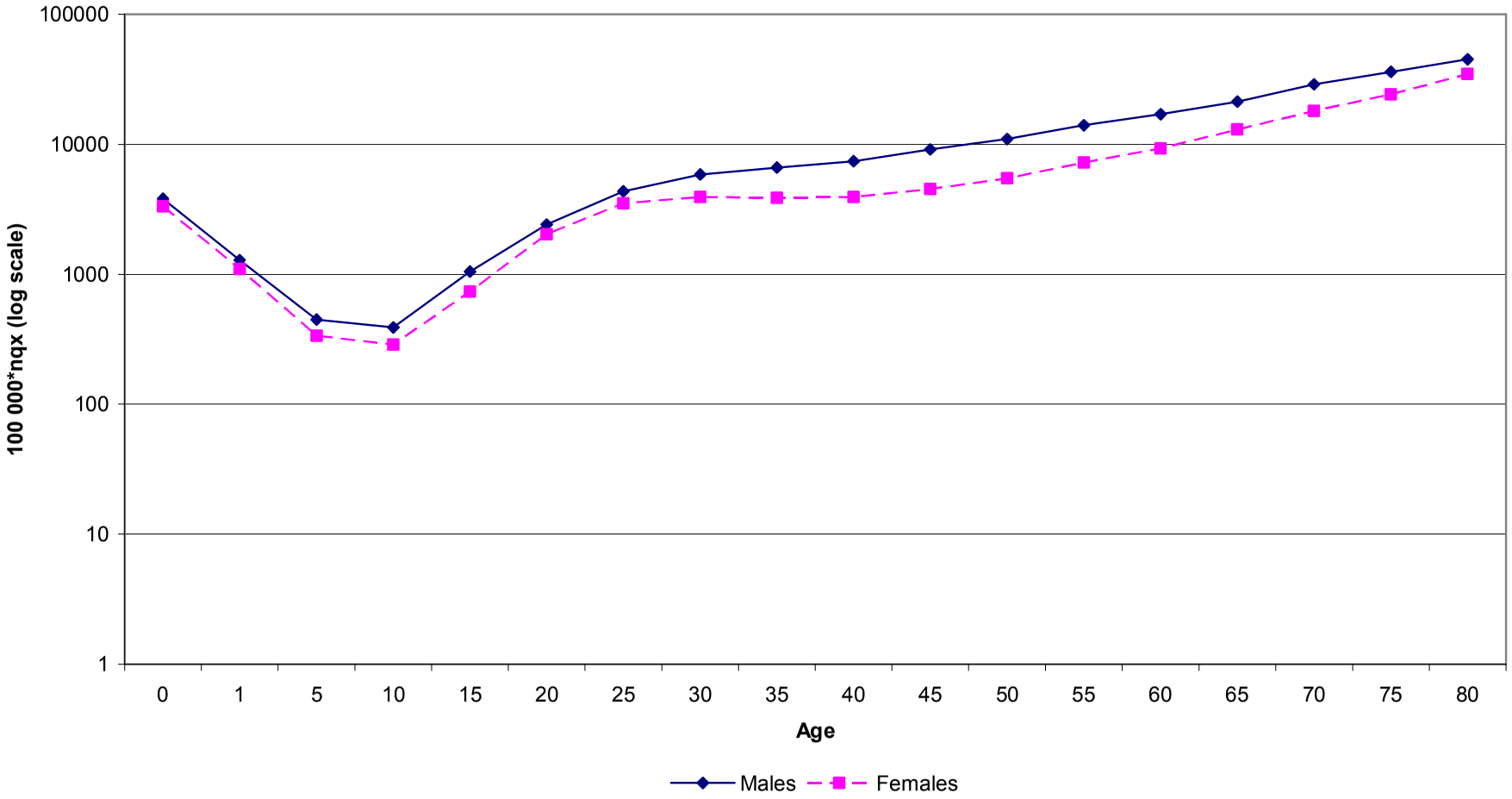

Fig 3a: Ill-defined causes of death as first mentioned cause, underlying cause and 'any mention on the record', Males, South Africa, 1997-2001

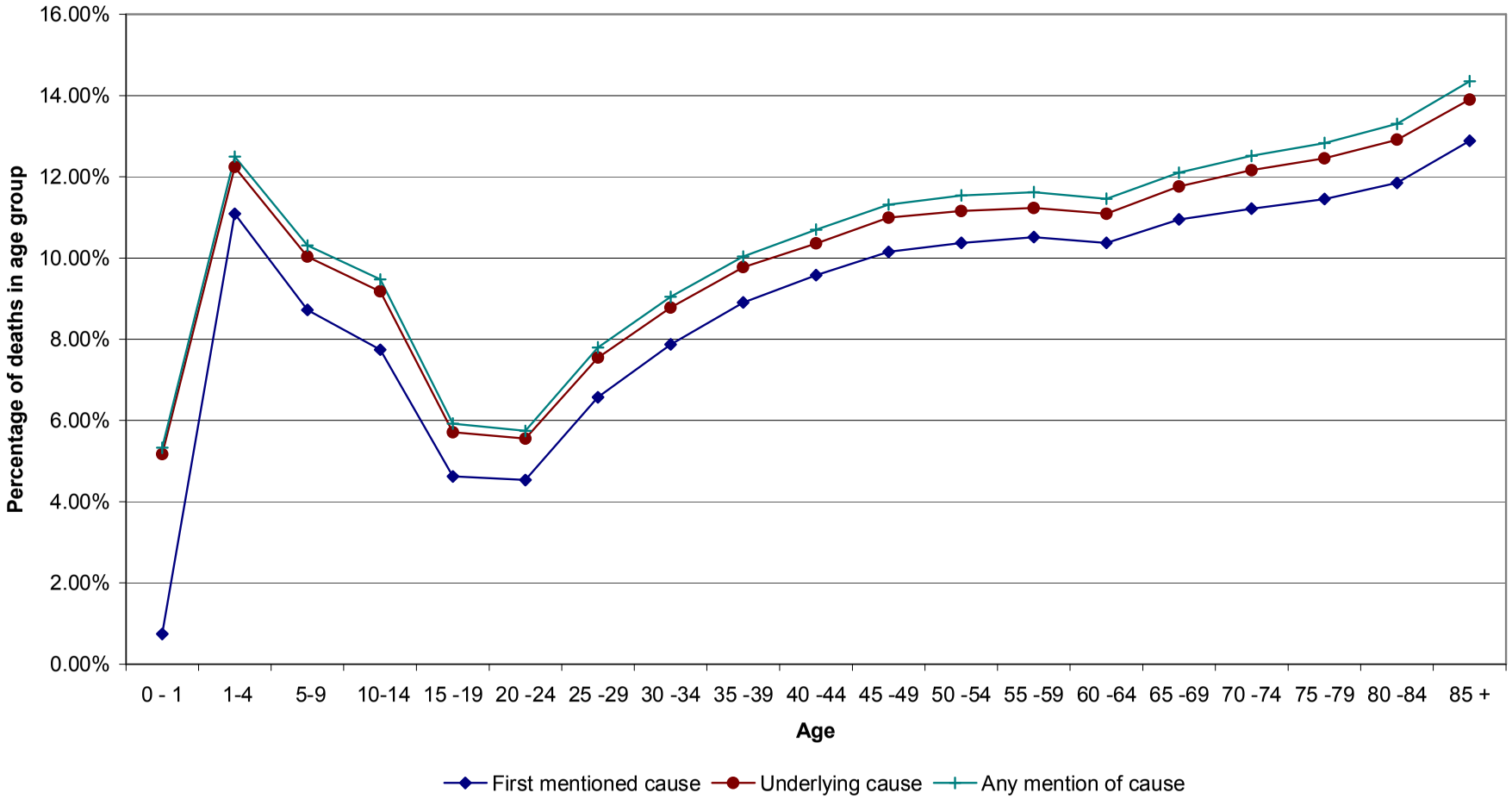

Fig 3b: Ill-defined causes of death first mentioned cause, underlying cause and 'any mention on the record, Females, South Africa, 1997-2001

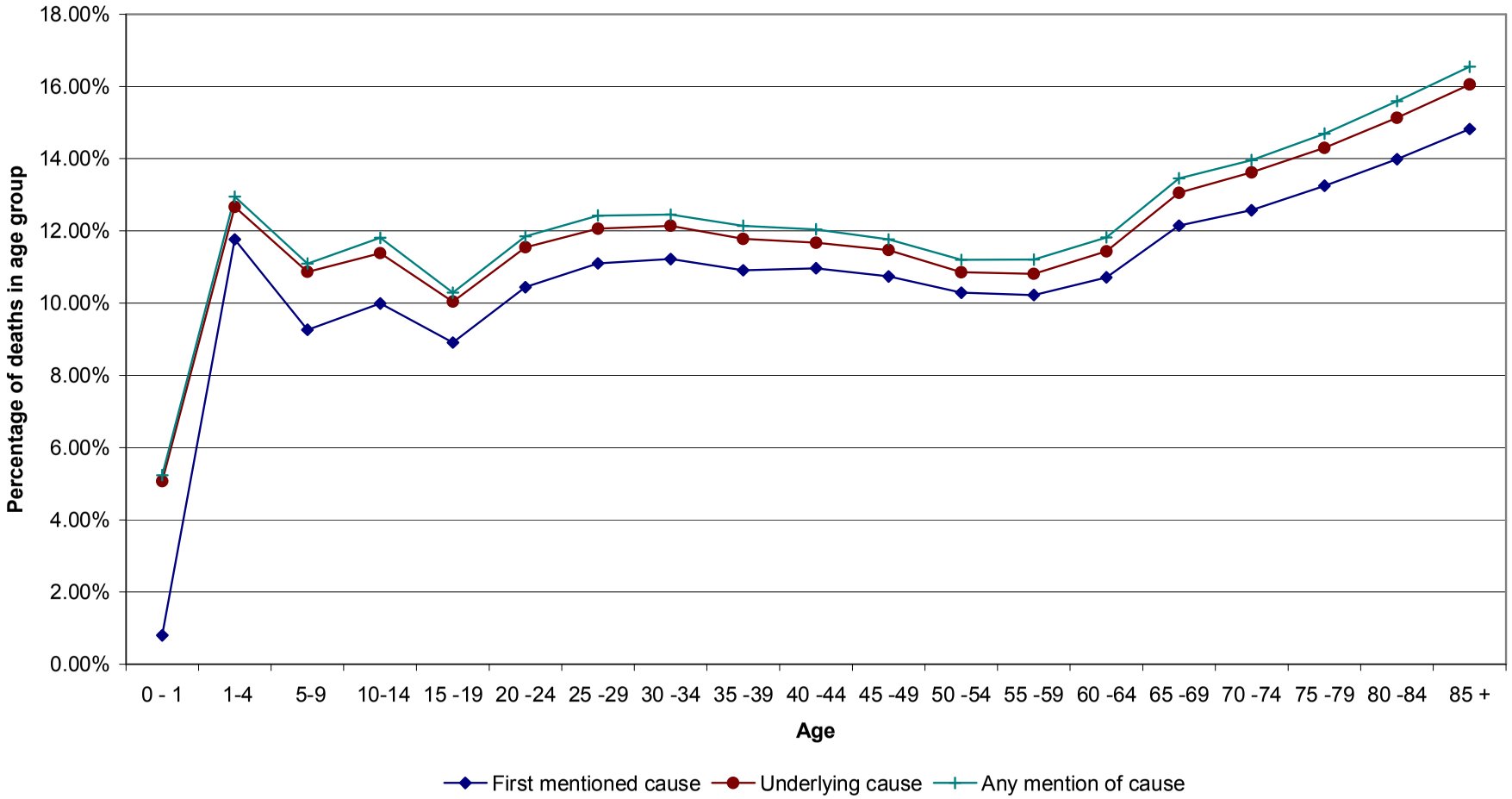

Fig 4a: General Symptoms and signs as first mentioned cause, underlying cause and 'any mention on the record', Females, South Africa, 1997-2001

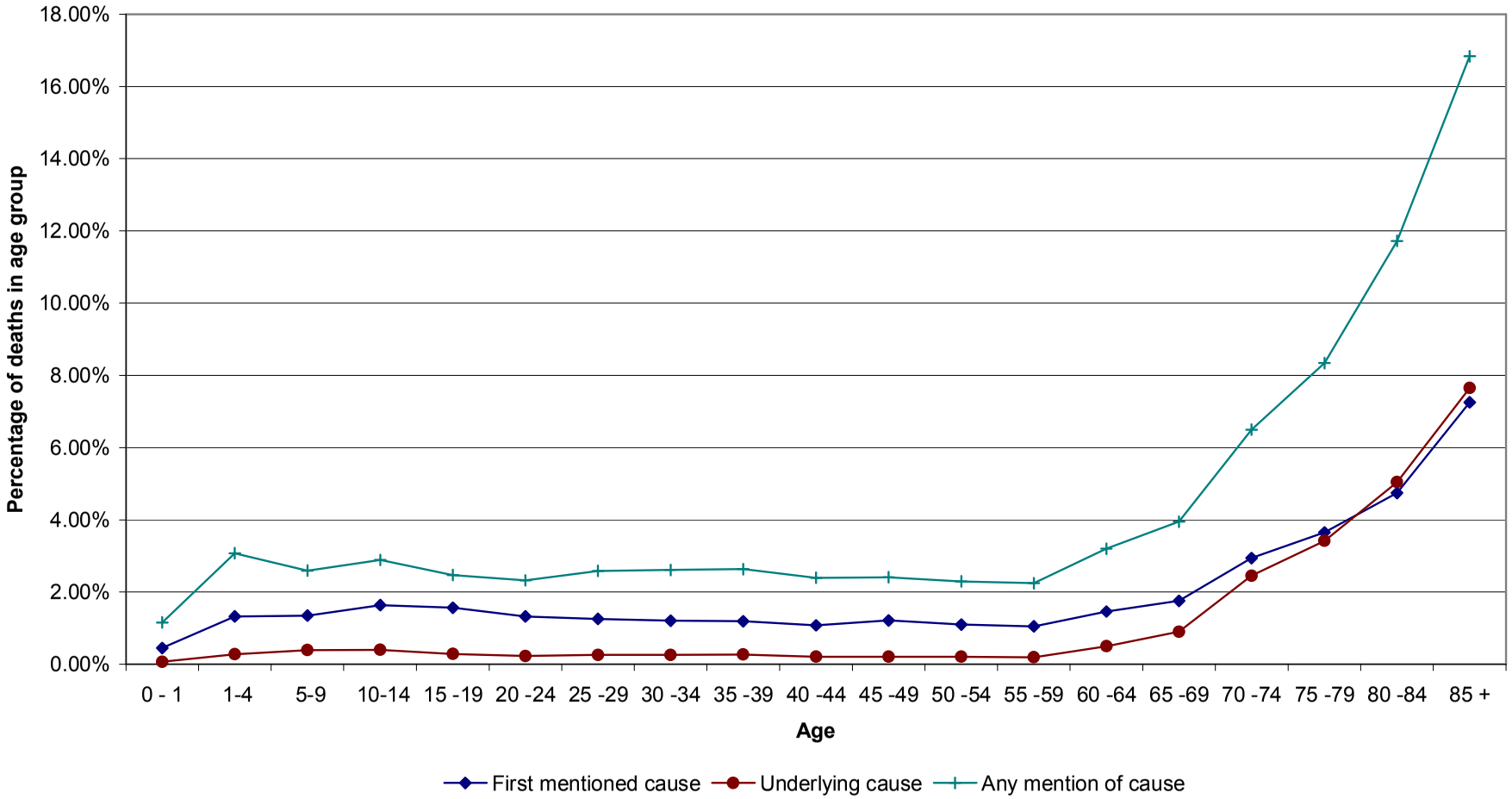

Fig 4b: General symptoms and signs as first mentioned cause, underlying cause and 'any mention on the record', Females, South Africa, 1997-2001

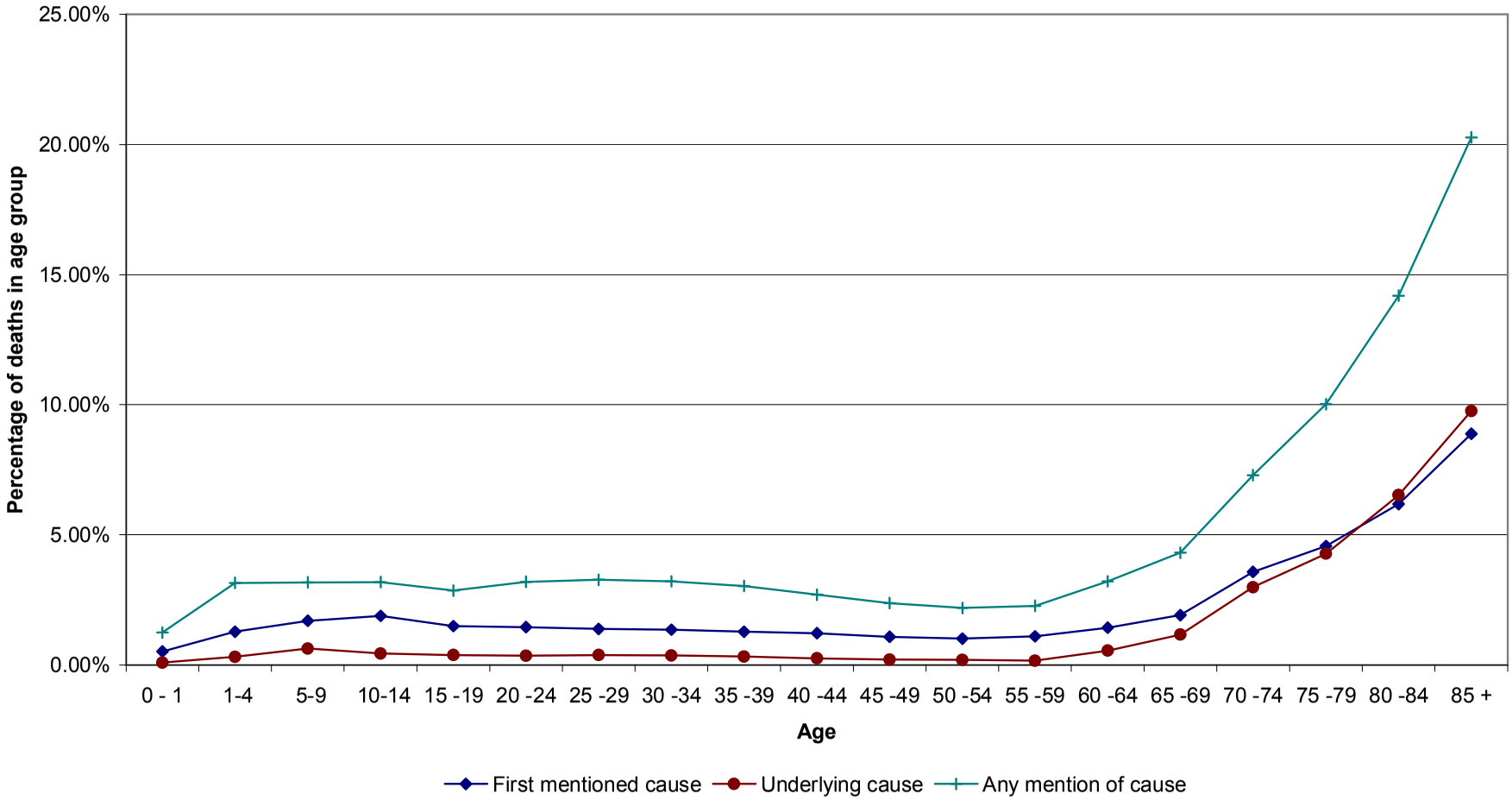

Fig 5a: Failure Pattern 1 (HIV=1, TB=0, Inf and pneu=0, Others=0), Males, South Africa, 1997-2001

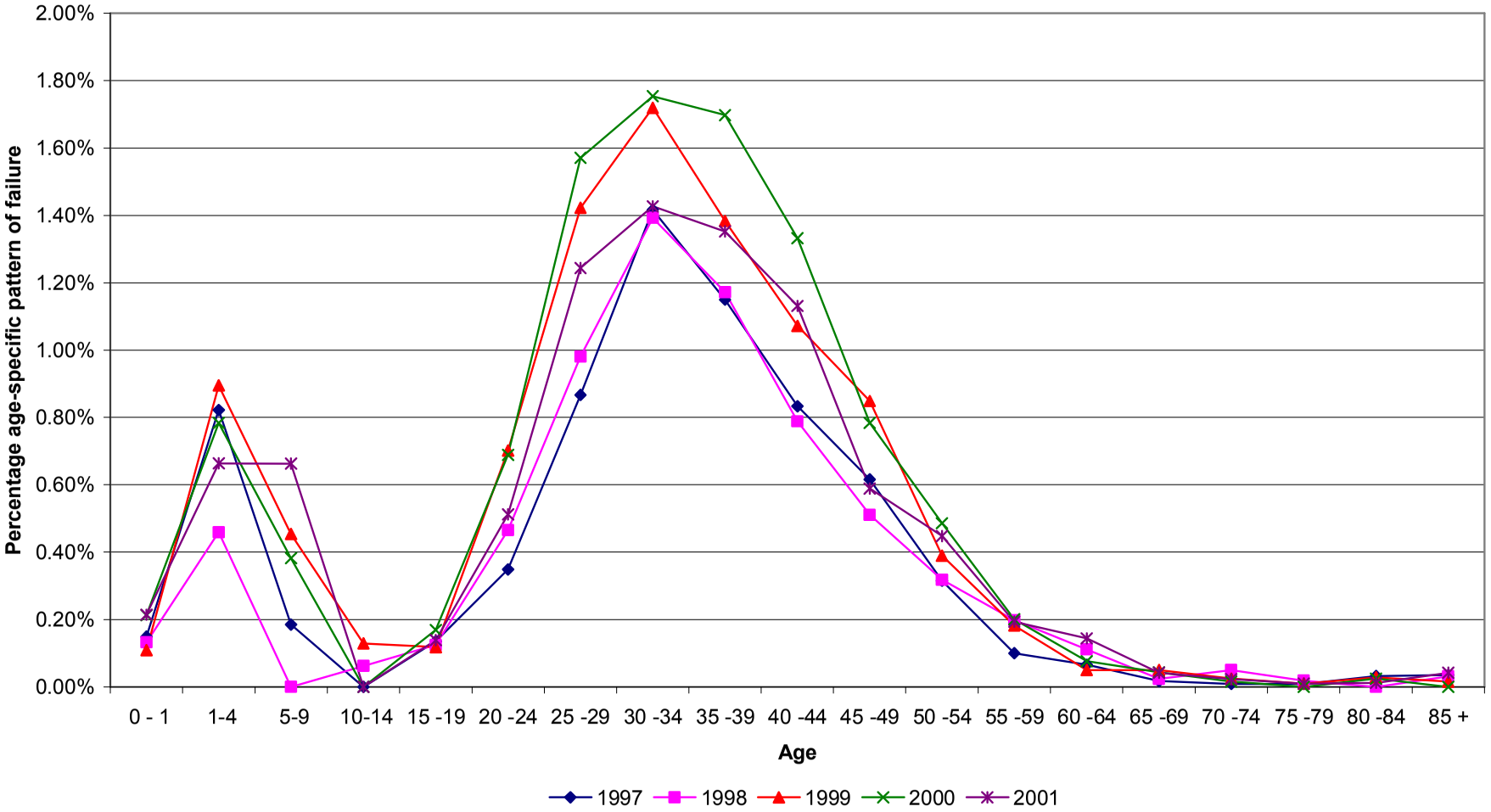

Fig 5b: Failure Pattern 1 (HIV=1, TB=0, Inf and pneu=0, Others=0), Females, South Africa, 1997-2001

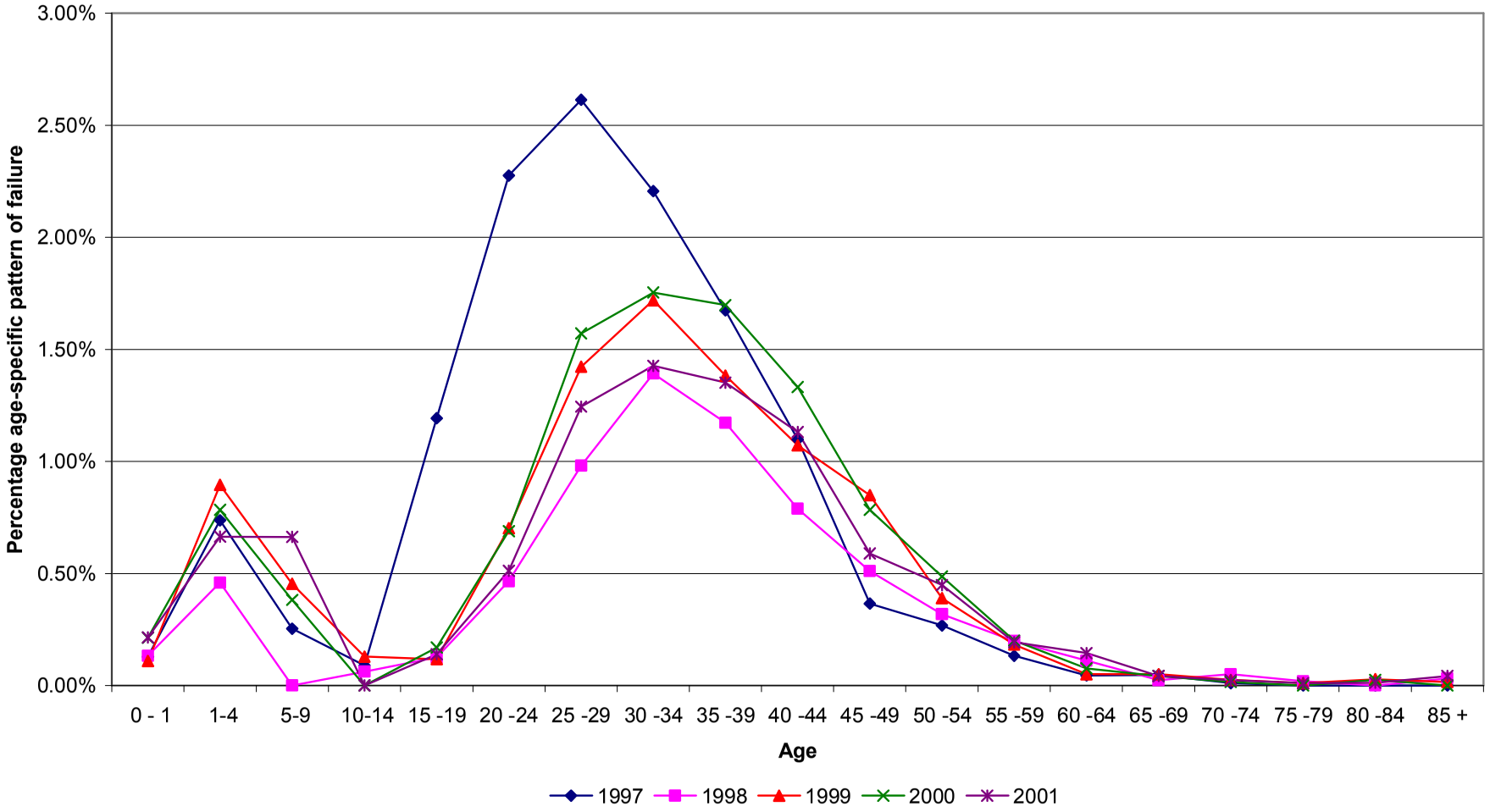

Fig 6a: Failure Pattern 2 (HIV=1, TB=1, Inf and pneu=0, Others=0), Males, South Africa, 1997-2001

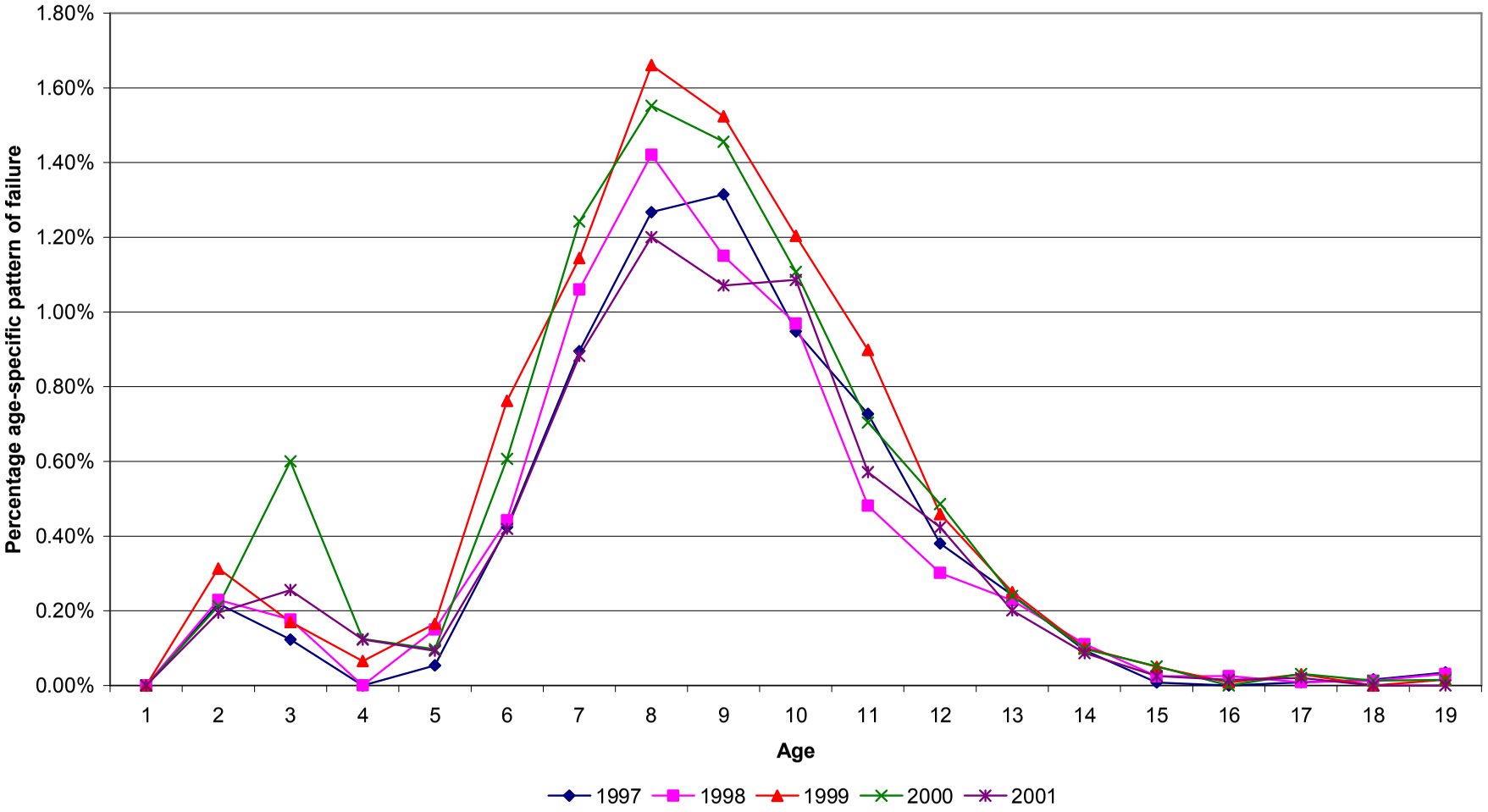

Fig 6b: Failure Pattern 2 (HIV=1, TB=1, Inf and pneu=0, Others=0), Females, South Africa, 1997-2001

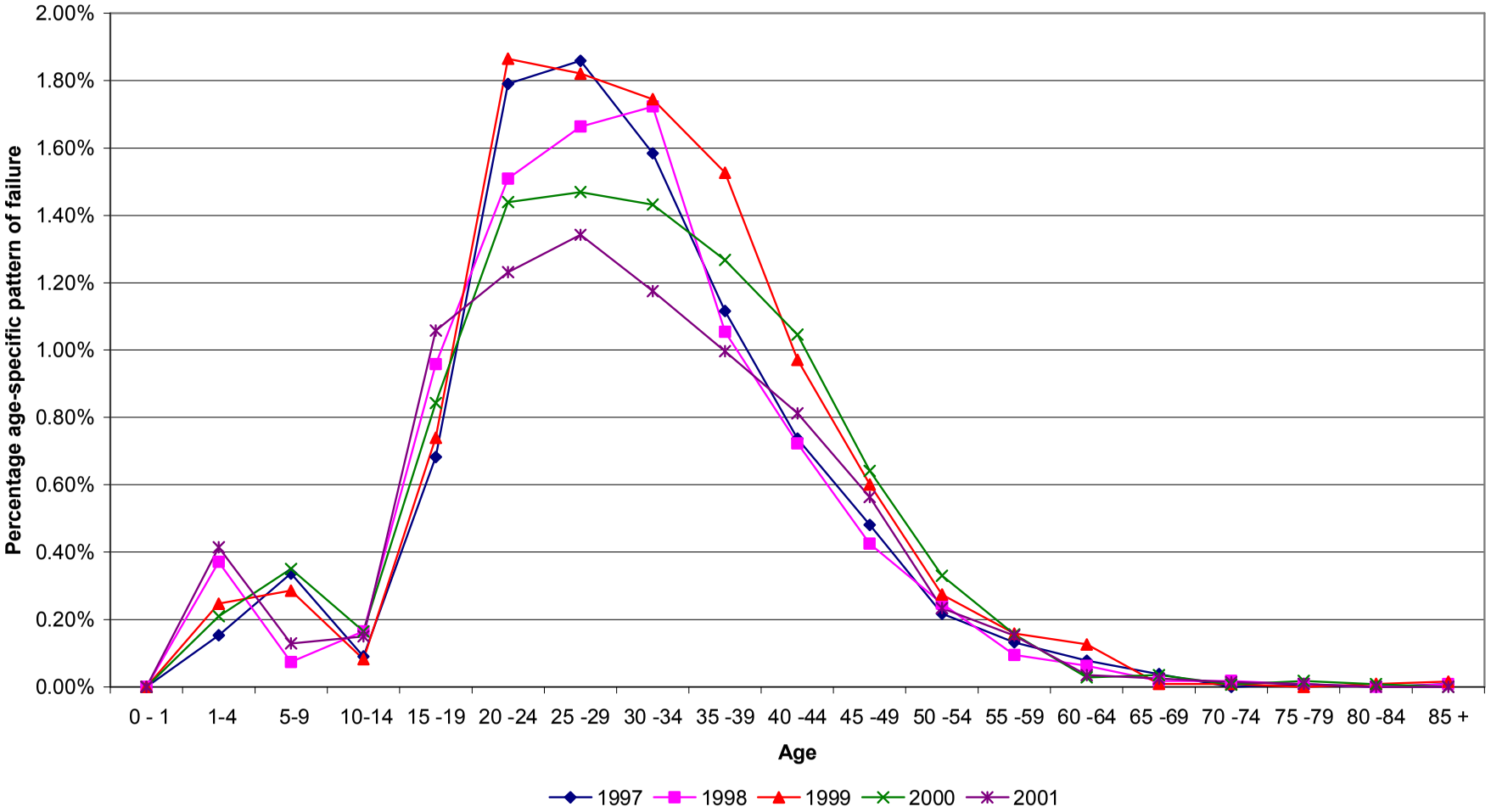

Fig 7a: Failure Pattern 3 (HIV=1, TB=1, Inf and pneu=1, Others=0), Males, South Africa, 1997-2001

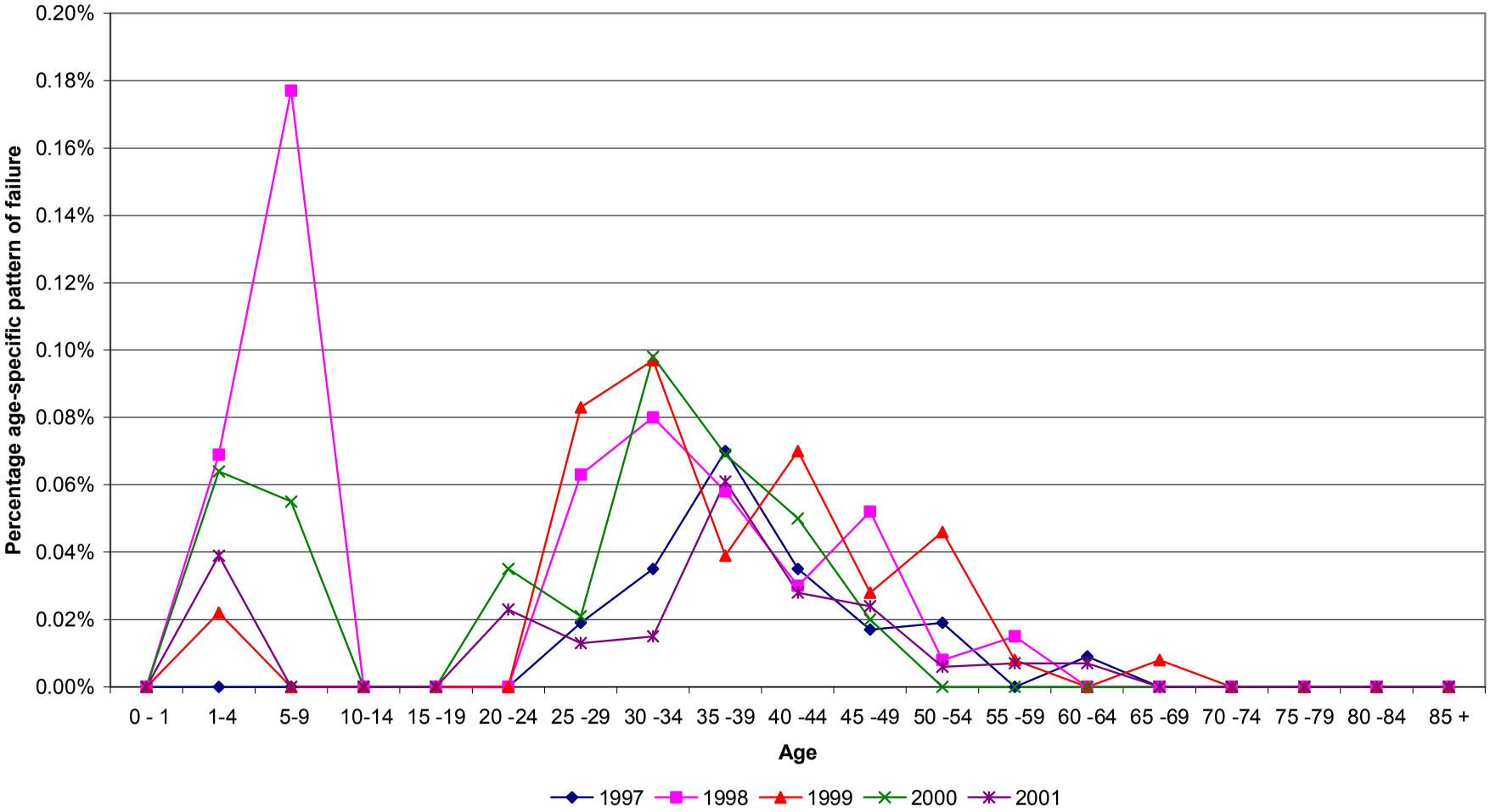

Fig 7b: Failure Pattern 3 (HIV=1, TB=1, Inf and pneu=1, Others=0), Females, South Africa, 1997-2001

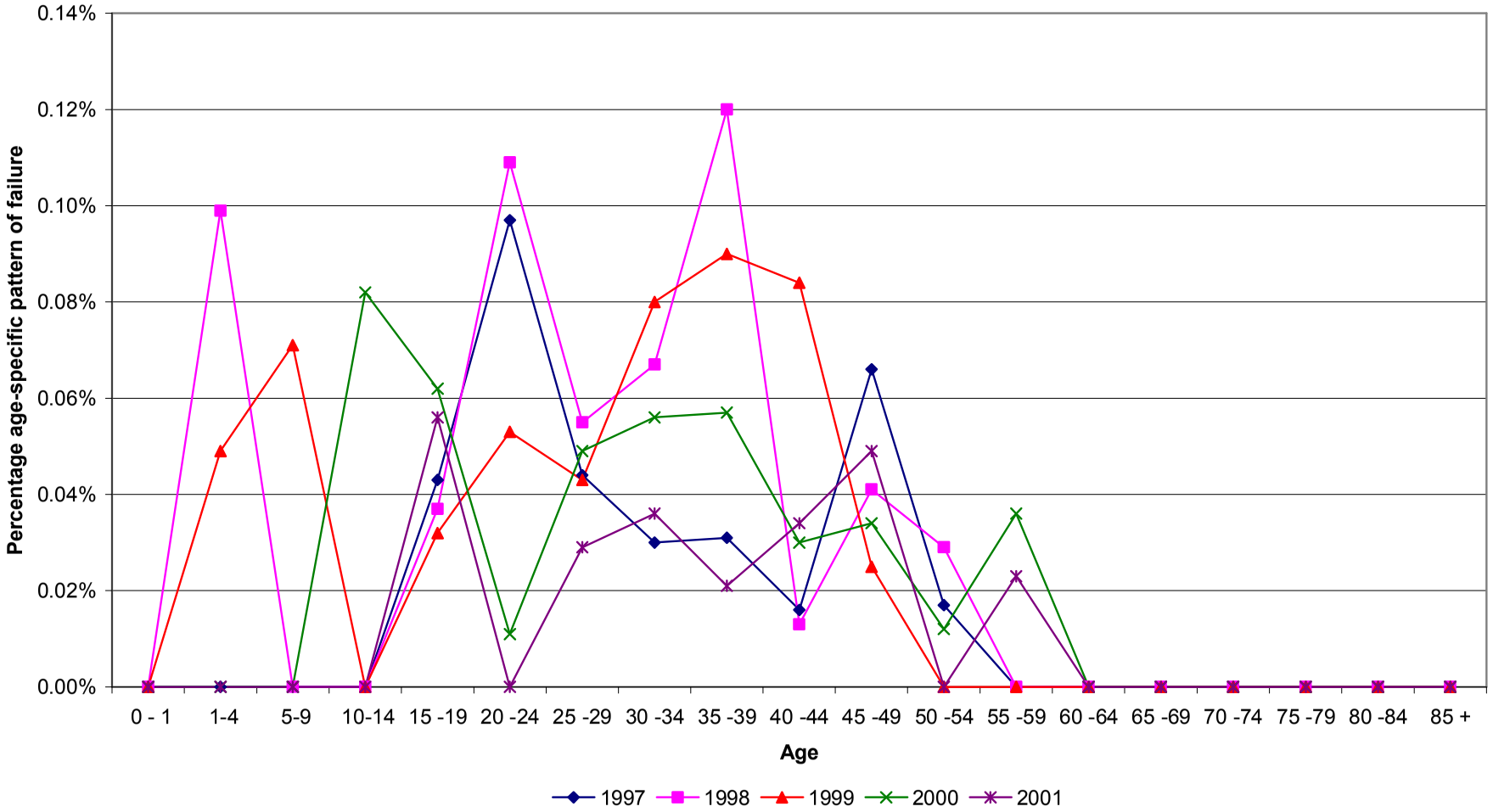

Fig 8a: Failure Pattern 4 (HIV=1, TB=1, Inf and pneu=1, Others=1), Males, South Africa, 1997-2001

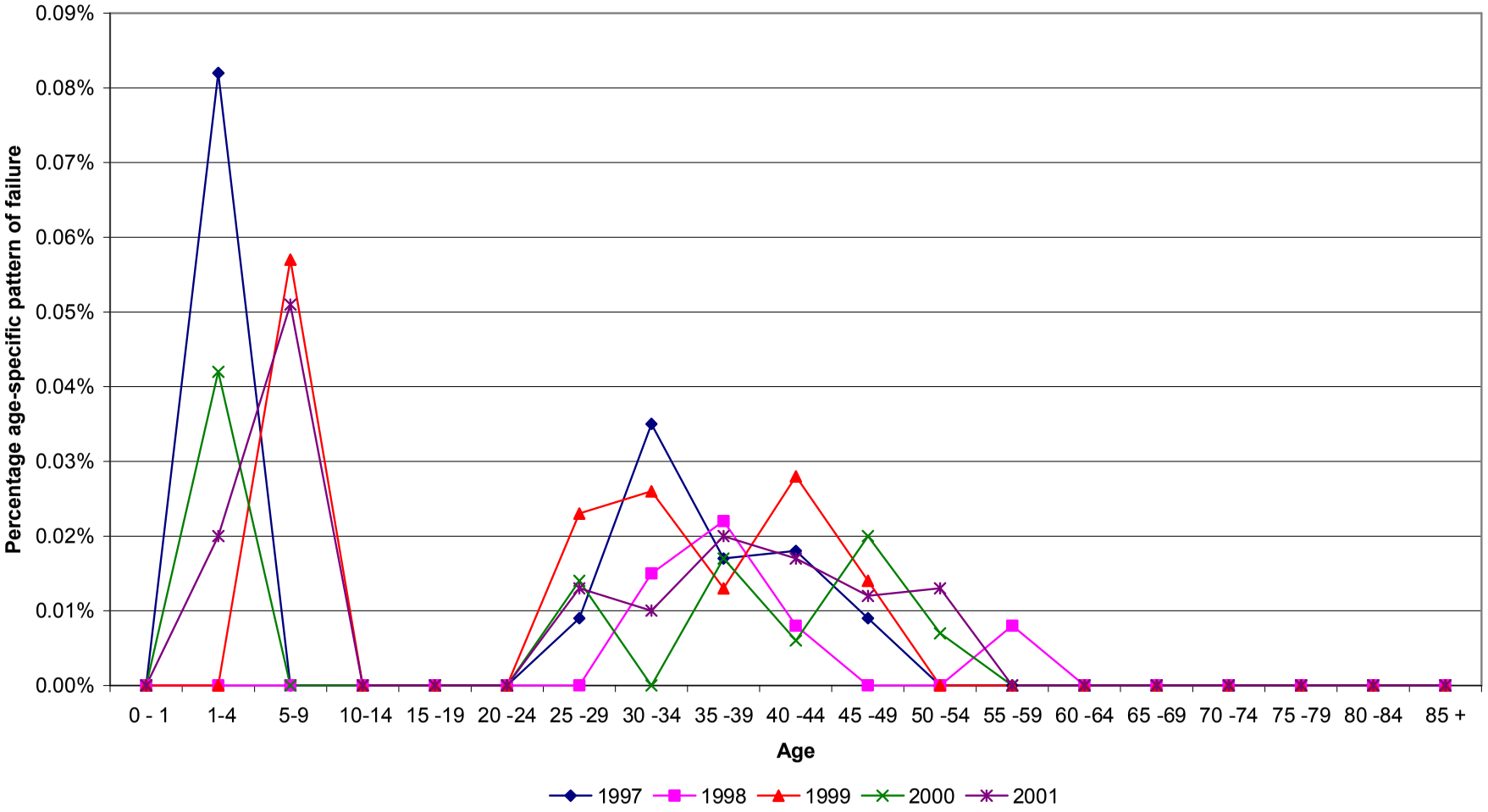

Fig 8b: Failure Pattern 4 (HIV=1, TB=1, Inf and pneu=1, Others=1), Females, South Africa, 1997-2001

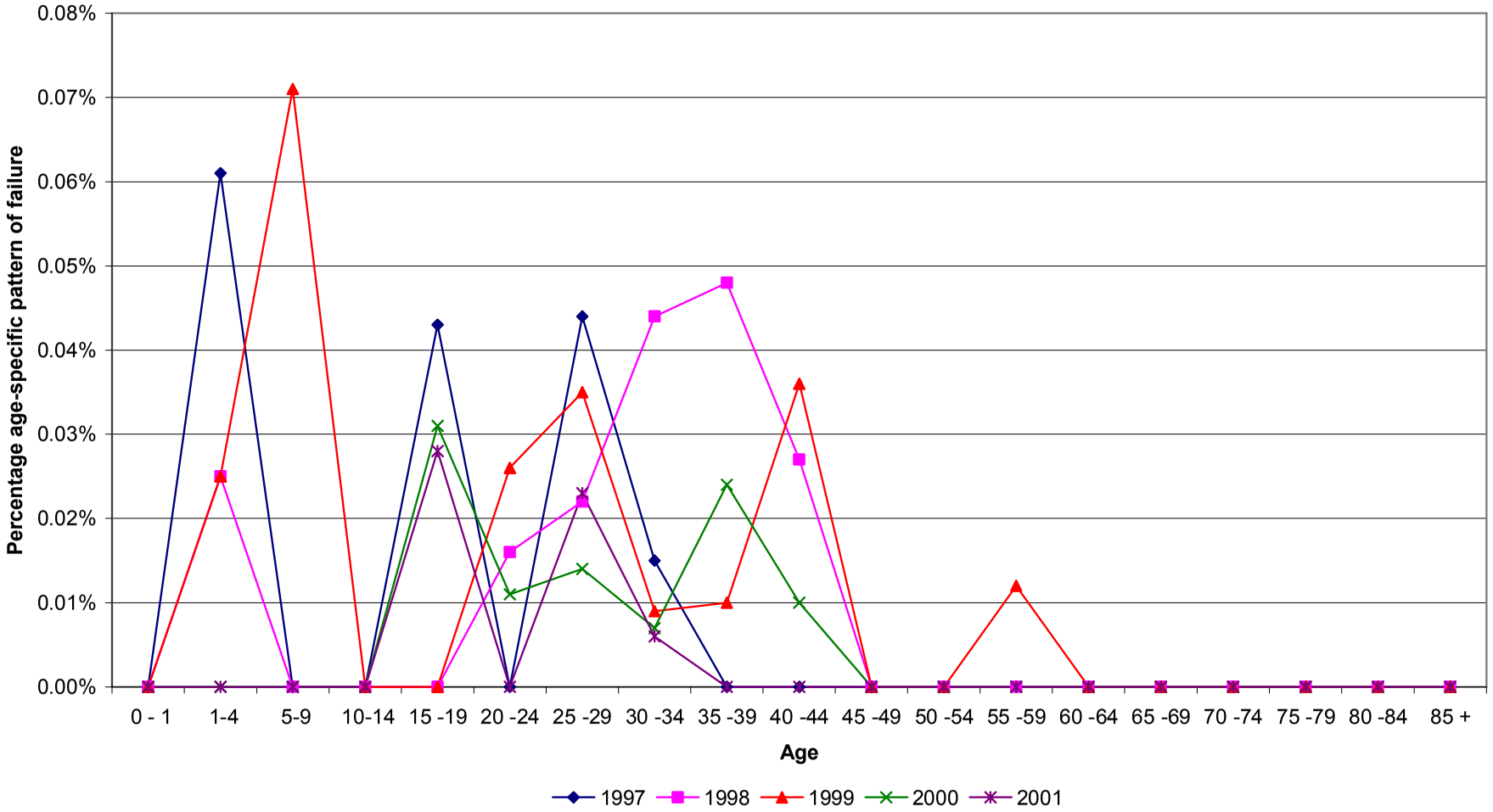

Fig 9a: Failure Pattern 5 (HIV=1, TB=0, Inf and pneu=1, Others=0), Males, South Africa, 1997-2001

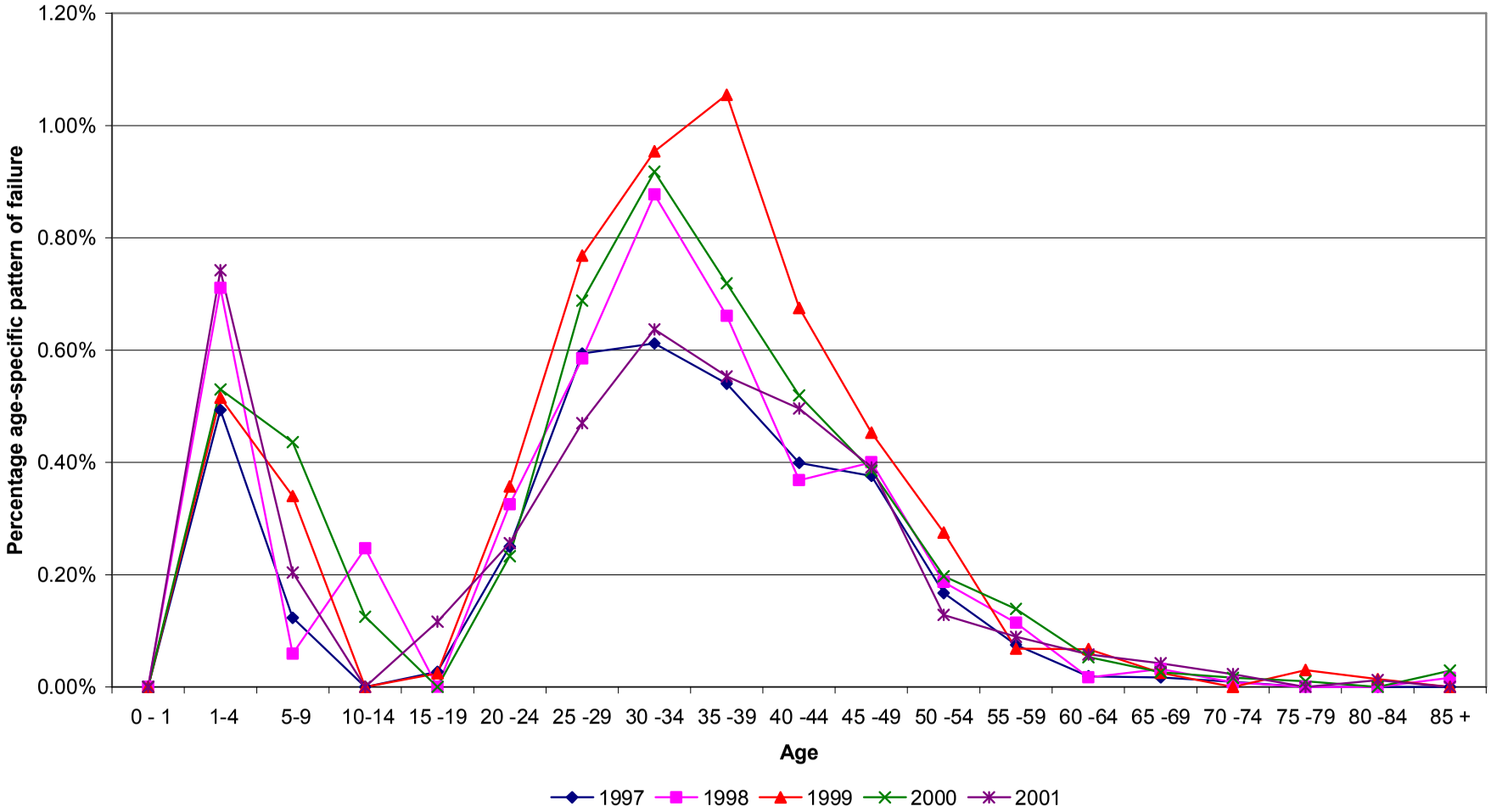

Fig 9b: Failure Pattern 5 (HIV=1, TB=0, Inf and pneu=1, Others=0), Females, South Africa, 1997-2001

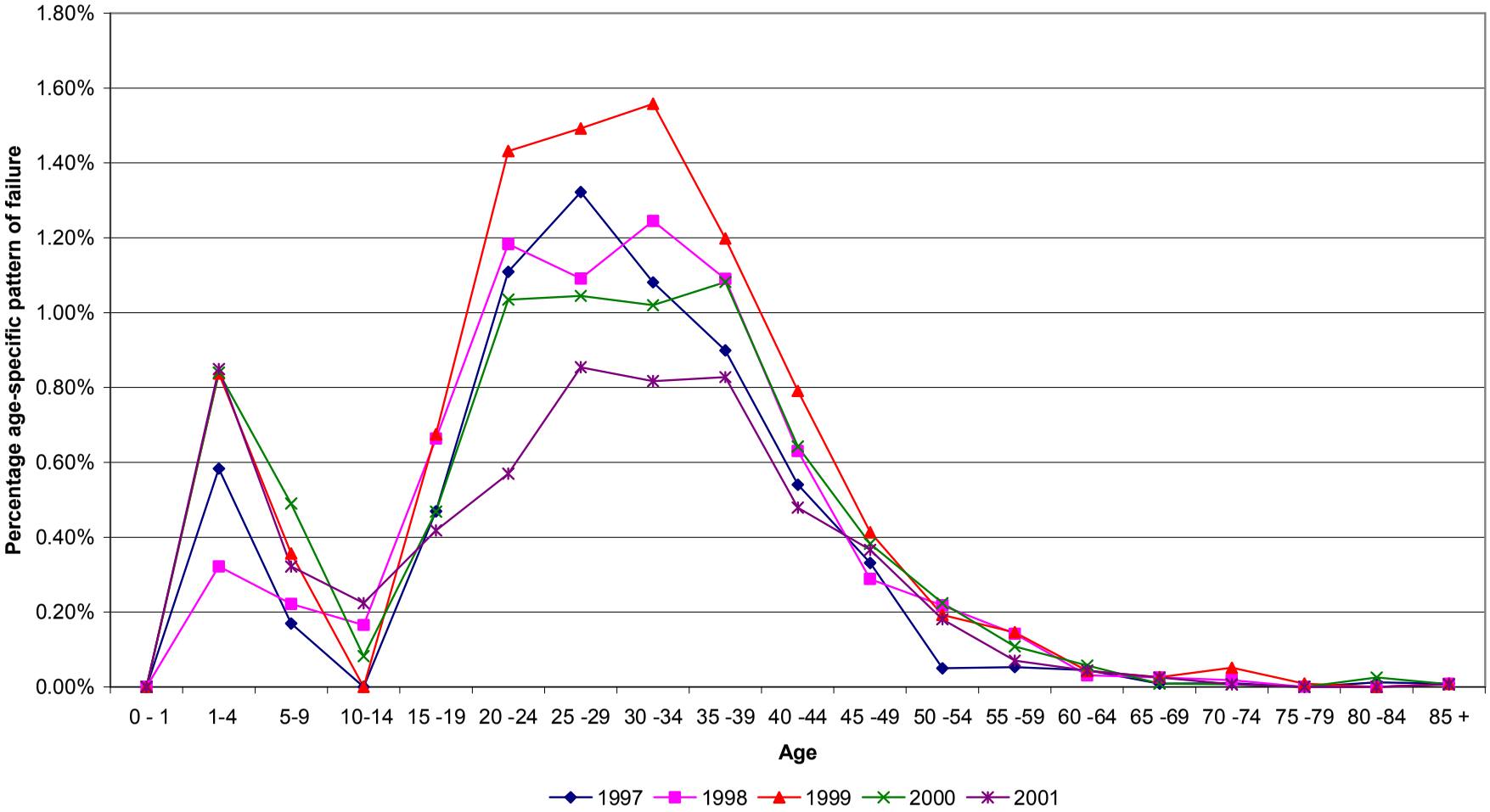

Fig 10a: Failure Pattern 6 (HIV=1, TB=0, Inf and pneu=1, Others=1), Males, South Africa, 1997-2001

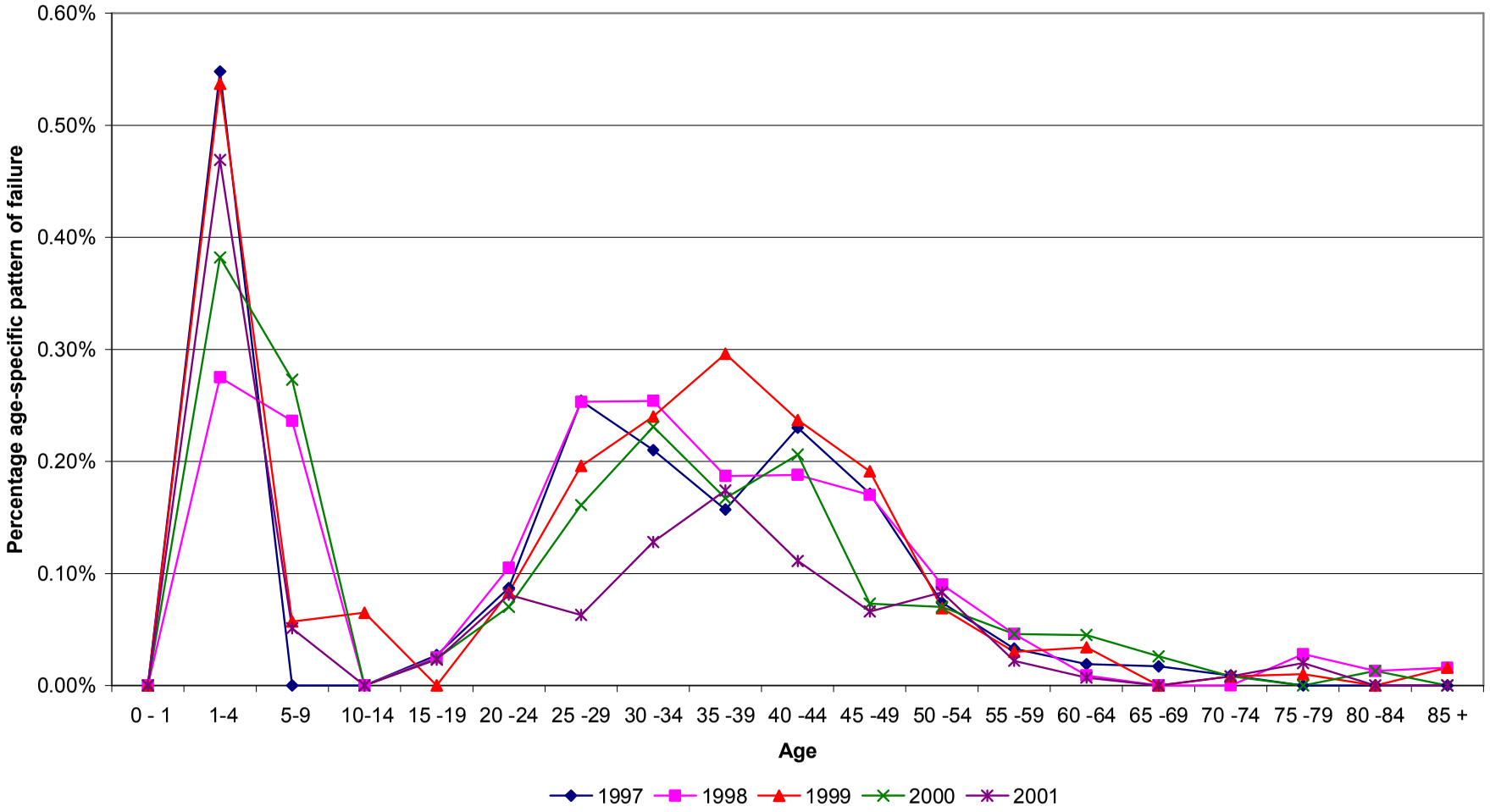

Fig 10b: Failure Pattern 6 (HIV=1, TB=0, Inf and pneu=1, Others=1), Females, South Africa, 1997-2001

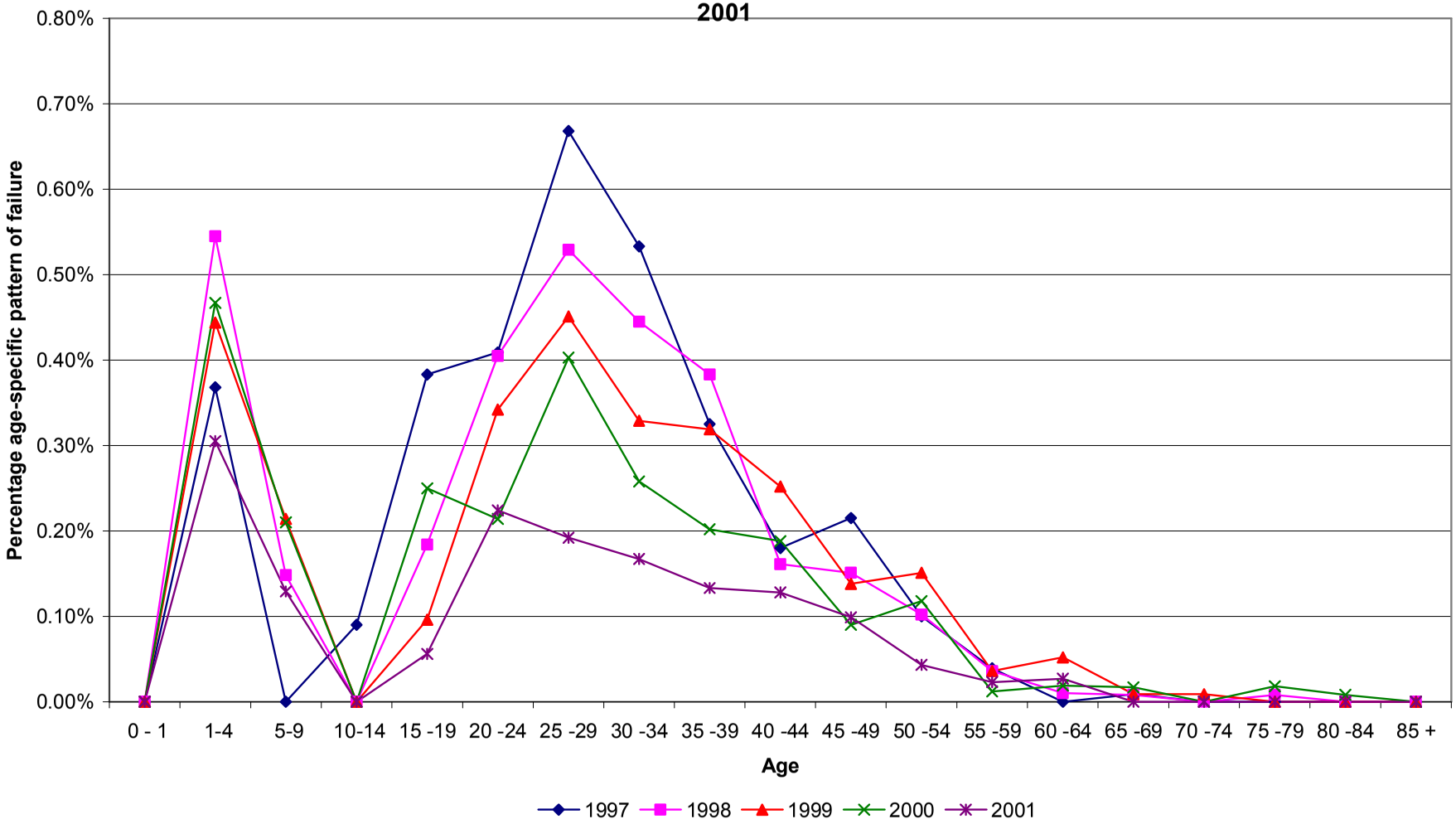

Fig 11a: Failure Pattern 7 (HIV=1, TB=0, Inf and pneu=0, Others=1), Males, South Africa, 1997-2001

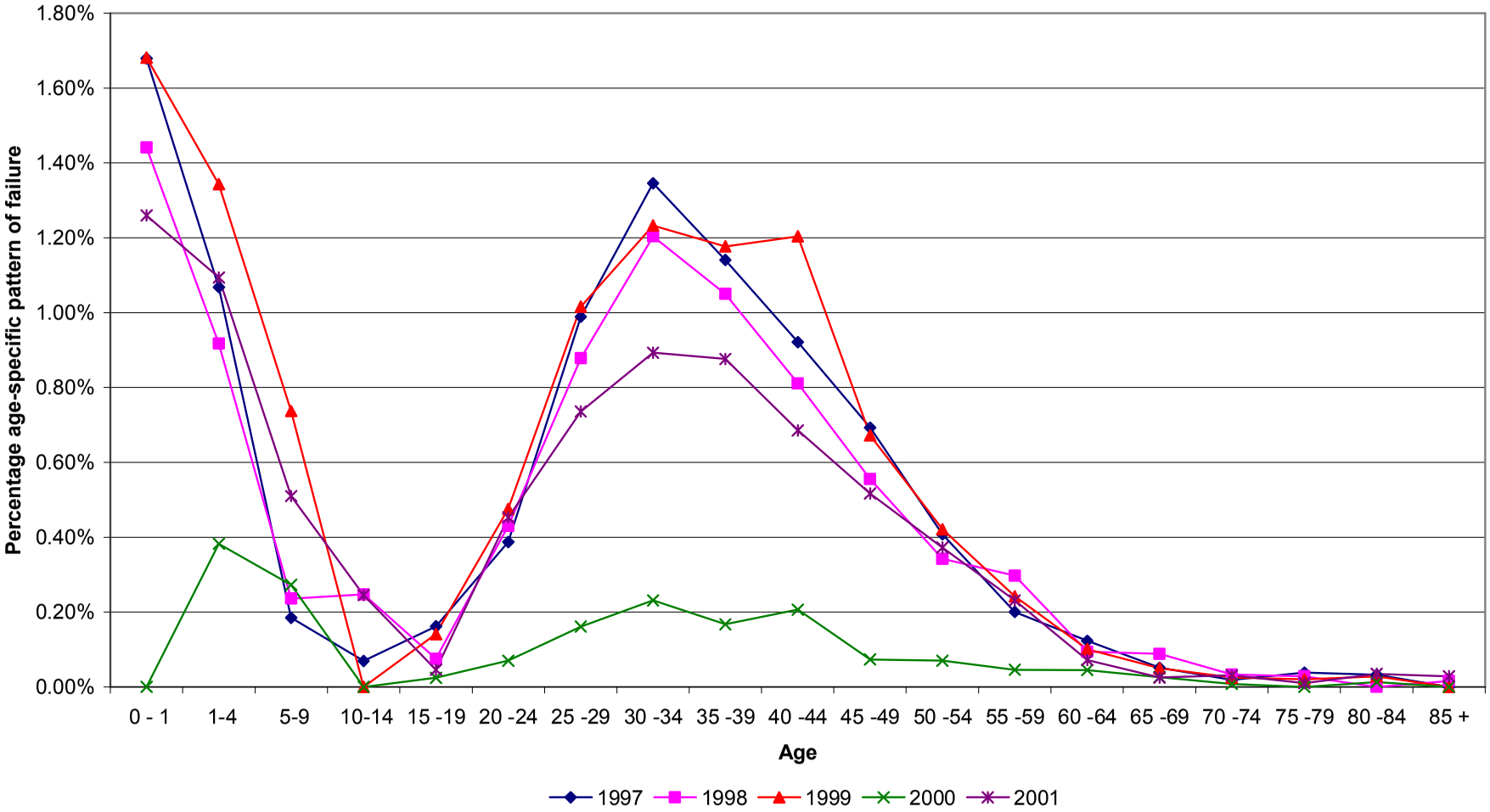

Fig 11b: Failure Pattern 7 (HIV=1, TB=0, Inf and pneu=0, Others=1), Females, South Africa, 1997-2001

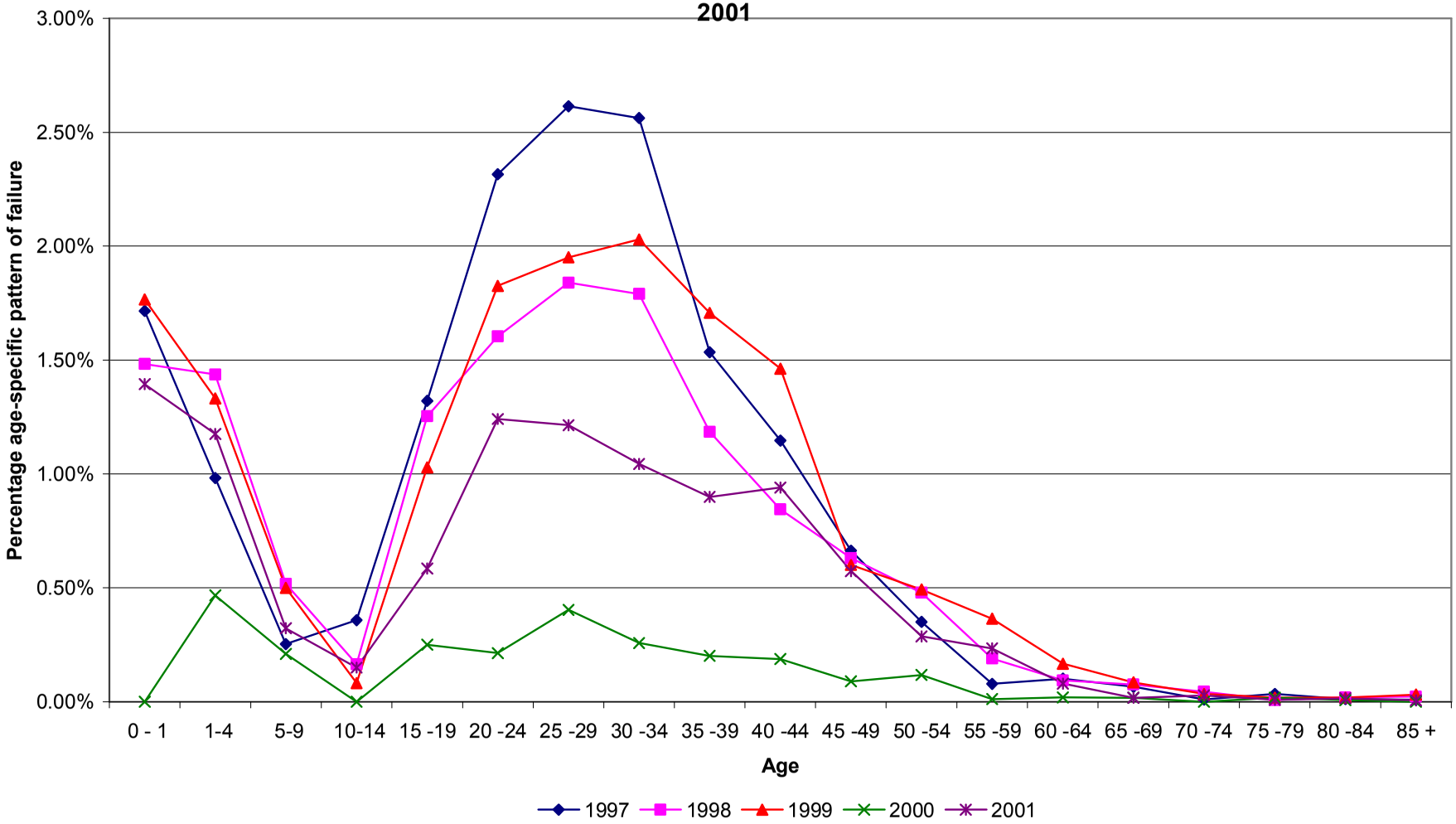

Fig 12a: Failure Pattern 8 (HIV=0, TB=1, Inf and pneu=0, Others=0), Males, South Africa, 1997-2001

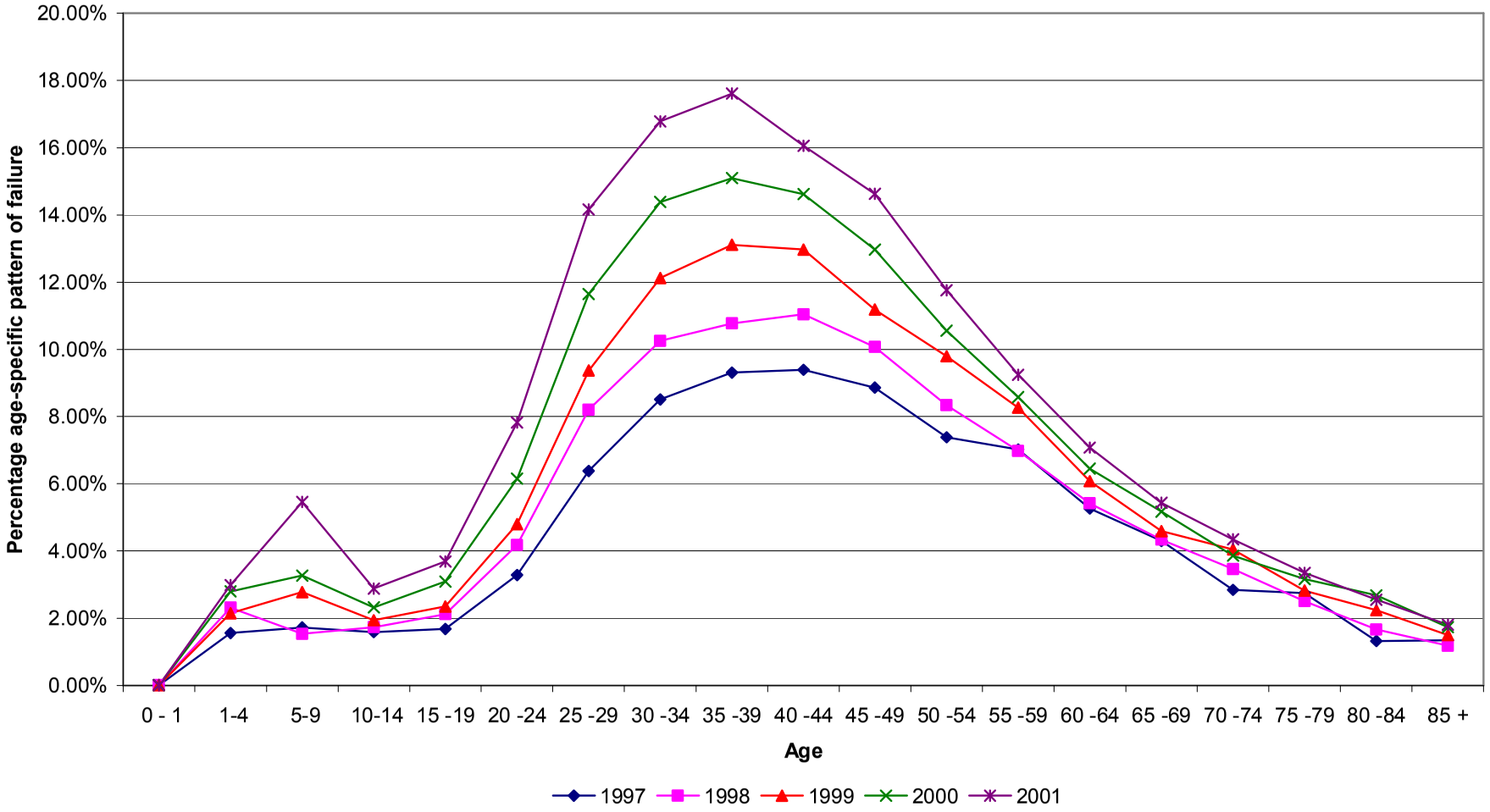

Fig 12b: Failure Pattern 8 (HIV=0, TB=1, Inf and pneu=0, Others=0), Females, South Africa, 1997-2001

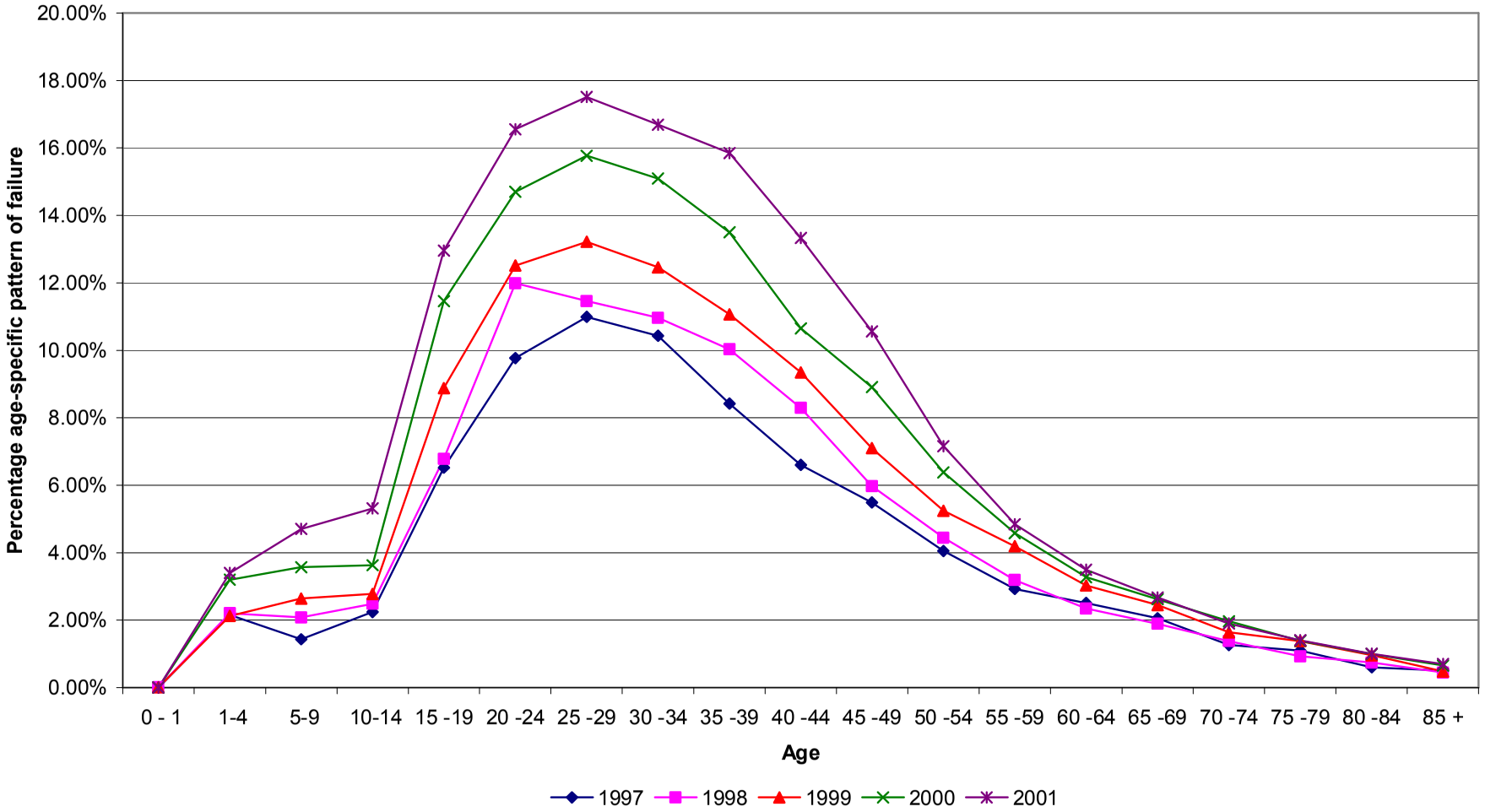

Fig 13a: Failure Pattern 9 (HIV=0, TB=1, Inf and pneu=1, Others=0), Males, South Africa, 1997-2001

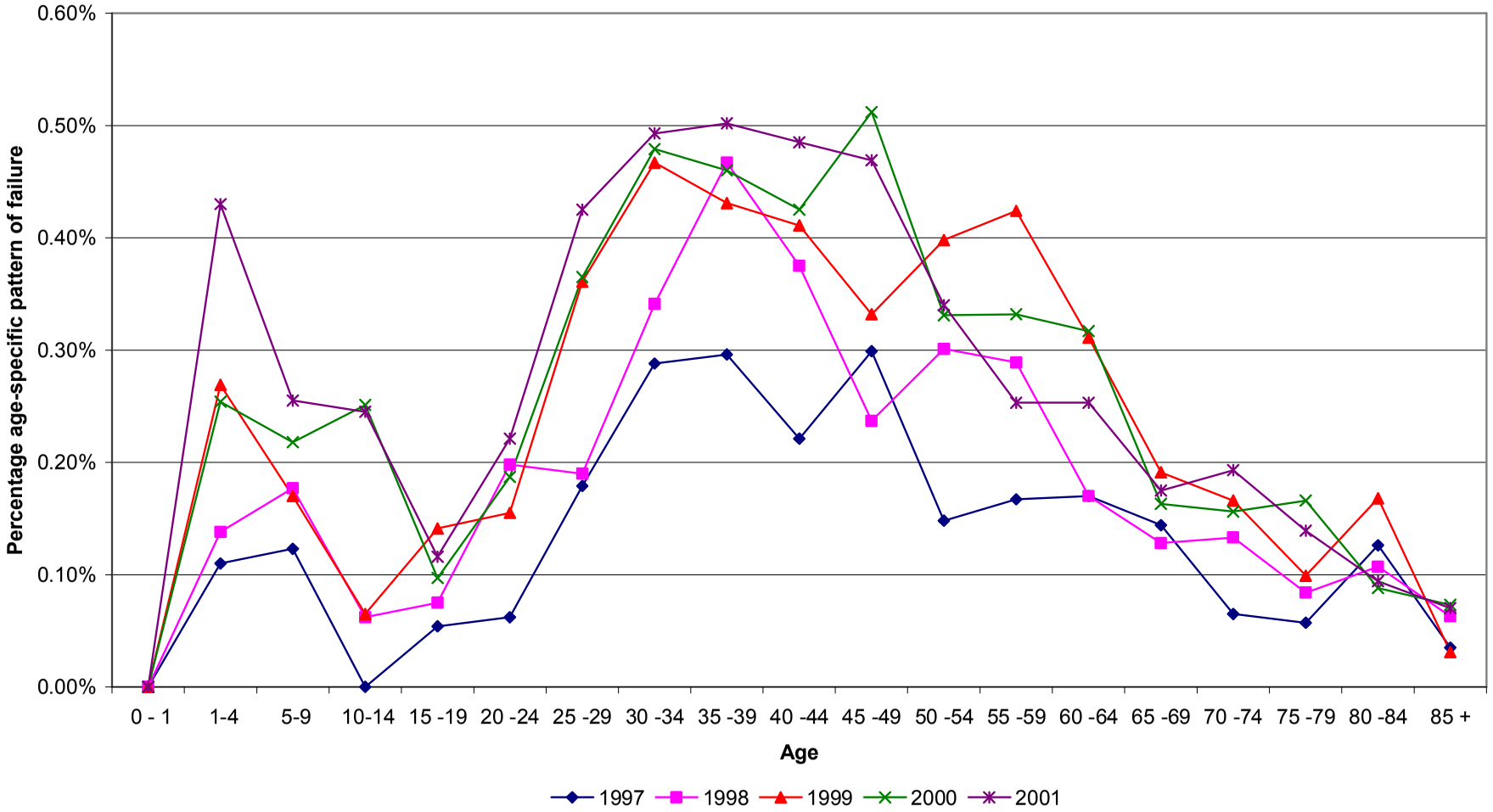

Fig 13b: Failure Pattern 9 (HIV=0, TB=1, Inf and pneu=1, Others=0), Females, South Africa, 1997-2001

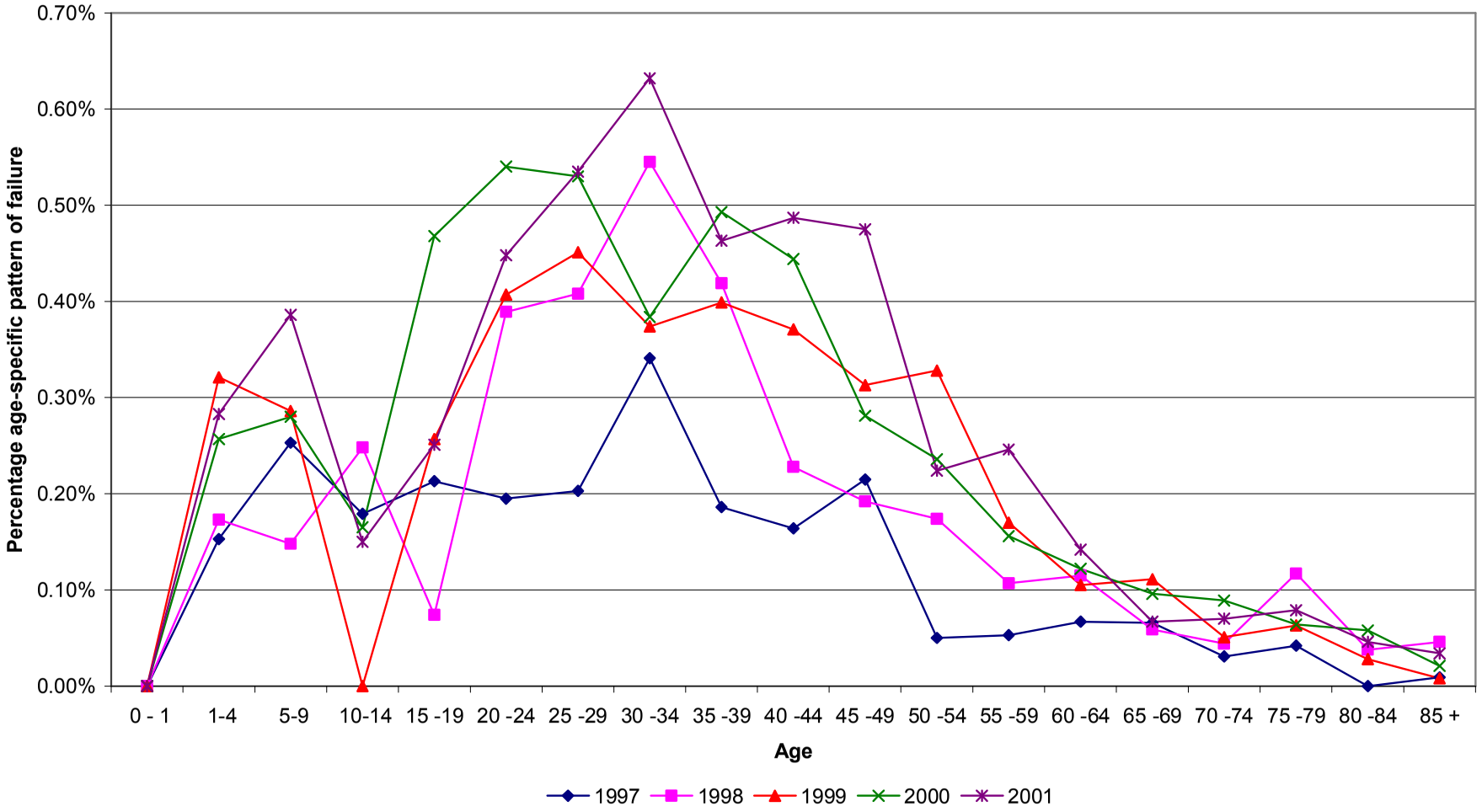

Fig 14a: Failure Pattern 10 (HIV=0, TB=1, Inf and pneu=1, Others=1), Males, South Africa, 1997-2001

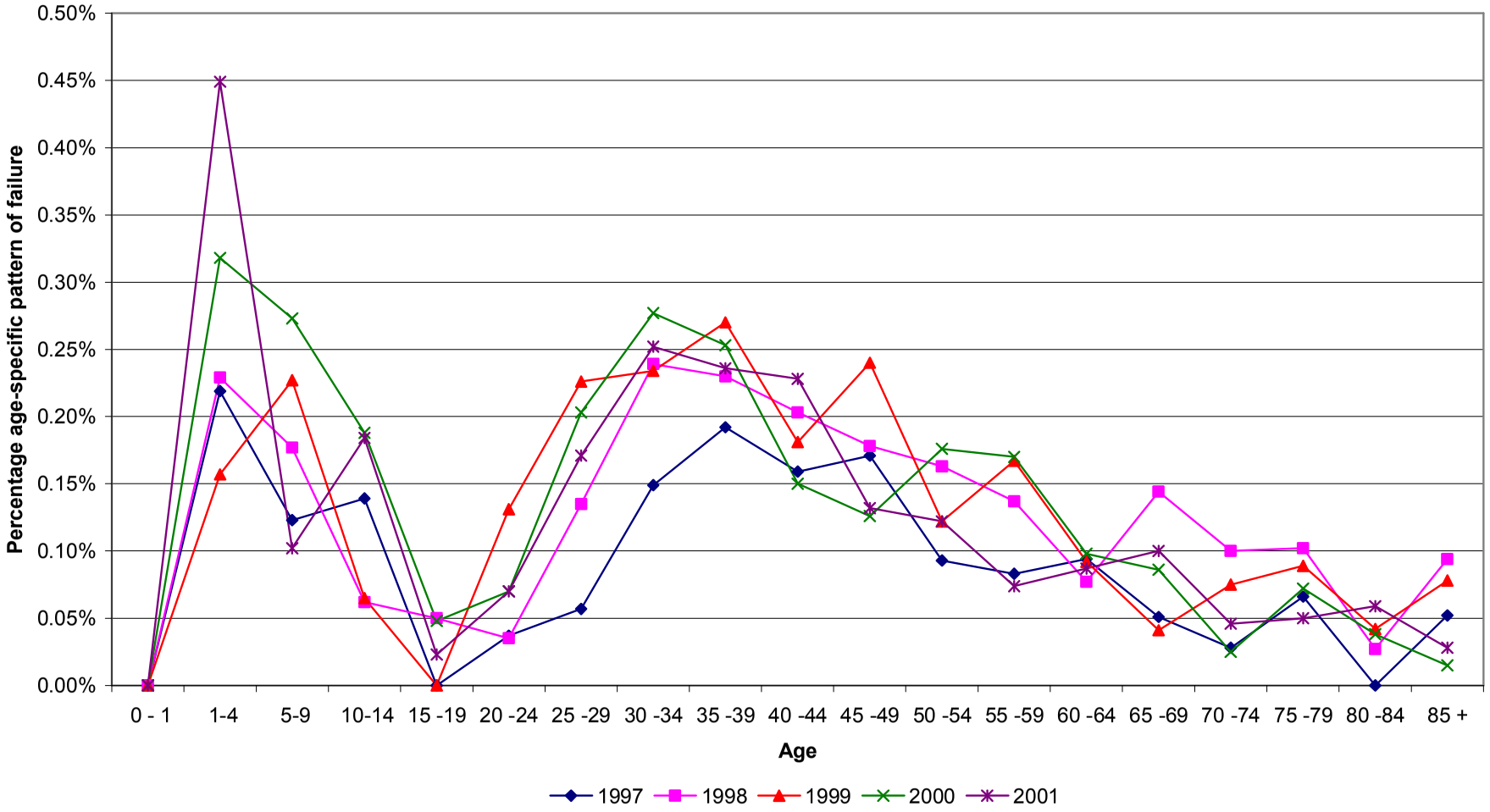

Fig 14b: Failure Pattern 10 (HIV=0, TB=1, Inf and pneu=1, Others=1), Females, South Africa, 1997-2001

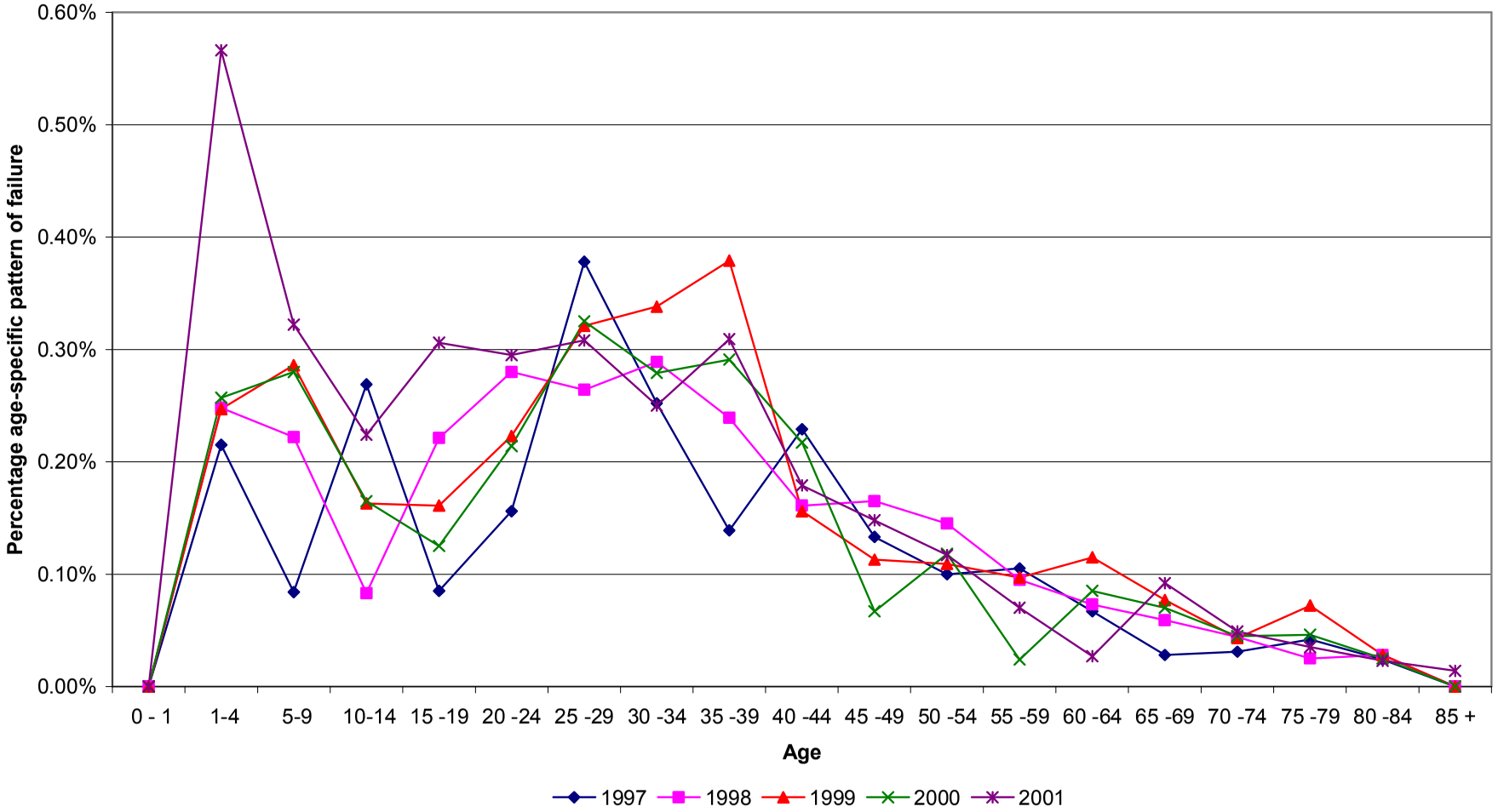

Fig 15a: Failure Pattern 11 (HIV=0, TB=0, Inf and pneu=1, Others=0), Males, South Africa, 1997-2001

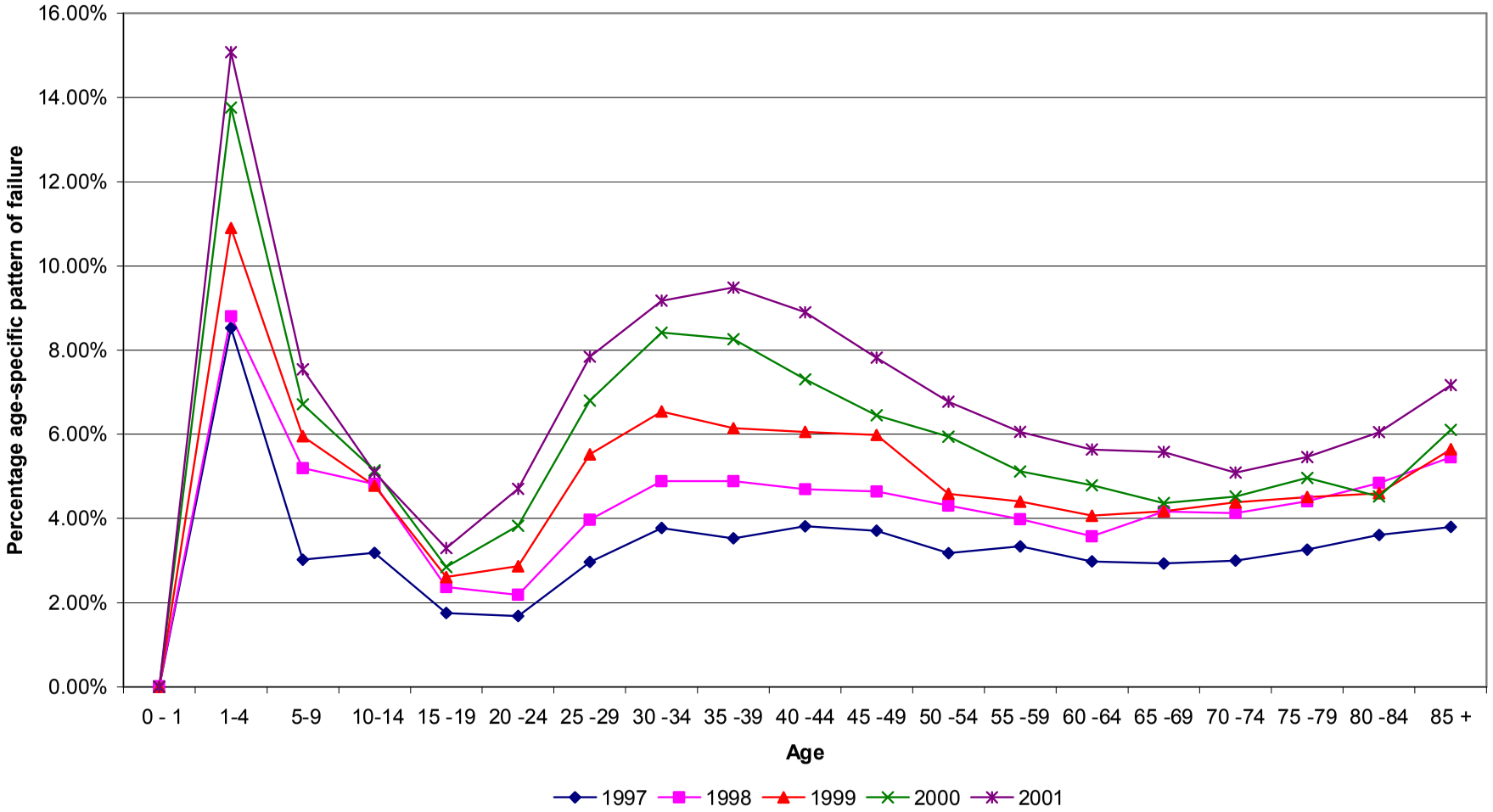

Fig 15b: Failure Pattern 11 (HIV=0, TB=0, Inf and pneu=1, Others=0), Females, South Africa, 1997-2001

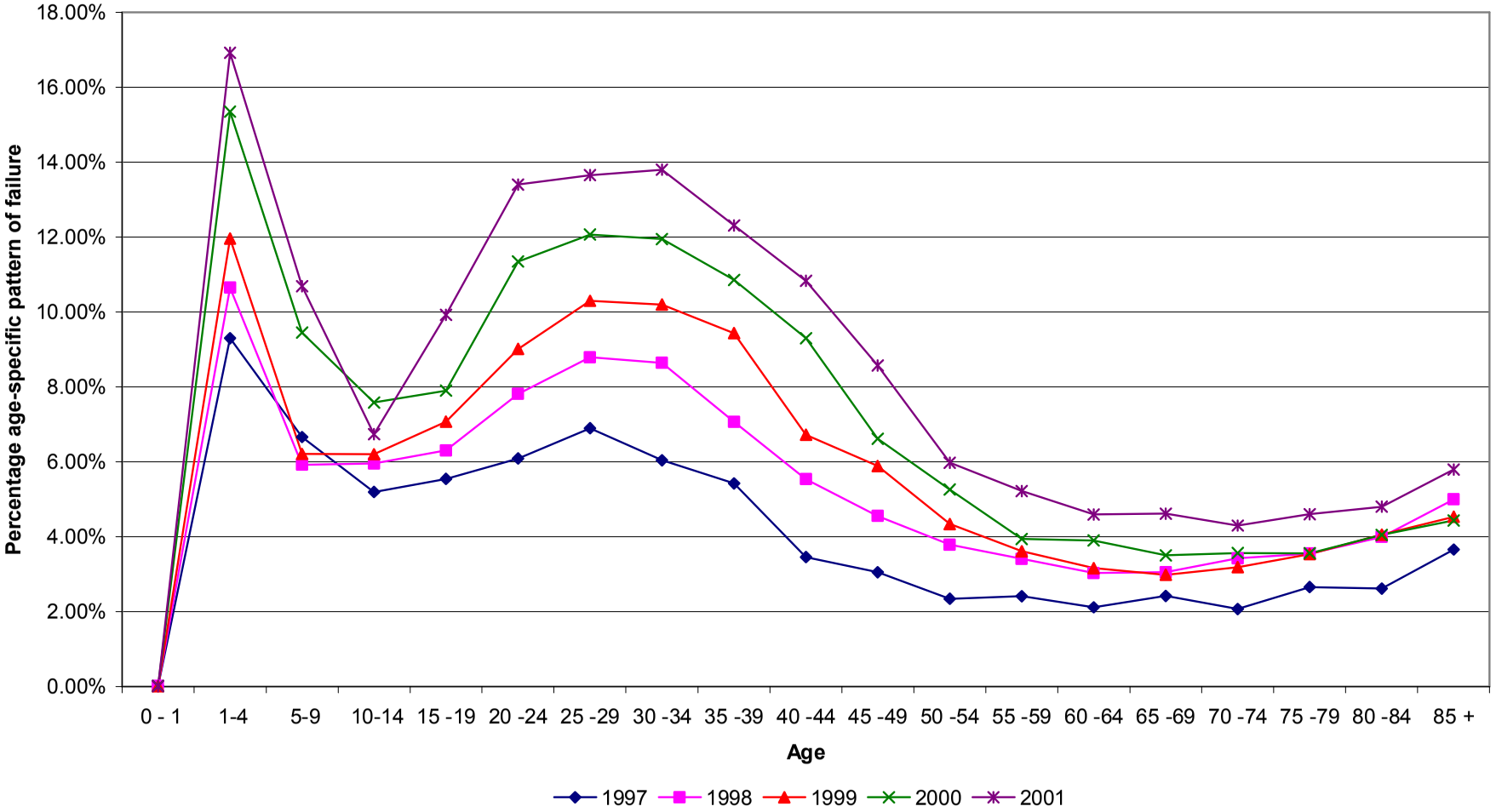

Fig 16a: Failure Pattern 12 (HIV=0, TB=0, Inf and pneu=1, Others=1), Males, South Africa, 1997-2001

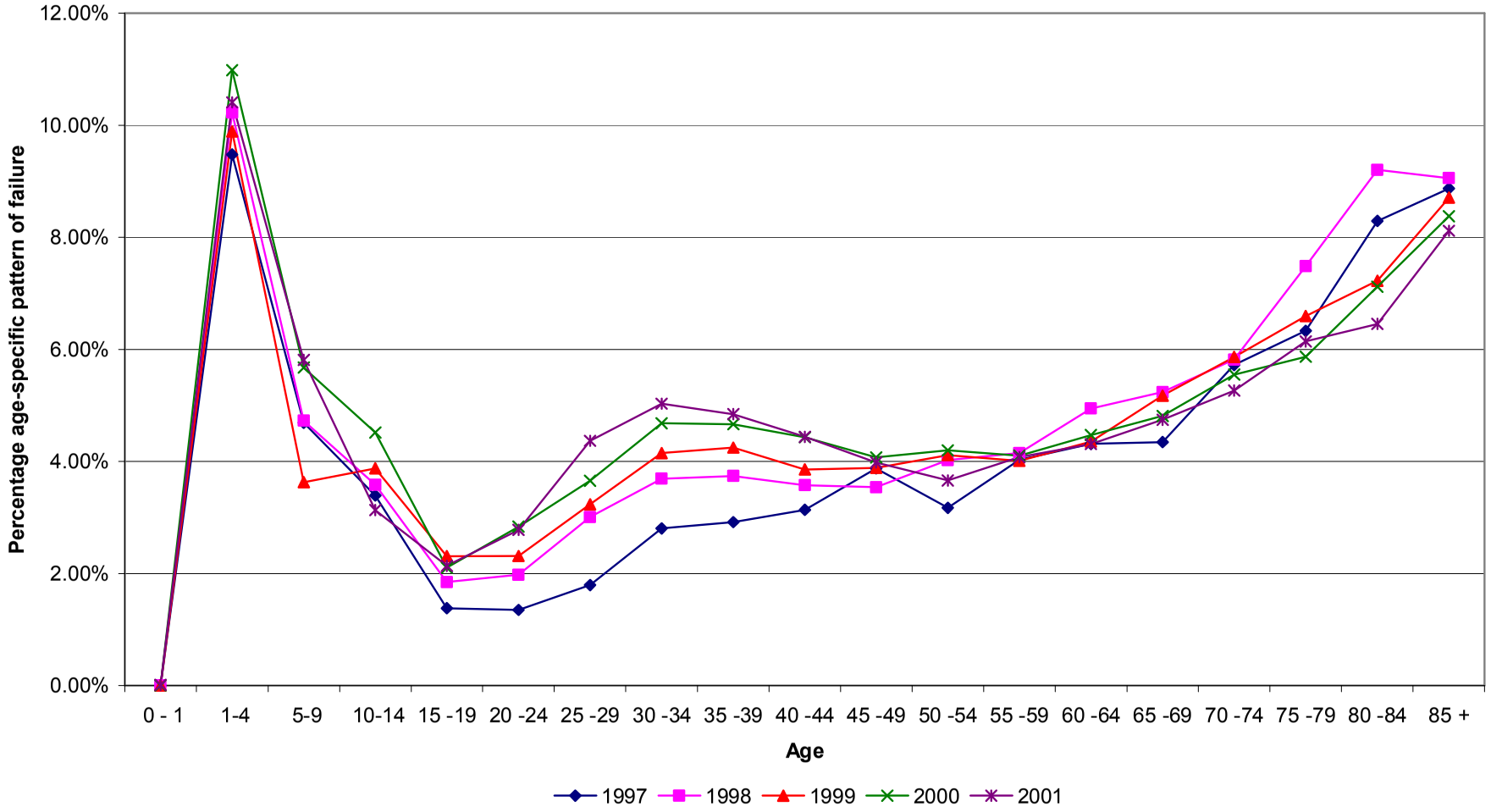

Fig 16b: Failure Pattern 12 (HIV=0, TB=0, Inf and pneu=1, Others=1), Females, South Africa, 1997-2001

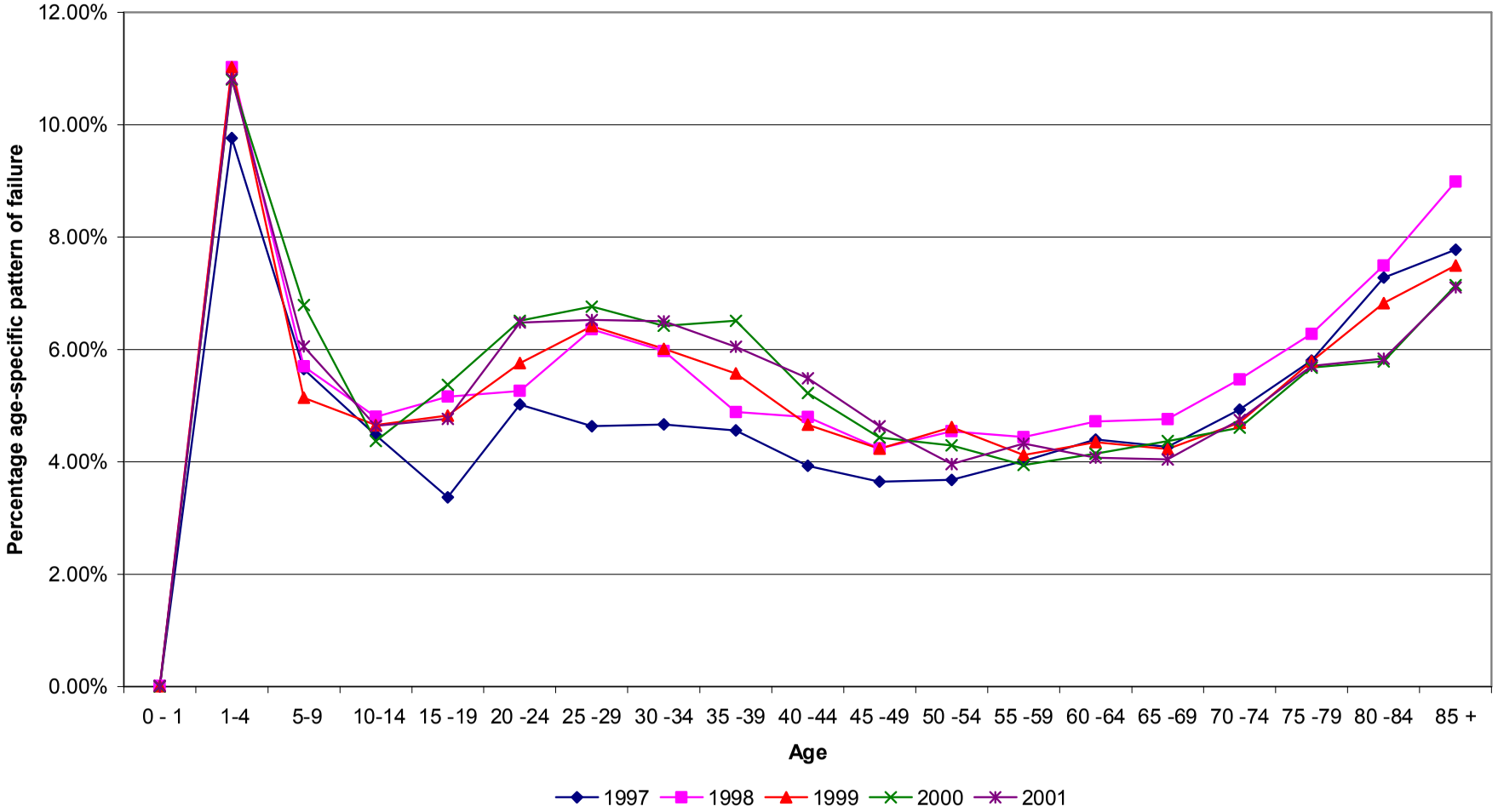

Fig 17a: Failure Pattern 13 (HIV=0, TB=0, Inf and pneu=0, Others=1), Males, South Africa, 1997-2001

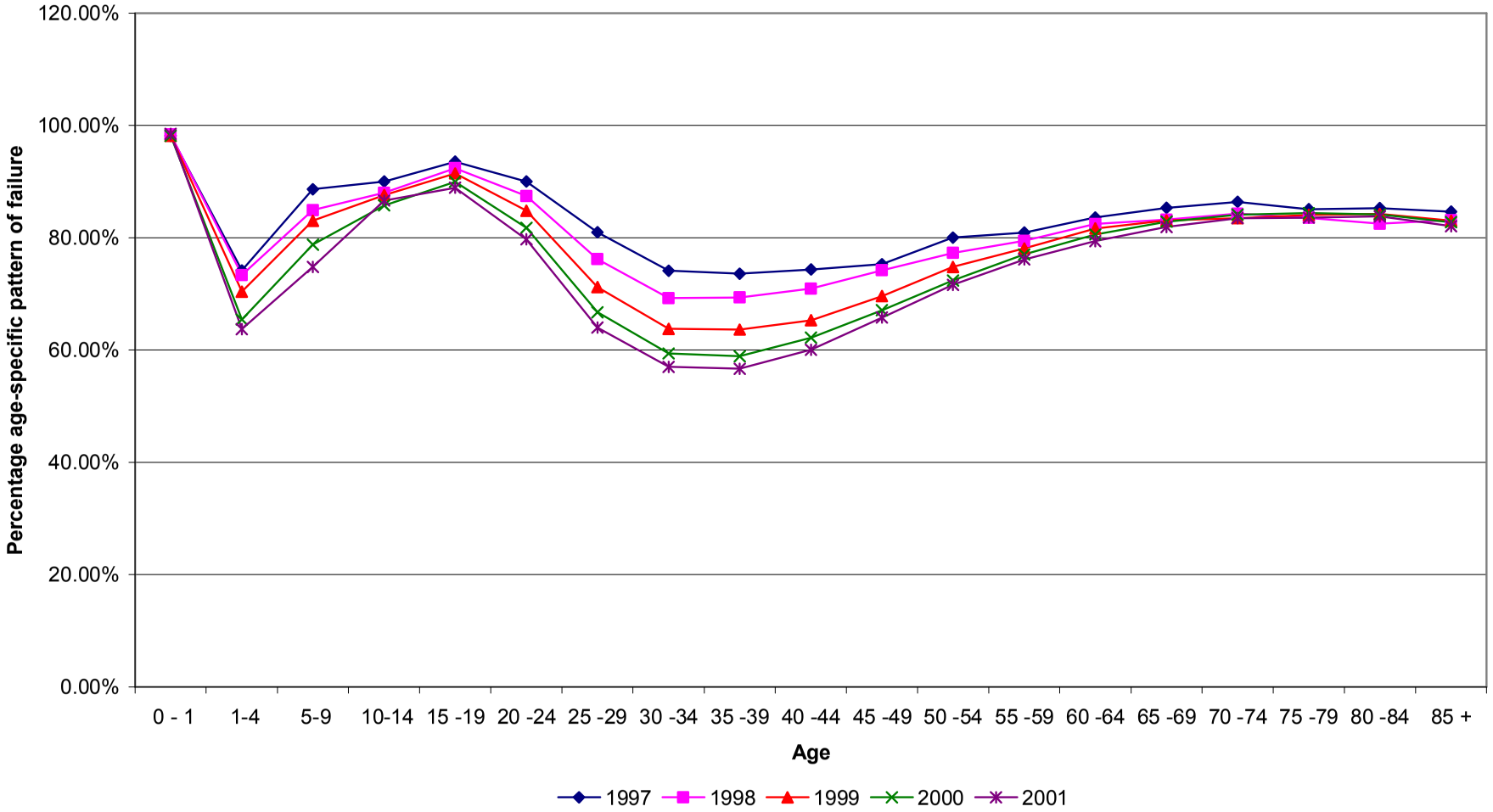

Fig 17b: Failure Pattern 13 (HIV=0, TB=0, Inf and pneu=0, Others=1), Females, South Africa, 1997-2001

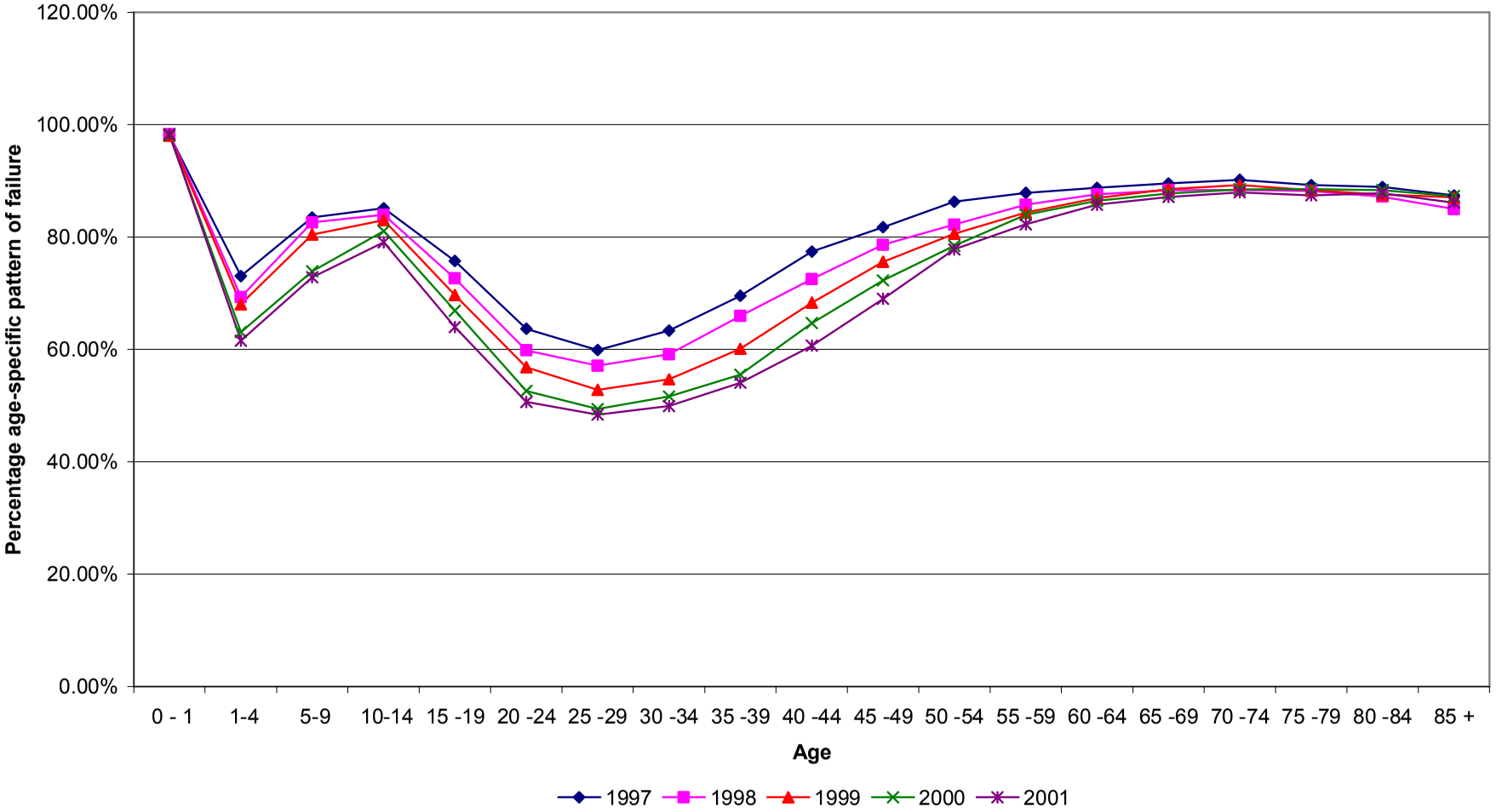

Fig 18a: Failure Pattern 14 (HIV=0, TB=1, Inf and pneu=0, Others=1), Males, South Africa, 1997-2001

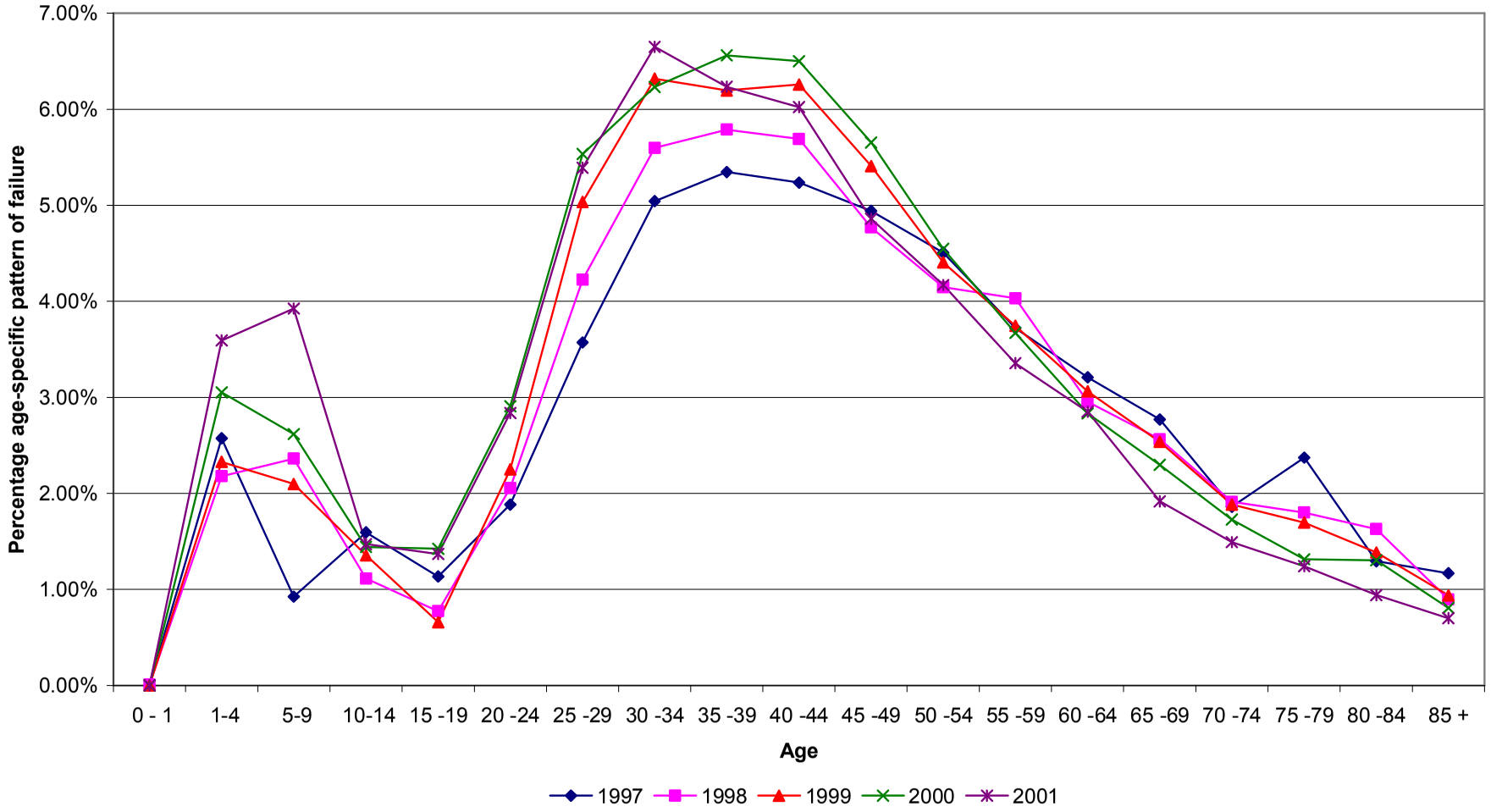

Fig 18b: Failure Pattern 14 (HIV=0, TB=1, Inf and pneu=0, Others=1), Females, South Africa, 1997-2001

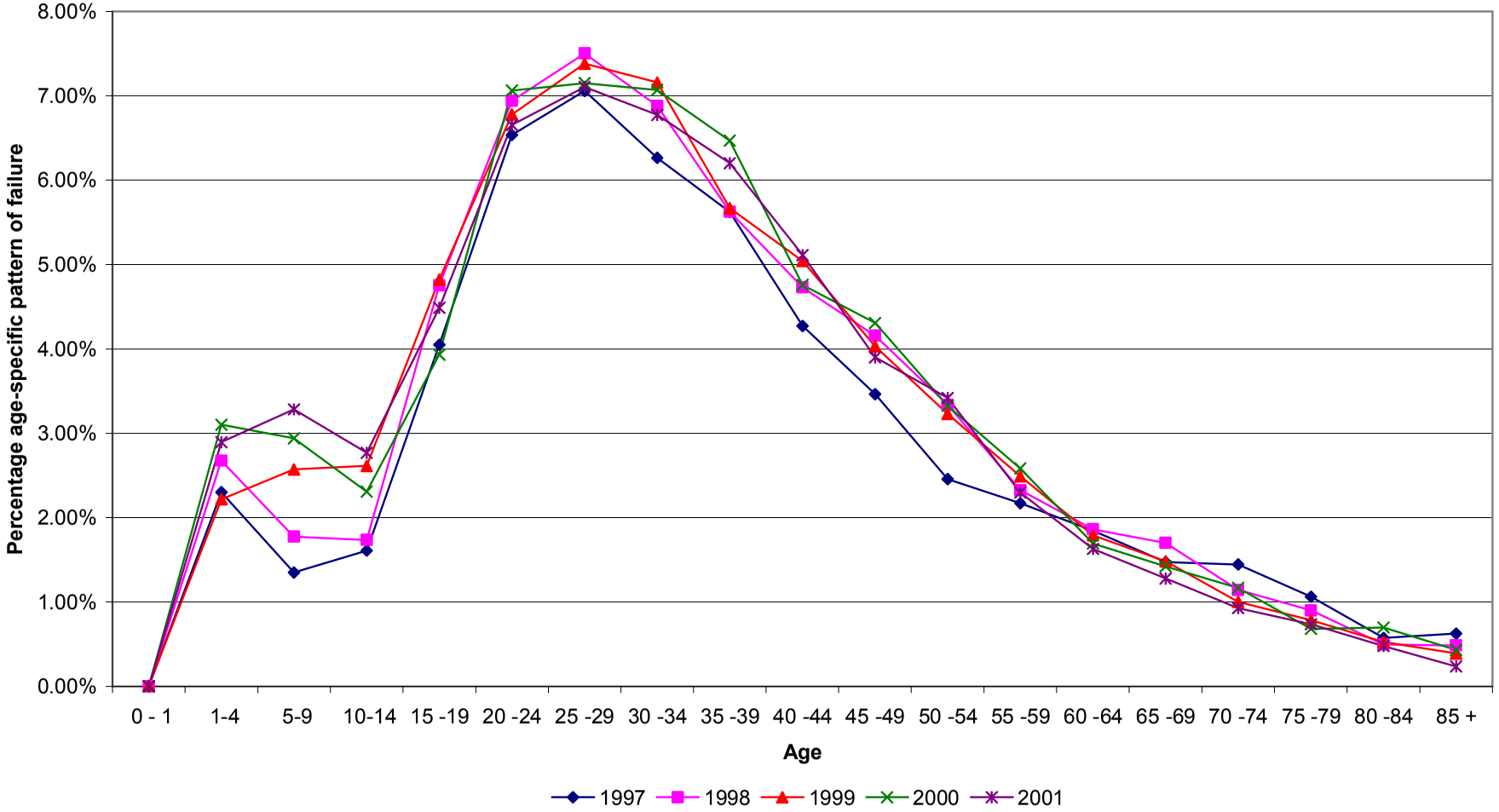

Fig 19a: Failure Pattern 15 (HIV=1, TB=1, Inf and pneu=0, Others=1), Males, South Africa, 1997-2001

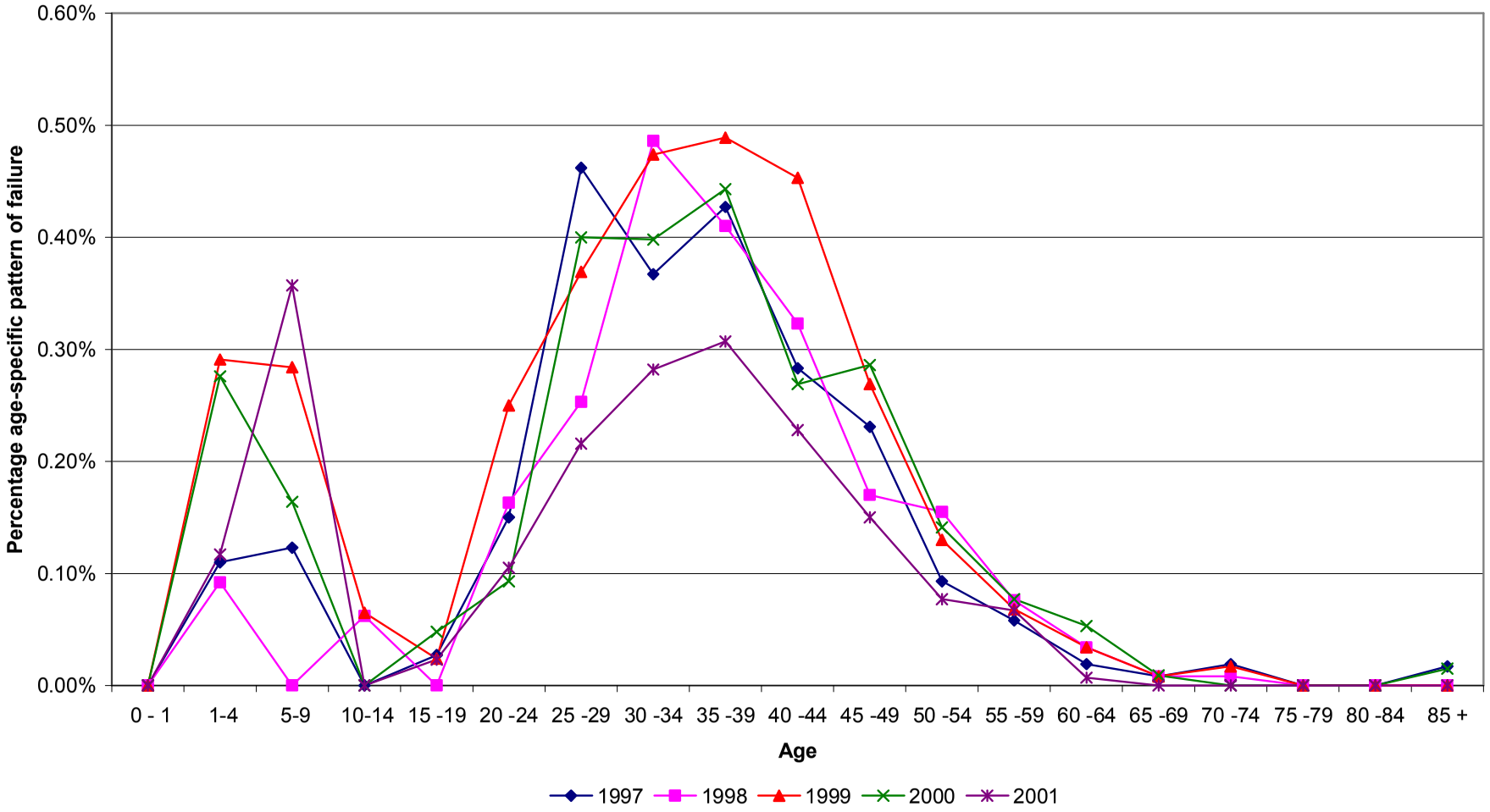

Fig 19b: Failure Pattern 15 (HIV=1, TB=1, Inf and pneu=0, Others=1), Females, South Africa, 1997-2001

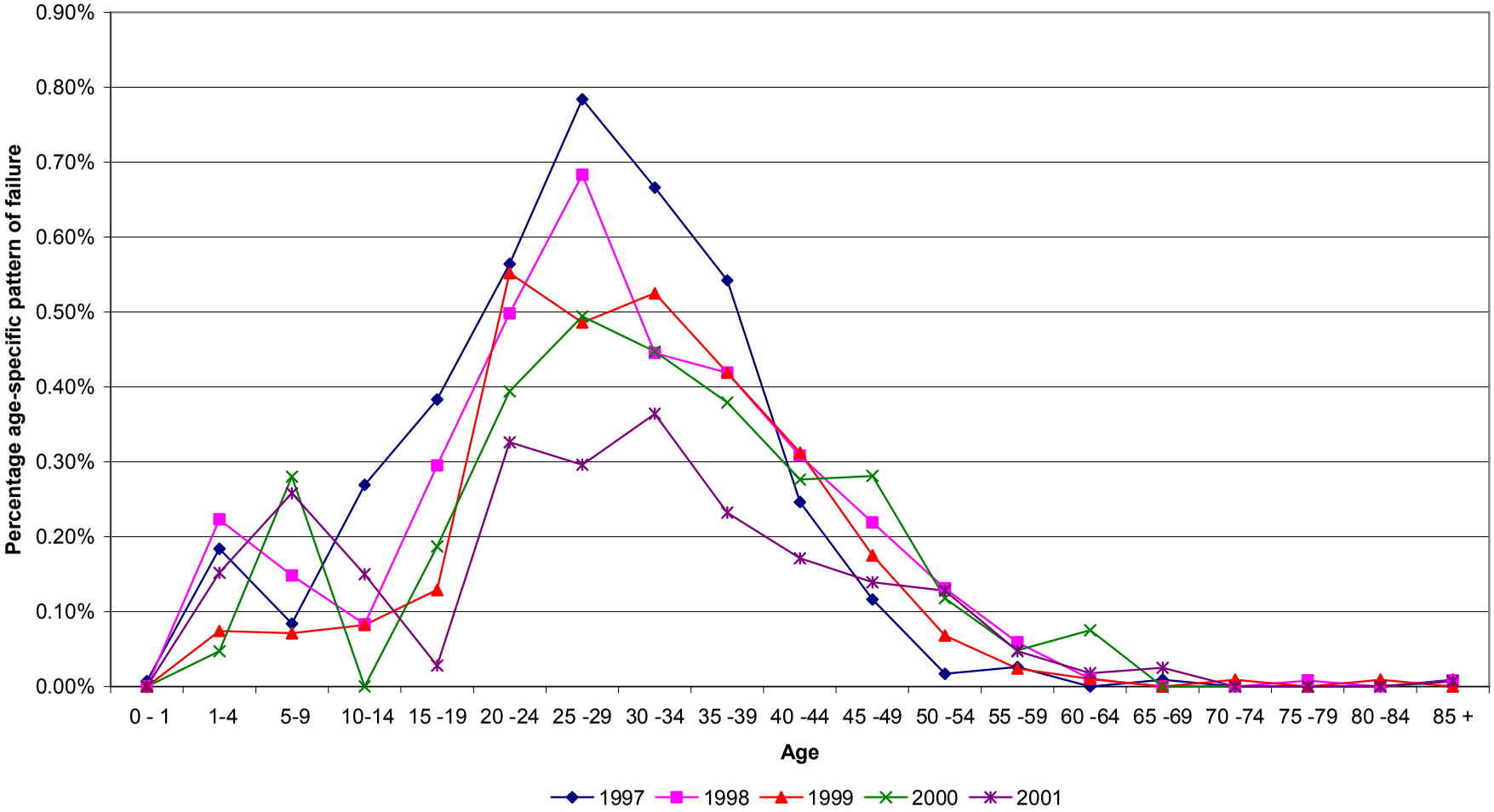

Fig 20: Summary of the profile patterns of failure involving the three causes of death (HIV, TB and Inf. and pneumonia), South Africa, Males and Females, 1997-2001

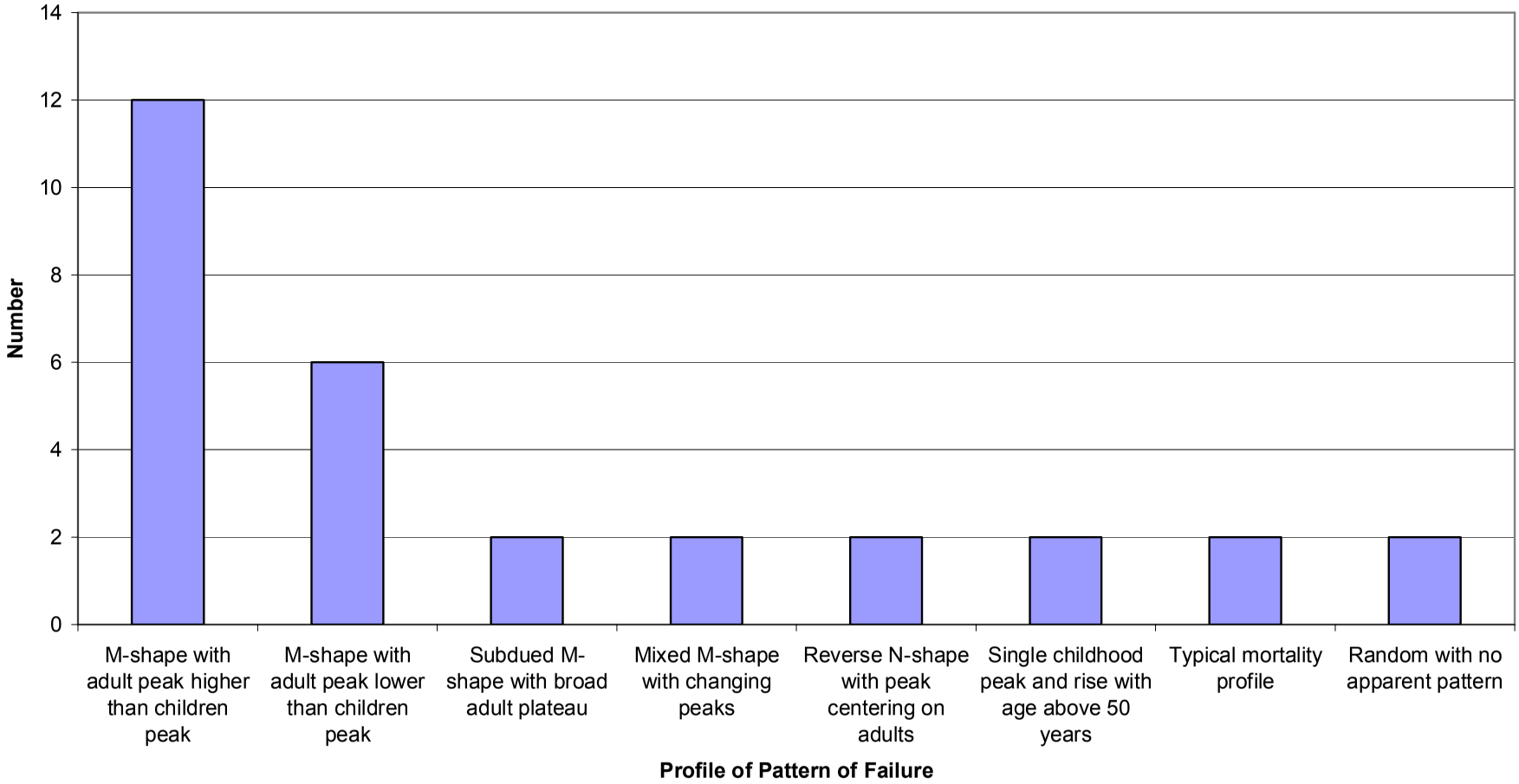

Fig 21a: Relative gain in life expectancy with the elimination of different patterns of failure over that with the elimnation of the pattern with 'any mention of HIV', South Africa, Males, 1997-2001

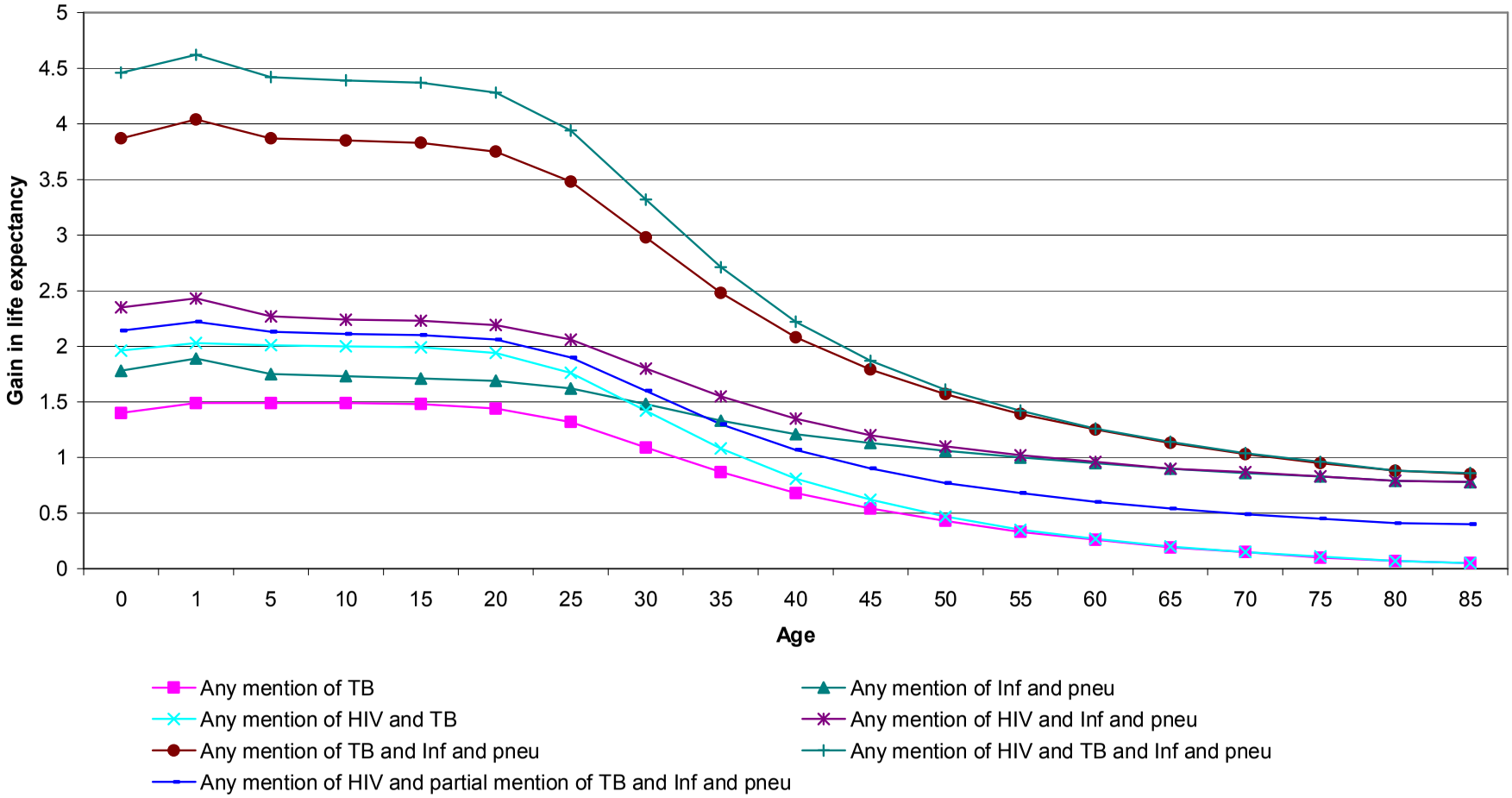

Fig 21b: Relative gain in life expectancy with the elimination of different patterns of failure over that with the elimnation of the pattern with 'any mention of HIV', South Africa, Males, 1997-2001