

**South African AIDS Conference 2003
Plenary I: “The Epidemiology of HIV”
Dr. Quraisha Abdool-Karim
August 4, 2003**

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DR. QURAI SHA ABDOOL-KARIM: -- Thank you very much guests, distinguished guests, friends, colleagues. Good morning. I want to take this opportunity to thank the organizers for allowing me this time to present on the evolving HIV epidemic in South Africa. What I would like to do in the next 20-25 minutes is spend initially a few minutes talking about epidemic transmission dynamics, mainly to spend the rest of the time talking about the evolving major HIV epidemic in South Africa, and spend some time looking at the implications of the current state that we are in in terms of the epidemic in South Africa.

Now before we look at the HIV epidemic in South Africa, I'd like for us to spend a few minutes just refreshing ourselves in terms of what we know about epidemics. I want to use the example of plague which has been around for many, many years. And the thing that's most striking about epidemics is that they generally have a ball-shaped curve. In the initial stages of the epidemic what we have is a few individuals who are infected, and depending on the number of people who are susceptible to infection and the interplay between those who are infected and those who are susceptible, you have a rapid rise in infection. Excuse me, until a plateau is reached and then what you have is those individuals who have been infected or become infected reaching immunity or dying, and you start to

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point of stability. Now if we move on to what we know about HIV epidemics and if we turn to two countries north of us, we look at Zimbabwe and Uganda, we see a very similar curve, this ball-shaped curve (unintelligible) of rise of infection, a plateau being reached and a decline and that's Zimbabwe not having quite reached the bottom but you can see that shape and if we move to Uganda you can see again, the rise of infection, the plateau and then the decline.

There are two additional definitions I want to make before I move on to the presentation of the epidemic in South Africa and that's the concept of prevalence which really reflects how much disease is at a point in time. So if you want to think about it in terms of a photograph, say if you take a picture, and we say all those wearing blue jerseys are infected, that's really what we're capturing when we look at prevalence data. The prevalence data are very important because they give us clues and indications in terms of the implications of the epidemic and these new infections on health care provision and the health impact of the epidemic.

The second definition relates to incidence rates and in contrast to prevalence, the incidents really reflects new infections in those who have no infection. So you start off with people who are uninfected. You follow them up over a specified period of time and you count how many people acquire

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are acquired over a specified period of time. The incidence rates in trying to understand epidemics is more sensitive for assessing the growth of the epidemic and it's a more sensitive marker of effect of interventions that have been put into place. So if we can now move on to the HIV epidemic in South Africa.

I think that it is important to contextualize the South African epidemic as part of a global epidemic. As South Africa contributes about 10% of the global burden of infection, given that we have less than 1% of the population, this is a substantial number of infections that we are seeing in South Africa. We have a major and a minor epidemic, and I will come to that in a little while, but I'm going to focus a lot of my talk on the major epidemic and there are some distinctive features of this major epidemic. While we are part of a global pandemic, we do have some distinctive characteristics that differentiate the epidemic we are experiencing in South Africa from other epidemics occurring around the world.

In terms of the major epidemic, prior to 1987, HIV infection was rare in the general population. We are experiencing incredibly high prevalence rates and unprecedentedly high, and, I will be presenting some of that data shortly. We are experiencing again, unprecedentedly high rates of infection in young women with an epidemic in South Africa the highest

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of 30, and that we are also seeing in the major epidemic predominately sub-type C infection.

In terms of understanding the epidemic in South Africa, we have several sources of data, but perhaps the most reliable source of data we have is the National Anonymous Antinatal Services conducted by the South African Department of Health which has been taking place since 1990, and we now have about twelve years of data. Many people will find biases if you take each of the data sets, but it is important in looking at the antinatal data it's because these are surveys that are conducted over time, it overcomes some of the biases that exists in doing cross-sectional surveys. What we see is a clear curve that's starting to take what we're seeing is half of that ball-shaped curve that we usually expect when we look at infectious disease epidemics. We see, excuse me, sorry I'm having a bit of a challenge here in terms of using the mouse as a laser pointer, but we can mark out three distinct stages: the period from 1987 to 1994, where we see a rise of infection; a period between 1994 and 1998, where we see a real explosive take off in the epidemic; and then this last stage, which is from 1998 to 2002, where we start to see some evidence of stabilization and plateauing in terms of prevalence data. But we have to remember that when we talk about the HIV epidemic as I mentioned earlier, we have a minor epidemic and a major

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like many parts of the world, as early as 1982, South Africa saw the first reported cases of AIDS. This epidemic was largely limited to men who have sex with men, transfusion recipients and hemophiliacs prior to the screening of all units of blood that's become policy in South Africa. This epidemic was largely a Plate B epidemic.

If you look at studies conducted in selected groups across the country, particularly in Kwa Zulu-Natal, Gauteng then known as (unintelligible) in a number of different populations, rural communities, mine workers, sex workers, antinatal clinic attendees and out-patients, there is clear evidence with large sample sizes that HIV infection in the general population prior to 1987 was rare.

If you turn now to that first stage of the current major epidemic talking about the generalized epidemic which begins, we think, around 1987, just that first period between 1987 and 1993 what we see is the introduction of HIV infection in the heterosexual population, a major epidemic starting to evolve including the general population, and because of heterosexual transmission of (unintelligible) epidemic through infection from infected mother-to-infant, a predominately Plate C epidemic, a steady growth in HIV transmission, and marked by an exponential increase with a doubling time of about 15.1 (unintelligible). So if you look here it gives you some

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specifically at a key issue at this generalized early stage of the epidemic in this period from 1987 to 1993, I want to draw your attention to this slide which reflects the age and then distribution of HIV in South African particularly this is a population based study where we're able to get data across the life cycle and able to plot the early rise of infection in women compared to almost ten years later rising infection in men. I think this already started and was an important clue in terms of what was to come in terms of spread of HIV, that not only were we starting to see a rapid spread of HIV, but the spread was distinctly different according to gender and age characteristics that this early rise of infection is an important clue in terms of who are most vulnerable and the potential when young women at this age getting infected what this means is that you have an open cohort that will continue to fuel this epidemic.

To move to the next phase between 1994 and 1998 really marks the explosive spread of HIV in South Africa, where in this previous stage moved from a small epidemic to a well-established generalized epidemic characterized by high incidence rates and explosive growth in HIV transmission and what we start to see is the coalescence of genetically diverse epidemics of Plate C infection, but mortality still being low. So this is the period that we are talking about and you can see

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literally see almost like a runaway train going from this point of low levels of infection to an incredibly rapid increase.

Now to get incidence rate data as explained, you need to start with negative people and follow them up over time. These are expensive to do and you have to have good rationale and justification, both scientific and ethical, to do that. We have in the context of a Phase 3 micro-chromosome trial in conducted in Kwa Zulu-Natal by the Medical Research Council Real Time Incidence Rate Data from the cohort of sex workers in Kwa Zulu-Natal and here you can see this rapid increase in incidence rates from 16.8% in 1996 and 1997, to 20% in 1999 and a cumulative incidence of about 18.2%

What this translates to, in terms of numbers and people, is that 1 out of 5 people who were uninfected at the start of 1996, acquired infection. In addition to the National Antinatal Survey Data, we have data from a rural community, about 300 kilometers north of here. These surveys initiated by David Wilkinson (misspelled?) in the early 1990s when he was a superintendent of Siyabuswa (misspelled?) Hospital give us also an indication of how the HIV spread in the rural community and very similar trends to what we observed from the National Antinatal Data those sort of early rise and the early stages of the epidemic a prevalence of about 4.2%. Now there's a lot of figures here and because we are talking about this period from

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are in yellow which reflect the prevalence going from 1993, 7.9% a dramatic jump to 14% in 1995, almost doubling in 1997 to 27%, and then by 1998 looking at close to 30% overall prevalence amongst pregnant women between the ages of 15-49 and here you can see the incidence rates starting to climb rapidly as well where the prevalence in 1995 14%, the incidence rate 7.1%, during same period these incidence rates are estimated by a method developed by Carolyn Williamson and are reliable extrapolations from cross-sectional survey data to 10.2% - 10.5%.

Of importance is the temporal trends in the age specific HIV prevalence amongst the same cohort of antinatal clinic attendees and I want you to follow the numbers highlighted in blue. So we take this cohort of 20-25 year olds in 1992, the prevalence is 6.9%. They move in 1995 to the cohort of 25-29 year olds, you see this dramatic rise from 7% to 18.8% following the same cohort 30-34 in 1998. You see the increase from 18.8% to 23.4%, and then in 2001 from 30-34 moving to 35-39 36.4%.

I'd also like to walk you across the first role which is prevalence amongst the 20-24 year olds and if you can simultaneously look at the next role which is the 25-29 is these are new cohorts of women coming in in this age group you see where their risk of infection dramatically increasing with

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2001. Now this is about as high as prevalence can go in terms of susceptibles and who can get infected.

I'm going to shift a little bit to some of the work done by Carolyn Williamson and her team in terms of the molecular epidemiology. In most epidemics what you see is a focused point of infection and split continuing. So if you take India, for example, you see a lot of clustering of the strains of the virus in India and these are all sequences from strains isolated in countries neighboring South Africa, the southern African region, and the zeda (misspelled?) which is in yellow, refers to strains isolated and sequenced from South Africans infected with HIV. What you see is a very broad distribution of the South African strains, the similarity in the South African with strains isolated in Malawi, Zambia, Botswana and so forth and what this really reflects is this epidemic in South Africa is not as a result of a single point source epidemic, but that what we have is multiple epidemics taking place simultaneously and during this period of explosive spread, what we start to see is the coalescence of these multiple epidemics that are occurring simultaneously.

I'm now going to move us to where we are at this sort of post-1998 period and what we are starting to see, as I've demonstrated from the data in Siyabuswa, is the generalized epidemic nearing saturation; that we continue to see high

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and that most importantly and significantly is that mortality is rising rapidly. Now a characteristic of that earlier periods that I spoke about is that we're talking about silent spread of HIV what we're starting to see is the face of the epidemic as people who were infected during those stages, they progress and advance and we start to see first increase in mobility and then the increase in mortality.

So just again taking that ball-shaped curve at this point and we are going to really focus now on this part of our epidemic. So if you can take the preventional data, we know from the early stages that the geographical distribution of HIV infection varies with the highest rates of infection in the east coast of South Africa compared to and the lowest on the west coast, but regardless of that geographic variation in distribution of infection. Again, I've just highlighted to make it easier to read some of the providences if you take Kwa Zula Natal, you can see if you take the last three years, 1999 to 2001, this is almost a stabilized prevalence that we see. Take the same with Phuthadithaba or if we go to the Northern Cape slightly higher of prevalence, but the trend is very similar that in terms of looking at the prevalence of infection, we more or less are not seeing dramatic increases as we saw during the 1995-1998 period.

Again, if we take this period and particularly if you

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again turn to the Siyabuswa data we see prevalence in 1999 and 2001 not dramatically different, 34% and 36%. If you look at incidence rates, the incidence rates are very high, 10%, but not dramatic increases just to note that the incidence is incredibly high at 10%.

If we compare the age specific prevalence again, looking at the antinatal data from Siyabuswa, bear in mind that the 1998 overall prevalence was 29.9% and 36.1% in 2001, you see for example in this 20-29 year old age group still very high rates of infection occurring about 40% in 1998, 2001 about 50% of women attending antinatal services infected with HIV. Again, if you look at the incidence rate data and focusing here on the overall incidence rate, 10% in 1998, very similar incidence in 2001, and if you look across particularly in the under 29 year age groups, the very high incidence rates reflected still in the 2001 data.

Okay, I'm going to shift now from the incidence data during this period to starting to look at the mobility and I've just taken two slides to reflect this maturing epidemic advancing HIV disease that we're starting from infections that occurred from Phase 1 of the epidemic in South Africa in terms of the major generalized epidemic. Now I think that there are many amongst us who are health care workers who work at various public sector facilities that can give you more graphic

three years.

One of the things that we know from the natural history of the infection in South Africa and in other parts of Africa is that TB is the most common presenting opportunistic infection. I want to share this data again from Siyabuswa from many, many wards dedicated to TB care needed to be closed down as part of that intervention.

Today if you go to Siyabuswa, you'll see that those wards have had to be re-opened and there are about four times more wards for women patients and particularly young women presenting with TB and HIV infection, and I've simply imposed the antinatal data and you can see the rise in the TB cases in this hospital increasing as the HIV prevalence has increased. If we move to Knysna (misspelled?) Hospital, the major testory hospital in this providence. In 1998, 54% of the medical wards were occupied by in-patients who were HIV infected. If you visit these wards today, the medical wards or the pediatric wards, the numbers are closer to 90%. Of these 54% of the patients in 1998, 84%, who were infected, met the WHO AIDS case criteria. Fifty-six percent were co-infected with TB and significantly the case fatality rates for those who were infected, 22% versus the uninfected 9%. These are data in terms of mortality that come from the National Demographic and Health Survey and this is all cause mortality for men in South

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not as dramatic, but certainly a 1.5 fold increase or 150% increase in mortality in men between the ages of 20-40.

Now we turn to mortality rates in women, and if you look there is substantial dramatic unequivocal rise in infection of mortality in women between the ages of 20 and 35 reflecting the HIV prevalence that we saw from about five years previously.

To summarize, the HIV epidemic in South Africa can be characterized, the major epidemic, by four phrases: the pre-1987 period, as a localized Phase B epidemic; the period between 1988 and 1993, a generalized Phase B epidemic starts; between 1994 and 1998, explosive epidemic with low mortality rates; post 1998 incidence high but stable and mortality rising rapidly. So that is where we are right now: What can we anticipate in the next phase. What we are going to see is mortality starting to exceed incidence and prevalence starting to decrease. I think that it would be most foolish to think that this prevalence decreasing is success in controlling this epidemic. What we are really going to see is that because mortality is exceeding the new infections taking place they must give these new infections that are occurring and to think that these are success of prevention I think again would be very premature and very foolish. I think what we need to do is look very, very seriously at this next phase of the rapid

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think really say that what this data underscores is the need for both prevention and for care. If we focus only in prevention we are going to see incredibly high rates of mortality continue

If we focus only on care and treatment we are going to see the continued spread of HIV.

This is an incredibly critical period in this epidemic and has major implications for key decisions that need to be made. In terms of the current epidemic, we can anticipate five parallel effects. First, the continuing large numbers of new HIV infections. We will see the ongoing high mother-to-child transmission rates. We will see rising mobility and its impact on health services, rapid rise in deaths and increase in numbers of orphans. It is essential and non-negotiable to intervene with prevention of new infections. To impact on the continued large numbers of new infections, the next plenary speaker Dr. Hoff will be talking about what possibilities there are for prevention and over the course of the next couple of days there are a number of symposia oral presentations and posters that will give more details of what these prevention programs can be and how they can be implemented. In order to respond to the ongoing high mother-to-child transmission rates we need rapid rollout of MTCT programs and again later in the week you will have more information on that. The rising

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of care including opportunistic infection prolific and the provision of highly active anti-viral treatment. The rapidly rising deaths speak to the need for starting to plan social services for families impacted by AIDS deaths and the increase in the number of orphans the need for programs and social services for orphans. The facts that HIV is affecting mainly young women highlights the importance of intervention targeting youth the need to address general inequities that fueling and the need for greater involvement of men in prevention programs. It is unequivocal that South Africa is experiencing a devastating epidemic, the world's worse, and this is just the beginning.

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