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by
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This presentation describes a specific type of serosurveillance for monitoring HIV infection trends in population groups. This is a method that many national AIDS control programmes and the WHO are now actively exploring; a method which we will refer to as HIV sentinel serosurveillance.

The surveillance component of most national AIDS control plans includes surveillance for the disease AIDS and for HIV infection. However, there are several reasons why surveillance for infection must be stressed. First of all, monitoring for disease is subject to the inadequacies and other problems of the disease reporting system - resulting in widespread underreporting of AIDS cases. More importantly, because of the very long latent period which is characteristic of HIV infection, the number of AIDS cases can be expected to continue to increase for several years, independent of the efforts of today's control programmes. The vast majority of AIDS cases which will occur over the next few years will develop from HIV infections acquired five to ten years ago.

Further, as today's control efforts are primarily directed at preventing infection, it is through monitoring these rates of infection that national and local programmes can best direct their strategies and evaluate the effectiveness of programme efforts.

The general outline of this presentation is, firstly, to show some trends that have been seen in serial HIV prevalence studies or in cohort studies which clearly point out the compelling nature (and urgency) of monitoring infection trends;

Secondly, to discuss some of the advantages and disadvantages of different approaches for obtaining information on trends in infection and specifically some of the advantages present in a system of regular sampling at sentinel sites, and;

Thirdly, to describe some of the key elements of sentinel surveillance and some of the future direction and needs.

1. Some examples of trends in infection

Some examples of trends in infection observed by serial studies for different population groups in different countries are shown in Fig. 1. Trends are shown for female prostitutes from one African city, homosexual men from a United States city, intravenous drug users from two European cities, and women seen at antenatal clinics from three African cities.

The dramatic curve shown in Fig. 1 represents the increasing prevalence of infection in female prostitutes in an African city. The prevalence of infection in prostitutes tested at this site increased from less than 5% to approximately 90% in the course of six years.

Similarly, very high rates of increase in the prevalence of infection among homosexual men in the U.S. and intravenous drug users are shown in this figure.

It can also be noted that there was a marked slowing in the rate of increase among these homosexual men after 1982.

For the IV drug users tested in these two cities, two different patterns appear, one of a more rapid increase followed by a possible slowing, the other showing a slower initial rate of infection followed by a possible more rapid rise.

The surveys of pregnant women from three different African cities show little or slow change in two cities (A & B), whereas in the third there appears to be a recent and possibly rapid increase (C).

Although there are limitations in the data in this figure, these trends do show us large differences between groups and between locations. In addition, it is clear that in some locations and groups the annual rates of seroconversion are very high.

Especially high annual rates of infection have been seen in some groups of prostitutes and for several cohorts of homosexual men. From the series of prevalence studies performed among prostitutes at this one site in this African city, the average annual increase in prevalence was 15% per year. From several cohort studies in homosexual men in U.S. cities, the annual incidence of seroconversion to HIV has also been extremely high. In the well-known San Francisco cohort, 10 to 20% of at risk men became newly infected each year for several years running. There were several years in several cities in which 5 to 10% of at risk men in study cohorts were seroconverting annually. There is a compelling public health need to know when and where this is happening.

2. Advantages and disadvantages of different study methodologies in determining and monitoring HIV infection

Several study methods have been and will be used for measuring prevalence or incidence of infection and for monitoring trends. The important differences between these studies are well known. Some key points about the application of these methodologies to surveillance of HIV follow:

a) Cross sectional or prevalence studies have been the most common HIV studies to date. Most countries have performed such prevalence studies at different locations and in different groups as part of the initial assessment of the situation. These studies have succeeded in providing health personnel and others with a very useful first cut at the situation, and for describing the pattern and prevalence of HIV infections. A variation of this are the national serosurveys which require very large numbers for an accurate estimate of the overall national pattern and prevalence of

HIV infections. So far, there are just a few countries who have attempted national surveys. Nationwide studies require an enormous investment of manpower and in most situations a serious drain is placed on an already very tight manpower situation.

At best, cross sectional studies provide only a snapshot of the situation. For initial assessment this has been essential. Some of these initial prevalence studies now guide our current programmes. However, more data are obviously needed for monitoring trends.

b) Cohort studies are a standard way to measure incidence; in this case, the incidence of HIV infection. Much of our best information on incidence of HIV infection and trends is from some of the cohort studies shown in Fig. 1. The limitations of these or any cohort study usually relate to questions of the representative nature of the group recruited, enrolled, and successfully followed. There are logistical and manpower problems involved in such detailed follow-up. Perhaps, most importantly, there is concern as to whether important characteristics of the cohort itself change as a result of the study (for example, as a result of the attention and education provided).

c) Serial prevalence studies offer another means of determining rates of change of prevalence and possibilities for deriving the annual rate of infection. Most information derived to date on trends is from serial prevalence studies as shown in Fig. 1. Problems have included too few data points, drifts or shifts in the cohort or group followed and varying participation rates with time.

All of these types of studies can be expected to continue to contribute greatly to defining the HIV situation. However, the development of systems for regular monitoring at sentinel sites may well serve as the backbone of surveillance systems to monitor HIV trends. Such a system will provide the consistency that will be needed by national AIDS programmes for effective public health surveillance of HIV infection.

d) A sentinel surveillance system with regular sampling can give public health officials a means of monitoring trends in infection in chosen population groups and of chosen sites in a regular and consistent (or uniform) way.

3. Sentinel serosurveillance

In sentinel serosurveillance, specific sites and population groups are selected; a predetermined number of persons are routinely tested, and testing is performed in a regular and consistent way. Testing could be performed daily, monthly, or quarterly. Scheduling the collection of blood samples as part of the routine work at these sites will make it regular, and it will be consistent if the same procedures are routinely followed.

The main purpose of sentinel serosurveillance is to detect changes - i.e. to monitor trends and to provide a basis for evaluating preventive strategies and activities. However, it should be pointed out that sentinel populations need not be "representative". At the same time, it is important that sites, facilities, or populations chosen remain similar, that procedures initially chosen continue to be used (unless they are improved), and that subjects are chosen in such a way that selection bias is minimized. Additionally, sufficient demographic data need to be collected so that changes in the population can be detected (e.g., an influx of refugees).

Some first steps in the development of a sentinel surveillance system are the selection of sites and groups for testing. A few examples of site and group selection follow.

Sites

In Malawi, eight sites have been proposed for the national HIV surveillance system. These include locations in all three regions, representing rural and urban locations, and sampling of some other areas of special interest - for example, because of proximity to the lake or to borders (Fig. 2).

Massachusetts has chosen 26 hospital sites throughout the state for a programme of monitoring for HIV infection among childbearing women by sampling newborn blood (taken for other purposes). Sites were chosen to represent inner city, other urban, suburban, and rural settings and they were selected from different locations throughout the state.

Target groups for testing

As for groups to test there are several considerations. Different countries have selected different population groups for regular testing according to local prevalence and transmission patterns. An expert group convened by WHO last year to review the issue of standardization of HIV serologic surveys recommended that for areas such as Africa, where heterosexual transmission is the predominant mode, that "sentinel" groups be chosen that represent both a high risk population and a group thought to more accurately reflect the HIV prevalence of the general sexually active population. Many countries, in fact, have chosen STD patients and antenatal clinic attenders. In part, these groups have been selected because they are easily defined, accessible, and because in many cases blood is frequently drawn for other reasons, e.g., for hemoglobin or VDRL. Where blood is drawn for other purposes, unlinked testing (which will be discussed later) may be possible which may help eliminate problems of participation bias, for example self referral or deferral, for countries where unlinked testing may proceed without individual consent. Antenatal clinic attenders are one of the few well populations that come routinely to the health sector.

Other groups

There are several other populations groups which could also be serially tested, including prostitutes. Local prevalence and other circumstances may dictate best choices. Testing of tuberculosis patients is common. It is probably most useful for initial assessment or for predicting an effect on the tuberculosis situation. Testing of long-distance truck drivers or other similar groups might be useful in locations where the HIV epidemic has not yet begun. In many countries, especially in developing countries, blood donors are not reliably representative of the general population and donor recruitment practices may vary widely from month to month. Self referral or deferral make voluntary testing sites less useful for surveillance purposes as well. There are many examples of this.

Some groups have been especially convenient to test, such as blood donors or voluntary military recruits who have been subject to continuous sampling. However, participation bias and seasonal trends argue against their selection as particularly useful populations to rely upon for reliable data to monitor trends although these data should be collected and analyzed by health officials.

The development of programmes of serosurveillance at sentinel sites includes selection of sites and groups to test, and then the establishment of set procedures and efforts to decrease selection bias. Where possible, the systematic collection of demographic indicators that might signal a change in the populations coming to that site should also be collected.

Selection bias and legal and ethical questions

Control of selection bias is a key problem. The optimal surveillance method for control of selection bias for monitoring trends is unlinked testing. Unlinked testing involves

the use of blood specimens collected for other purposes but tested for HIV serological markers after personal identifying information has been removed (unlinked) from the blood sample. Unlinked testing is being evaluated in a few countries now. Surveillance or surveys based on either unlinked anonymous or voluntary anonymous testing are the methods of choice for surveillance system and for broader public health reasons.

It is essential to ensure that privileged personal information is not disclosed to unwarranted persons. Breaches of individual rights may cause individuals to avoid future testing, resulting in participation bias in the surveillance system. It may also cause others in the same risk or risk behavior group to avoid contact altogether with health and social service out of fear of being tested. The problem of developing a reliable surveillance system is therefore tightly linked to developing an overall disease control programme that facilitates information and education to groups and persons at risk and which also protects human rights. Special care, competence and thoughtful planning are required.

Informed consent and availability of counselling are essential unless unlinked testing is chosen.

Summary

In summary, it is first clear that there is a need to monitor for trends in HIV infection, that this need is urgent, and that the need will be ongoing. Certainly several methods are available and more than one will need to be applied in national programmes. For example, there are still many regions in most countries where there is no information so in these areas, a simple prevalence study using samples of convenience may be what is first needed.

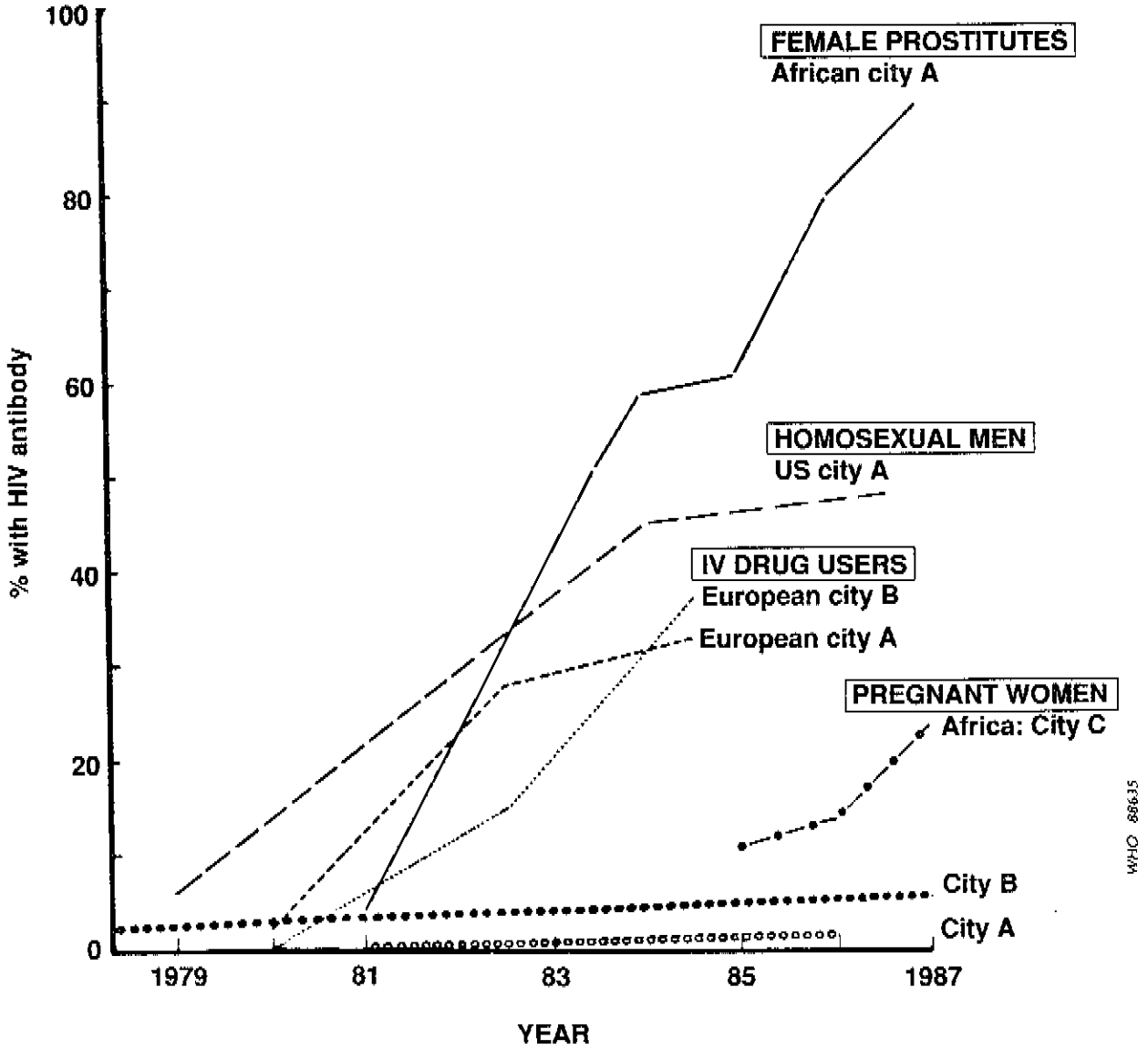
For monitoring HIV infection trends, many national programmes are pursuing a direction based on regular sampling at predetermined sites of predetermined population groups. Some of the key advantages from such sentinel surveillance systems include obtaining information from several selected sites and from different selected groups simultaneously and in a manner in which the groups, sites, and procedures become established and regular. For many sites the possibility of it becoming routine may be an additional and important advantage.

Public health surveillance intended to guide programme decisions should not be viewed as an academic study. However, we recognize that the attention to method and detail that is usual in research studies is needed for the development of a reliable national surveillance system. Further, information on prevalence is first of all national information. In this regard there is a great need for better in-country collaboration in some countries, in particular where many research groups are working. In most countries, for example in Africa, the coordinating body is the national AIDS committees and national AIDS programmes. Much of the valuable information being collected by many research groups can directly contribute to the development of the national surveillance programme as well as to specific other research goals. Such information or research data need to be promptly shared with the national AIDS programmes.

WHO's role regarding national surveillance (as for other programme components) is one of support. Specifically, WHO is providing technical and financial assistance for the development of sentinel surveillance systems now as well as assistance with coordination. The Global Programme on AIDS (GPA/WHO) invites reports from national programmes regarding their HIV surveillance. With such reports, GPA can continue to assist in the modifications necessary for the further development of effective surveillance systems for monitoring trends in HIV infection.

Figure 1.

Examples of trends observed by serial studies for different population groups and countries



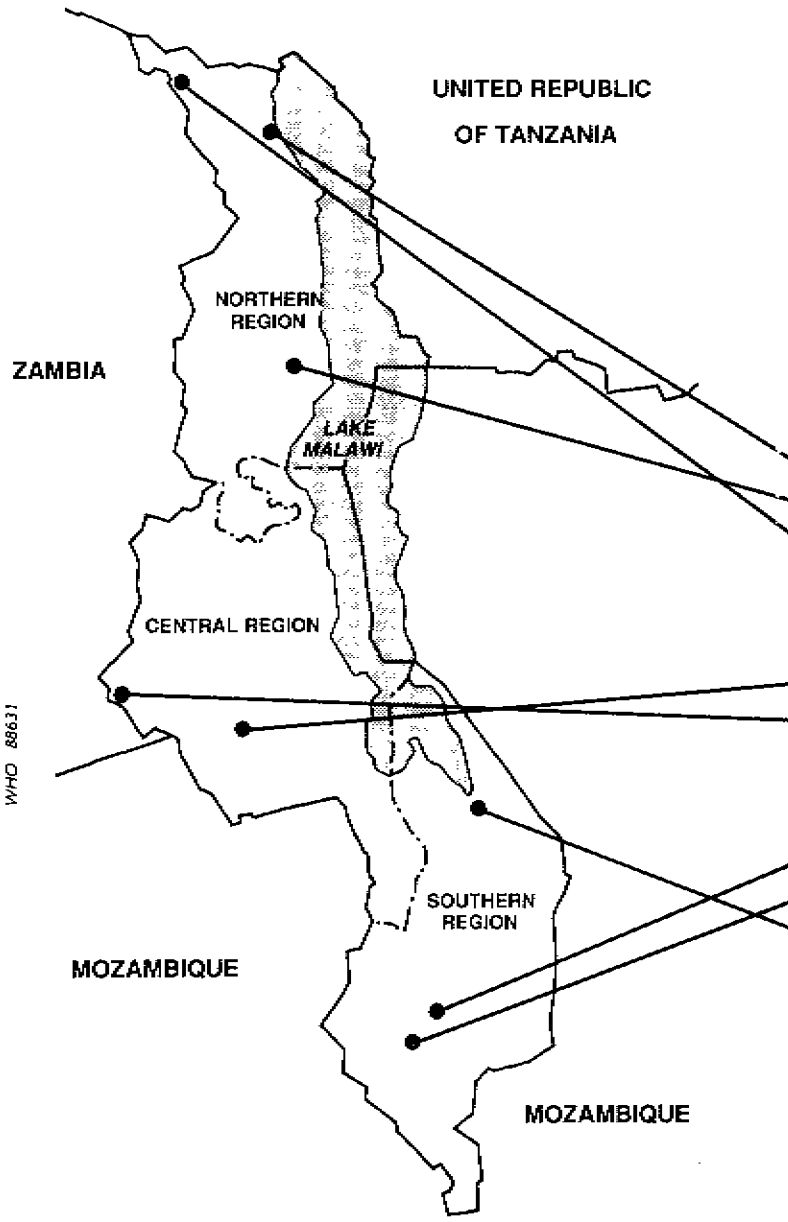


Figure 2.

MALAŴI

8 SITES SELECTED FOR NATIONAL HIV SERO-SURVEILLANCE

Northern Region	Characteristics of site
• Karonga	rural, near border
• Mzuzu	semi-rural
• Chitipa	rural
Central Region	
• Lilongwe	urban centre
• Mchinji	rural, near border
Southern Region	
• Blantyre	urban centre
• Chikwawa	rural
• Mangochi	mixed, near lake

(prior sero-prevalence data available at all sites except Mangochi and Mchinji)