

HIV epidemic control in gay men in New Zealand: The big picture

The first thing to say is something about overall philosophy, which is that the HIV epidemic in gay men has many different interwoven layers of complexity (slide 1). It is often said that “if you can’t measure something, you can’t manage it.” I think that that is a subset of an even more important point which is that “you can’t manage complex things if you don’t understand them”. Measurement is an important part of understanding, but it is not the only part. This is one of the main reasons behind the NZAF Knowledge Project and it was also a central reason why I first came to work on HIV in 1984. I started trying to learn about the epidemic in the eighteen months before I began full time work in this field, and the goal then was to understand HIV transmission better before trying to intervene and alter outcomes. This presentation is about what we now understand about the HIV epidemic in the broad, and there are points here which are both old and new information. The main thing is that all of them have significant strategic implications for epidemic control.

The first general point to make, the one that people often do not recognize, is that New Zealand has done well in terms of the way that we have managed the HIV epidemic so far. If you look at adult HIV prevalence in the adult population aged 15–49 years using data from selected countries in 2007 (published by UNAIDS, WHO and unicef), what you find is that we are doing very well when marked against all of the countries that we would usually compare ourselves to (slide 2). And that applies for everyone across the board - gay, straight, IDU and sex workers. It is important to keep that in mind because if we concentrate exclusively on the problems we’re currently working to address, it can lead to the conclusion that nothing we are doing has been successful. It is important from time to time to remind ourselves that everything is far from a failure. The broadest of the broad picture is that New Zealand remains an outstandingly positive story in HIV management, even though we’re very worried about the increases in HIV transmission in gay and bisexual men that occurred over the first five years of the new millennium in particular.

Now, when you move a step further into the analysis, of course the HIV epidemic is not one epidemic but actually a series of sub-epidemics. And when you move a step further still and look at the picture in New Zealand using sentinel data from sexual health clinics collected in 2005 and 2006 (published by the AIDS Epidemiology Group at Otago University) - which is the best data we have at the moment across the board for the whole population - what you see is heterosexual men and women have an extremely low HIV prevalence. It is important to remember that these are sexually active people so you would expect them to be more at risk from HIV than average. Lesbians have zero HIV prevalence in this study, and in marked contrast 4.41% of gay and bisexual men are HIV positive in this sample - 6.07% in Auckland and 2.07% across the rest of the country (slide 3). So this data from STI clinic users makes clear that it is gay and bisexual men who are at highest risk from HIV in New Zealand. Exactly the same picture emerges from the national epidemiological dataset on HIV infection.

But the flipside of the 4.41% - let’s call it 5% to round it out - is that 95% of gay and bisexual men in New Zealand *don’t* have HIV. This is another important element that we have to remember. So while we are

by far the most at risk subgroup from HIV in New Zealand, 95% of us are still not infected. In other words, while most gay men in New Zealand don't have HIV, most people who do have HIV here *are* gay men.

The next slide (slide 4) shows the proportion of the New Zealand population comprised of gay and bisexual men. I've taken a general consensus figure of 5% of males in developed countries across various measures of attraction, orientation and so forth, divided it in two to result in 2.5% of the overall population. This small group accounted for 83% of the HIV infections acquired here in 2010. So in overall summary: Most people with HIV in New Zealand are gay and bisexual men (so targeting specific prevention messages to that minority group is vital), most gay men in New Zealand still do not have HIV, and even after thirty years of international HIV transmission we remain one of the most successful countries in the world in our overall management of the epidemic.

So the need to target gay and bisexual men in the local context is clear, but what does the picture look like in international comparison? The next two slides illustrate the situation as clearly as anything I have seen. Slide 5 focuses on low and middle income countries and it shows a much higher burden of HIV infection in gay and bisexual men across the board. Now that was not clear in the early days of the HIV epidemic because in almost all countries in Africa there were no studies of HIV prevalence in gay and bisexual men and almost no open social recognition of the presence of homosexual behavior either. As global attitudes on sexuality have changed, we're finding a very clear picture of heightened risk in gay men everywhere around the world that is similar to that already seen in western countries. Slide 6 highlights the deeply alarming situation in New York between 2005 and 2008 where the HIV case rate in gay and bisexual men was 140.4 times as high as that in heterosexual men. Gay men are at very high risk indeed from this retrovirus.

I think that those last five slides taken together lead you to ask a very basic question: Why are gay and bisexual men so disproportionately affected by HIV?

The first clear scientific data that helped to answer that question came from the San Francisco Men's Health Study and was published in JAMA in 1987 (slide 7). A key point to note is that alarmingly high HIV prevalence levels of almost 50% or more are possible in gay men. Prevalence doesn't have to be 4.4%. It can be extremely high under the right circumstances for HIV transmission - which means no condom use for anal sex and no awareness of HIV risk. But the main point I want to highlight from this paper is the finding that only receptive anal/genital contact had a significantly elevated risk of HIV infection. And that was the first really solid piece of scientific information we had which indicated just how risky unprotected receptive anal sex is for HIV transmission. We had also had clear biological evidence published the previous year that retroviruses cannot pass through intact latex condoms (slide 8).

In the context of the New Zealand epidemic response in the early days, that data triggered a move from generalised safe sex guidelines that covered everything (ie: anal sex, oral sex, kissing - any potential body fluid exchange) to something that was formalised in all our prevention advertising material from August 1987, which is that we were going to concentrate just on promoting condom use for anal sex. This is really important because we then had a decade long programme in this country which ran from

1987 to 1997 which exclusively encouraged that behavior change intervention. We didn't talk about oral sex much and certainly didn't worry about kissing from that point on. We took the position that the available evidence suggested that unprotected anal sex represented by far the largest HIV transmission risk, so the best use of our limited human and financial resources was to direct all of our firepower onto promoting condom use, and that would make the biggest impact on the future management of the epidemic. Slide 9 illustrates the new focus of our HIV prevention campaigns from August 1987.

Now in October 2011 we have a lot of unequivocal data that backs up the findings from the San Francisco Men's Health Study in 1987 and actually explains it, so I can cite chapter and verse on why that is the case. We now understand far more about the biology of anorectal HIV transmission as slide 10 illustrates. There are six separate points summarized there which explain why there is an especially high risk of HIV transmission from unprotected anal sex, and I'm sure there is still a great deal more to find out about this yet. So if you think that summary is worrying, wait until you see what that slide is likely to look like a decade from now. We must accept that we are talking about a very high risk sexual activity from the standpoint of HIV transmission, and that the core reasons for that are biological and not socio-cultural.

Slide 11 summarises the main finding from the recent Baggaley, White and Boily (2010) meta-analysis and systemic review which concluded from all the available data in developed countries that unprotected receptive anal sex is 18 times riskier than unprotected receptive vaginal sex. I think that clearly validates the decisions that were made in 1987 to focus all our prevention resources on condom promotion for gay and bisexual men.

So, in summary so far: We've established that overall New Zealand is doing well, we've established that gay men bear the biggest risk of HIV infection but that most gay men in NZ don't have it, that gay men everywhere are at disproportionately affected and the main reason for that is because of anal sex, and there is some very specific biology behind that which most people don't clearly understand - including the majority of our medical practitioners at this time.

That leads to the second big question: Where has all this work to focus HIV prevention on reducing transmission through unprotected anal sex got us since 1987?

The short answer is that from the first high point of new diagnoses in New Zealand in 1989, just two years of after we started focusing exclusively on anal sex, you see a line which steadily tracks downward to a low point in 1997, ie: 10 years later (slide 12). Sometimes people ask what evidence we have that condoms work? Well, in fact the slope of that line is pretty good evidence that they do because promoting condoms was our entire behavior change message over that period. We concentrated on that and did not allow ourselves to be distracted by other approaches that sidelined condom use (such as 'negotiated safety' or any other 'grey area' risk minimization strategy).

This slide summarises a lot of information especially when it is considered in conjunction with the following two. The first point is that it took us a while from when we first started actively promoting safe sex in August 1985 to get the epidemic under control in gay men here. That was partly because a lot

of people came back home to New Zealand from overseas with HIV, and we have no way of knowing in retrospect what the mix between those infected in New Zealand and those infected overseas was for any HIV diagnoses before 1996 - but it is probable that infection overseas accounted for the great majority of those early cases. Clearly we succeeded over the 10 year period (1987-1997) in reducing new HIV diagnoses very sharply. Also as a result of legalized needle and syringe exchange (also from 1987) we have never had a problem with HIV transmission through injecting drug use in New Zealand (including through IDU in gay men). New HIV diagnoses have clearly increased steeply in gay and bisexual men since 2000 (the blue line on the graph in slide 12), and so also did the red line (heterosexual transmission) between 1999 and 2006, but as is apparent from slide 13, the red line is primarily a result of importing people into the country through immigration, refugee resettlement and family reunification who have a pre-existing HIV infection. After that policy was amended in 2005 this inflow of HIV positive new residents began to fall sharply.

Let's now move on and examine the following two bar graphs in more detail. As you see in slide 13, the number of heterosexual people infected in New Zealand remains very small indeed. The number of gay men infected in New Zealand in 2010 was 67 out of 35,000, 50,000 or 70,000 (depending on the estimated size of the gay male population), but the number of heterosexual people infected in New Zealand in 2010 is 10 out of approximately 2.78 million, so it's a totally different denominator. People often fail to recognise the importance of the size of the denominator, and it is a mistake to do that.

What that means is - to be quite clear - New Zealand has never had a domestically driven HIV epidemic in *any* group other than in gay and bisexual men. Not at any time. We have reliable data on where gay men were infected from 1996 (slide 14), and we know that between 1997 and 2000 by coincidence just 21 cases each year were diagnosed each year for four years in a row where infection is known to have occurred in New Zealand. That is, to be perfectly clear, a very significant achievement in international terms. There is really only one way to go with a sexually transmitted viral infection like HIV in a population of around 3.8 million after that point, and inevitably that is up. So nobody should be particularly surprised that new HIV diagnoses in gay men have risen since then. However it is important also to acknowledge clearly that we remain very disappointed that new HIV diagnoses have gone up in gay men here. We certainly didn't want them to go up and we are working hard to find a way to get them to go back down again. But the reality is that the picture between 1997 and 2000 was an extraordinarily good result which everyone in New Zealand more or less got accustomed to. And then new HIV diagnoses in gay men suddenly rose over the next four years and since then new diagnoses have continued to rise but much more slowly, with the highest point of all in 2010 (by just one or two).

That is the central issue we have now to examine, because from 2000 on we have had an epidemic of HIV in New Zealand which we know is driven primarily by domestic transmission. We can't say this for sure before 1996, except I can tell you from reliable anecdotal evidence that many of the early cases certainly came from overseas. You can't contract HIV if there's no one present who is infected to acquire it from - that is the bottom line. The end result is that having clear knowledge about where the virus was contracted has been one of the most pivotal pieces of information for getting gay men to tune in once again to HIV risk messaging since 2000.

Now let's step right back again for a minute. I'm going to put all parts of the local HIV epidemic other than that in gay men to one side now. We're going to forget about everything else with the exception of the data on slide 14, look at the increase in new infections acquired in New Zealand and ask: "What it is that happened from 1997 on when we had achieved this low end point outcome - purely by promoting consistent condom use for anal sex?"

What has caused that sharp rise in new HIV diagnoses? The next slide (slide 15) is a timeline for antiretroviral medication rollout divided into 1986-1990, 1991-1995, 1996-2000, 2001-2005 and 2006 on. It shows the month and year of FDA approval for the various antiretroviral medications, and as you can see, there was one in 1986-90, four in 1991-95 and then a massive number between 1996 and 2000. Of course 1996 was the year that combination antiretroviral therapy was bought in overseas and I think it happened just a little bit later here in the middle of 1997, which just out of interest, coincided with the low point of new HIV diagnoses in New Zealand. It may indeed have contributed to it - you certainly cannot discount that possibility.

So if you look at the epidemic in the broad, there's a massive change in antiretroviral availability from 1996/97 and you can see this plainly illustrated on slide 15. Slide 16 is the incidence rate of opportunistic HIV related illnesses among adults and adolescents with AIDS in San Francisco and you can also clearly see what happened there between 1996 and 1997. There is a precipitate drop from 1994/95 levels where the lines on the graph just fall away and that obviously is reflected - as I will stress later - in death rates too. Essentially that is also the point in time which marked the start of a major change in gay community demands on NZAF, because before 1997 the pressure - enormous, grinding pressure - was on our support staff who were dealing with people who were ill and dying. Our prevention programme on the other hand was interfacing with a community that was cohesive, that had successfully seen the passage of important gay law reform initiatives, was still clearly listening to HIV prevention messages and was by and large very concerned about avoiding risk. I often say, because I think it's a very good way to think about it, that every gay man knew what the *question* was and it was just up to us to provide the *answer*. And people were hungry for that answer because they did not want to die, which is a very strong personal motivation for action.

Then effective combination antiretroviral therapy was introduced, followed immediately by the drop shown in slide 16 in the incidence of new opportunistic diseases. This represented a major change in health status for positive people. And that immediately altered the equation - but we didn't fully understand at the time just how strongly it had affected it. We realized that the prognosis was improving for HIV positive people but we didn't appreciate the extent to which it was going to result in a decline in levels of concern from negative gay men over time, and indeed from *everyone* else as well, around HIV risk.

It is centrally important also to acknowledge that the introduction of combination therapy marked the starting point for a steady annual increase in HIV prevalence in gay and bisexual men, which is the direct result of steep reductions in HIV related mortality. Not only that, but because HIV related morbidity was also reduced, more HIV positive gay men were also resuming sexual activity. It is completely clear in retrospect that any post-treatment declines in condom use in this group would inevitably have serious prevention consequences over time.

And there's another major thing that also happened coincidentally with this, which is the second important explanation for the sharp HIV transmission rise since 2000: The internet was really taking off.

I said right at the start that the major risk was unprotected anal sex, but we also have to remember when we are looking at an epidemic we're looking not just at transmission in dyads between two people (slide 17). To create an epidemic HIV has to spread right throughout a sexually connected network. What we saw in slide 3 was that about 5% of the gay population in New Zealand was infected in 2006, but by January 1985 48.5% of gay men in San Francisco had already acquired HIV (slide 7). So in other words, an epidemic is a *population* phenomenon, and in order to be a population phenomenon it has to spread effectively from one person to another. So it's not just that the sexual activity itself is very risky for HIV transmission. If gay men only had anal sex once with just one person in their life, the epidemic - as everyone can immediately understand - would not grow, no matter how risky anal sex was. But when you put that heightened risk from receptive anal sex into the context of a highly sexually active population with multiple partner changes over a short period of time, then you have the capacity for very rapid transmission of the virus from one person to another.

So the nature of the sexual network is another thing that is critical in trying to work out why the increase happened, because the sharp rise that we see here requires a complete explanation. What I'm saying is that anal sex was certainly going on before, so what was it that actually resulted in this step change in HIV transmission occurring? I don't think there's any doubt that part of explanation is to be found in major changes in sexual network structure (illustrated in slide 17) that were driven by the internet.

Person C in here is right in the middle of the network even though they've got the same number of sexual partners - friendships in this case, but let's call them sexual partners for these purposes - as Person D. The key point is that Person C is very, very closely linked in with a whole lot of other people and Person D isn't. So, the reality is that if HIV somehow gets into the network around Person C it is going to spread far more quickly than if Person D gets it, because it's only got one or two ways to go, so it takes a longer time to move through the population. So, for rapid spread you have to think about that as well and this is the key point with slide 17, that the internet really came into its own as a significant new source of sexual partners for gay men at the same time.

So from 1996/1997 new antiretroviral treatments were available and people started to really think they were going to work, and that optimism firmed up between 1998 and 2000. Then the internet also really came into play as well in terms of all of the new options for partner acquisition that it has provided (illustrated in slide 18). So those two things together shifted HIV transmission to a higher level. I think a good way to understand that is purely at the level of partner availability. What the internet did was that it massively increased sexual partner availability - for both HIV positive and negative gay and bisexual men. As slide 9 (NZAF's condom promotion poster from 1987) says: "It takes two to have unsafe sex, but only one to prevent it". So everything to do with condom use is dyadic (ie: it involves two people at minimum), and even if someone wants to have unprotected sex, if their partner won't have it with them, then it cannot occur. Which is another reason why when we are thinking of 'treatment for prevention' it is vital not to imagine you can solve the whole problem just by working with the 5% of gay men in New Zealand who have HIV and ignoring the other 95% who are negative. Because most of the

time, the 5% will be having sex with the other 95%, and if the 95% make themselves *available* for unprotected anal sex, the virus will inevitably spread.

So, an important driving issue was a step change in partner availability at the turn of the century - a major change - and unfortunately a lot of these men probably didn't have a close gay community connection or a strong history of understanding the HIV epidemic. Also a significant number of those who started to use the internet to find sexual partners at this time were not necessarily comfortable with their sexuality and so were trying to edge into the gay scene in a more secretive way that the internet actively facilitated. This opened up a relatively inexperienced new sub-population in terms of HIV transmission risk, and we had no HIV prevention material up on internet dating/sex sites at that time to address any of those issues in a meaningful way.

The end of result of those two things that I've just described (ie: the introduction of effective new drug treatments and the step change in partner availability facilitated by the internet) feeds into the next graph (slide 19) which is the percent naming HIV/AIDS as the most urgent health problem facing the United States. That data is not just from gay men of course but for everyone, and I think there are some very interesting things to say about it. In October 1987 when everybody was still terrified of HIV - almost universally - 68% thought it was the most urgent health problem facing the United States. Then you notice that by the time we got to 1997 when treatments came in that concern had already dropped by 30%. I think that's probably because the general public had realised by then that most people were not at risk and so were less worried about the epidemic. It would be interesting if we had a parallel graph of attitudes to HIV in gay men but we don't.

You'll also see that from 1997 until the present public concern has dropped by another 30% and I think you can put that decrease down to two things: The continuation of the fact that in the United States all of the other HIV sub-epidemics were in decline except for the one in gay and bisexual men, and the fact that a lot of people now think that the heat has been taken out of that sub-epidemic as well. So in the end we have this situation where we're trying to run prevention campaigns for gay men in an overall social context where from October 1987 to March 2009 the proportion of people who were really worried about HIV has collapsed from 68% to 6%. The flow-on effect of that general population attitude shift on our community and on the extent to which people are personally worried about HIV is inevitably very significant. A lot of that is of course driven by the media, and with this data there is also a series of associated slides (not included here) which show sharp decreases in mainstream media coverage of the HIV epidemic. That started to fall away in the United States from 1987 as news media interest turned elsewhere. So more and more, if we want people to understand the rise in new diagnoses since 2000 we have to deal with that changing social context and the next few slides elaborate on that point.

We're now at slide 20. I discussed at the start (slides 5 and 6) that HIV has had a disproportionate impact around the world on gay men in terms of the total percentage of the population infected (ie: the percentage of gay and bisexual men with HIV compared to the percentage of the rest of the population). But from 2000 on - for the reasons that I've outlined in terms of antiretroviral treatment, the effect of the internet and probably less HIV awareness in the new generation of gay men as well - virtually everywhere you look around the world there has been a ramping up of new HIV diagnoses in gay and

bisexual men. This has occurred across the board more or less in developed countries, with the possible exception of Sweden which did well until 2006 but then recorded increases in gay men much like everyone else. As an aside, it is important to note that Sweden spends a great deal more money per capita managing the HIV epidemic than most other places. So by 2008 every developed country had seen an increase in new HIV diagnoses in gay men. This means that whatever has caused it has happened everywhere. It has affected all of us, including countries that are focused very strongly on condoms, and so our situation is not unique except that the rise in new HIV diagnoses in New Zealand has been off an extremely low base. So for anyone who might conclude that our condom programme is no longer working as well as it did and that we should now be looking at other interventions, the reality is that we are still doing well in any possible international comparison.

Another smoking gun on what has gone on in the world between 2000 and 2010 for gay men is, of course, to ask the question: Is this increase *just* HIV-related? If partner availability is a significant driver of it, you would also expect to see increases in a whole series of other STIs - and in most places you see exactly that (slide 21). The increases appear to be somewhat less pronounced in New Zealand because condoms significantly reduce STI spread too - not as well as they manage HIV, but still substantially. But in the countries that haven't focused primarily on condoms promotion, or where they have more or less abandoned sexual behavior change programmes by neglect or because they thought it was too difficult for some reason, you see the same increase since around 2000. So once again that data in slide 21 shows clearly how the same sort of increase in new STI diagnoses has happened in gay men in the United Kingdom since 2000.

The reason I show those two slides a lot - and maybe I don't often hammer home the reasons hard enough - is that you can't escape the connection between HIV and STIs in gay and bisexual men. And there's a deeper connection here too that we also have to remember: There is a direct synergy between HIV and the STIs in terms of spread as well, namely that many STIs increase the likelihood of contracting and transmitting HIV, and HIV can in turn increase the likelihood of contracting and transmitting many STIs - especially in the context of unprotected anal intercourse. That is an incredibly important issue. We must never forget the STIs and we must never forget the central role that condoms play in helping to control them.

Slides 22 and 23 clearly illustrate several important issues using more data from the United Kingdom. The orange line going across the top in slide 22 is annual HIV diagnoses in gay and bisexual men. The dark green line is AIDS diagnoses and the yellow line is AIDS deaths. The latter two both show a sharp decline from 1996 when effective treatments were introduced, and the first shows a clear increase in new HIV diagnoses from 2000. As this is specifically MSM data and you might wonder what happened after 2005. This is shown in slide 23 and you can see how new HIV diagnoses have continued to climb. That is a really alarming result of nearly 1,000 more diagnoses per year in the United Kingdom than at the earlier peak of the HIV epidemic in 1984. It is very unlikely that would have happened if condom promotion programmes had been strengthened for gay men.

So the question is: "What do we have to put in place to deal with this problem effectively?" I have already summarized the New Zealand HIV prevention strategy since 1987 and I think it's important to finish by talking about condoms and why they work.

We know that condoms are effective, and because it would have taken a lot more slides to do so, I haven't laid them all out again here, but we have the requisite data to hand. A minimum 95% reduction in HIV risk occurs when condoms are used *consistently and correctly*. Note that there is a benchmark study of heterosexual transmission in Europe which had zero transmissions in a very large sample of HIV discordant couples under those circumstances of both correct and consistent use. A problem with the majority of condom studies is that all people have to do is say that they have used them when they haven't and it makes condoms look like they are significantly less effective than they actually are. In fact most published studies on condom effectiveness have methodological biases of one kind or another that favour the null hypothesis. People also apply a standard to condoms that they don't apply to any other domain of health promotion. Have you ever - even once - heard someone say that seatbelts don't work when there has been a report in the media that someone has crashed in their car, gone through the window and killed themselves when they were not wearing their seatbelt? Does anyone say that seatbelts don't work under those circumstances? I suspect you have never heard that and nor have I. People always say that someone failed to put on their seatbelt. The problem is sheeted home completely to user failure. But when gay men don't use condoms consistently, you often hear it said that condoms don't work. Now, I think we have to get quite serious about dissecting the implications of that difference in attitude, and that is partly what the last four slides are about.

Slide 24 makes clear that: "It is very important to recognise that everyone who transmits HIV increases the future infection risk for other gay men." And this means an increased risk for *all of us* whether we use condoms or not. "Over time one single episode of unprotected anal sex can be the direct cause of a large network of new infections." Because of the nature of our sexually active population, dyads turn into chains and chains turn into complex sexual networks in very short periods of time. "The corollary also applies: A significant reduction in HIV transmission will spark a self-propagating decrease in spread over time because there will be less people who can pass HIV on to others." That is, a self-propagating decrease in HIV spread will occur at the population level as opposed to the self-propagating increase that happens when condoms are not used.

Slide 25 is a reminder that vaccines are a surprisingly good analogy for behavior based prevention. I've yet to find any level at which this analogy is not useful. For example, I think everyone knows that we currently have a resurgent measles epidemic occurring New Zealand, and that is because there has been decreased uptake of measles vaccination. One of the important ways that vaccines operate is that they cause a self-propagating decrease in the spread of infectious diseases because if you don't have them you can't pass them on. So other people are in effect also protected when someone makes a decision to vaccinate their child against measles. So if you vaccinate your child and then send them to pre-school, not only is your child going to be protected, but the other children are going to be protected from the risk your child would have posed to them if your child had been infected with the disease.

Exactly the same thing applies when gay men use condoms for anal sex. The gay men that use condoms are also protecting other men that they don't even know from HIV, compared to the gay men who don't use condoms and who usually unknowingly pass HIV on. They can then set a bow wave of new infection off, introducing a new infection into the sexual network which then starts bouncing like a billiard ball from one person to another.

The term for this is 'herd immunity'. It is the indirect protective effect of vaccination on people who are not vaccinated themselves. So, in fact condom users are also protecting people who don't use condoms, and the corollary applies as well - the people who don't use condoms are putting all the rest of us at heightened risk. So that means that the idea that it is entirely an individual's free choice whether they vaccinate their child against measles or not is completely wrong. Similarly the idea that individual gay and bisexual men are free to choose whether they use condoms or not in a highly interconnected sexually active population - linked in 2011 by NZDating, Grindr, Facebook and everything else - is also completely wrong.

So the vaccine analogy is a particularly effective communication tool. It is also powerful because it reminds you that even when we had been very successful (ie: got the majority of the sexually active gay and bisexual men using condoms and achieved very high levels of individual condom use) all you have to do is introduce the next generation of gay men each year into the population and gradually your proportion of condom users will steadily decline if you don't continue to promote condoms actively across the board. It is also a useful analogy because, even for the people who have been using condoms reliably for a while, it is necessary from time to time to give them the equivalent of a 'booster shot' explaining why it is still important to maintain condom use even though HIV is no longer a rapid and inevitable death sentence.

How can this be done? One of things that it is becoming a priority for me to repeat regularly again is an explanation of how HIV works inside the body. After launching into a general discussion about the biology of the virus I usually present a 'thought experiment' along the lines of the following:

"I have explained a little background about genetics and how HIV is transmitted. I want you to imagine now that I'm going to inject you with a piece of genetic material which will destroy the biological systems in your body that control your ability to fight off infectious diseases and cancer. And I'm going to insert that DNA into your cells in such a way that after a time many of the cells in your body will have it, and will automatically operate to damage your immune system in future without me having to do anything else. It will also be impossible for anyone to remove that piece of genetic material from your body once it is established there. Do you think that would be a good or a bad thing to happen? Would you think that was just like getting a cold or the 'flu or something similar? Because my reaction is that there is just an enormous world of difference in biological terms between infection with HIV and infection with most of the other viruses and bacteria that we generally encounter in the course of our lives".

That is partly because - and this point goes to the heart of the knowledge issue as well - most people do not understand any of this basic biology. Unfortunately the HIV epidemic is a highly complicated beast. It is simple to stop the transmission of HIV if condoms are used carefully and consistently, but not easy to persuade people *why* condoms need to be used. You are probably familiar with the old line: "If you have to explain something, you have already lost the argument." That is now a touchstone in contemporary communication. In these days of bumper stickers it is the person that gets the message out there as bluntly as possible and as quickly as possible that usually wins the argument. So for all these reasons I think that the vaccine analogy is particularly useful communication tool.

I want to draw all this together now with slides 26 and 27. In thumbnail summary, we designed our HIV management strategy when we knew very little about the virus, and we now know a great deal about why condoms work so well. We also know - and this is important - that for a behavioural intervention it can have a very high level of uptake. We know that because condom use *has* had a very high level of uptake in the past, so that is not just a hopeful assertion. Our central task now is working out how to increase that level of uptake once again across the board, and in order to do that we must make sure that gay and bisexual men are informed about HIV and the other STIs. It is important that everyone who needs to hear the condom message receives it and that they also have enough background information about the issues so they can clearly see why they should use condoms for anal sex.

I think our target communities are generally divided into two groups on these matters. Many people are not very interested in the biological background. They just want advice from sources they trust about the best course of action to stay safe and are therefore likely to be happy to rely on NZAF's expertise. But other people want to contest everything, as you know. They want to pick it apart and dissect it, and they are quite suspicious of professional authority. What needs to happen in that case is that people must be given the clearest and most irrefutable overview of the argument that we can put together.

In that respect it is hard to go past two of the sentences in slide 26: "The male latex condom is the single, most efficient, available technology to reduce the sexual transmission of HIV and other sexually transmitted infections." And: "Condom use is a critical element in a comprehensive, effective and sustainable approach to HIV prevention and treatment". There is still nothing available other than condom use that comes even close to being as effective for HIV prevention in gay men at the population level.

We must always remember that we are trying to accomplish two things here: We are trying to stop epidemic transmission between *individuals*, but we are also trying to stop HIV spread at the *population* level. And in order to lift an epidemic control strategy to population scale, you first have to establish if the intervention will work at a population level, and this is where the 'treatment as prevention' approach has yet to prove itself. Everyone now fully endorses the idea that it is important to target substantially increased effort into the 5% of gay and bisexual men who are HIV positive in this country - it is a given that we need to test people more regularly and also to institute HIV treatment much earlier for those who are infected. But we must also accept that there is at present very little evidence that the HIV epidemic in gay and bisexual men can be managed successfully by working with HIV positive people alone. Even if we could locate every single person with HIV in the country - and we know that you can't find the people who are in the acute HIV infection stage by antibody testing for a start - it is extremely unlikely that the epidemic would be controllable without the active involvement of the 95% of gay men in New Zealand who are HIV negative. If we do not actively recruit negative men into the overall HIV management campaign to work together with positive men it will almost certainly fail.

By definition you cannot recruit negative people into a programme that is focused exclusively on managing HIV positive people, and in so doing you exclude HIV negative men from a meaningful role in HIV prevention. For all these reasons it is clear that the best way forward at this time is a two strand strategy that aims to maximize condom use for HIV and STI prevention (slide 27) and *also* to ensure early and effective HIV and STI treatment in the gay and bisexual male population (slide 28). And we

must clearly acknowledge too that there is still some way to go before we can be sure how efficacious antiretroviral treatment is at the individual level in preventing HIV transmission through anal sex, let alone whether it will work effectively to stop HIV transmission at the population level for MSM in general.

There are three things that could alter this picture meaningfully in future if they were to happen. One development that would be a big step forward from what we have now is moving from effective combination treatment to a sterilizing cure. One downside is that it would be harder to maintain condom use and that still matters because a sterilizing cure for HIV is very unlikely to eliminate new HIV infections at the population level, and it certainly will not stop the spread of other STIs between gay and bisexual men. But in order to answer the question of whether sterilizing cure is even theoretically possible it is necessary to think about the underlying molecular genetics of HIV. As discussed earlier, the current state of affairs with HIV infection is like taking a small piece of software, putting it into a computer and having it lodged there in such a way that it cannot ever be removed. You don't have any virus protection system that can permanently extract it once it has been installed.

So the development of a sterilizing cure would be a big step forward, but of much greater importance still would be the ultimate goal of sterilizing vaccination. That is different approach to therapeutic vaccination where you give someone a vaccine and it just stops HIV causing illness - the virus is still present inside the body but the vaccine reduces the chance of transmission and especially the likelihood that the vaccinated individual will become sick. Therapeutic vaccination would certainly be an important development, but HIV will still be grinding away causing systemic inflammation and ongoing biological damage to the infected person. So while it is likely to be much better than regular drug treatment, it is still far from the ideal option.

However the development of a sterilizing vaccine would alter the picture completely. As soon as one is developed and in production we will have a massive step change in HIV management that will alter everything across the board - except of course that the substantial risk from other STIs will not be reduced. However I think everyone understands that the biological challenges that scientists will need to confront before a sterilizing vaccine for HIV can be developed are monumental. One internationally prominent vaccine researcher commented a few years back that if we succeed in developing a sterilizing vaccine for HIV we will also have the knowledge required to wipe out most of the cancers. In other words, when we eventually get to that point we will have the ability to manage a great deal more than HIV alone.

Until we reach that optimal goal I do not believe we are likely to have anything that is as good as universal condom use to protect sexually active gay and bisexual men from HIV and STI infection. The central issue that we always have to determine is the capacity for full population upscaling - how do you get comprehensive population coverage? Until you have *proved* you can upscale alternative prevention interventions, it would be deeply irresponsible to allow our most efficacious *and* effective behavior change strategy based around condom promotion for anal sex to fall into disuse. This means that the correct way forward at this time can be best summarized as 'prevention + treatment', in other words steady evolutionary development of our current strategic and tactical approach to HIV prevention and clinical management of HIV positive people. Sterilizing vaccination would certainly create a

revolutionary change in the present scenario, but that remains a tantalizing scientific prospect for another time.

Tony Hughes
Research Director
New Zealand AIDS Foundation
Auckland

Transcript: Recorded October 2011
Edited November 2012

Slides: Attached

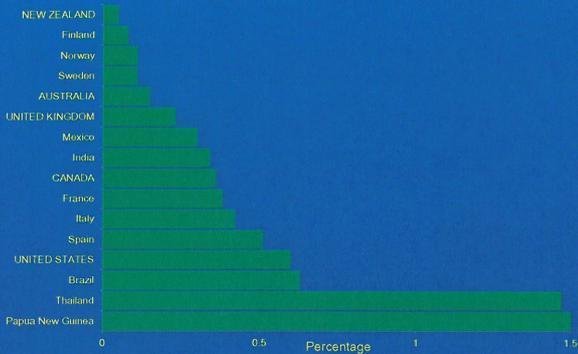
HIV epidemic control in gay men in New Zealand: The big picture

Tony Hughes
 Research Director
 New Zealand AIDS Foundation

Overview for HIV knowledge project, NZAF National Office, Auckland, 25 October 2011

“The HIV epidemic in gay men is extremely complex and difficult to manage. It cannot be controlled without an in-depth scientific understanding of the behaviour of the virus and the dynamics of its transmission at the populational level.”

HIV prevalence in the adult population aged 15 – 49 years in selected countries, 2007



UNAIDS, WHO and UNICEF. Epidemiological Country fact sheets on HIV and AIDS. New Zealand, Finland, Norway, Sweden, Australia, United Kingdom, Thailand, Mexico, India, Canada, France, Italy, Spain, USA, Brazil, Thailand, Papua New Guinea. <http://apps.who.int/GlobalAccess/Access/Access/EFS2008/index.asp>

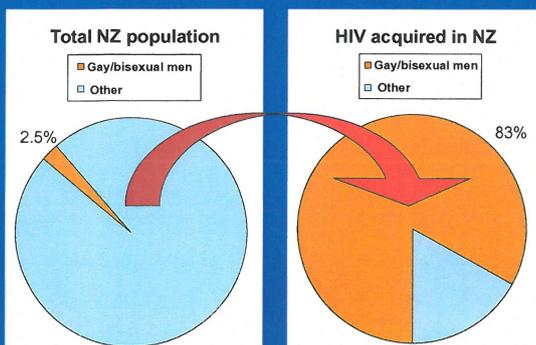
HIV test status in sexual health clinic attenders in 2005-2006

Group	% HIV +	% undiagnosed HIV +
Homosexual and bisexual men	4.41	2.01
Homosexual and bisexual women	0.00	0.00
Heterosexual men	0.12	0.06
Heterosexual women	0.14	0.04

Note: HIV prevalence in homosexual and bisexual men in sexual health clinics in Auckland is 6.07%, outside Auckland is 2.07%, and in New Zealand in total is 4.41%.

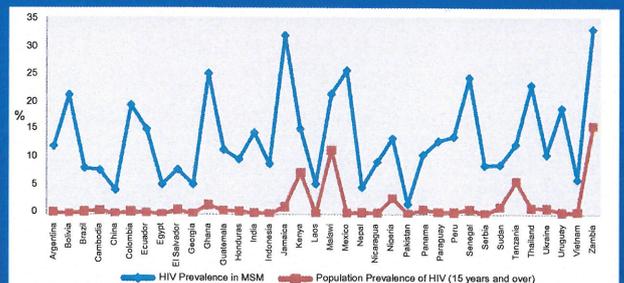
AIDS Epidemiology Group. (2007). Unlinked anonymous study of HIV prevalence among attendees at sexual health clinic 2005/6. Report to the Ministry of Health, Dunedin. AIDS Epidemiology Group, University of Otago Medical School.

HIV infection acquired in New Zealand in 2010



Data provided by AIDS Epidemiology Group, Department of Preventive and Social Medicine, University of Otago. Updated May 2011. Graph produced by Research, Analysis and Information Unit, New Zealand AIDS Foundation 2011.

Disproportionate burden of HIV in MSM around the world



Adapted from: Lacer, K., Ryan, D. "The PEPFAR technical guidance on HIV prevention for Men who have sex with men." UNAIDS/PEPFAR presentation, 2011.

Source: Beyrer, C. et al. "The expanding epidemics of HIV type 1 among men who have sex with men in low and middle income countries: Diversity and consistency." Epidemiol Rev 2010; 32: 137-151.

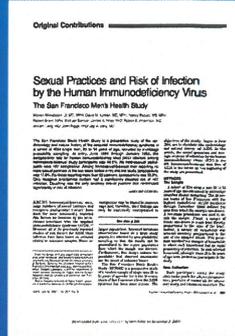
MSM have a 140 fold higher risk for newly diagnosed HIV and syphilis compared with heterosexual men in New York City.



- "The average prevalence of male same-sex behaviour for years 2005-2008 (5.0%; 95% CI: 4.5 to 5.6) was highest among men aged 40-49 years (8.0%) and lowest among men aged 18-29 years (3.9%)."
- "During 2005-2008, there were 9571 new HIV cases among MSM and 1249 among MSW, resulting in an MSM HIV case rate that was 140.4 times as high (95% CI: 132.1 to 148.7) as the rate among MSW (2526.9/100,000 vs 18.0/100,000)."
- "The total number of [primary and secondary] syphilis cases over four years was 2678 among MSM and 334 among MSW, resulting in an MSM syphilis case rate that was 147.3 times as high (95% CI: 130.5 to 163.2) as the rate among MSW (707.0/100,000 vs 4.8/100,000)."

Pathella, P., et al. J Acq Imm Def Syn 2011; 38: 408-416.

Sexual practices and risk of infection by HIV



- "At entry, June 1984 through January 1985, the seropositivity rate for human immunodeficiency virus (HIV) infection among homosexual/bisexual study participants was 48.5%. No heterosexual participants were HIV seropositive".
- "Among homosexual/bisexual men reporting no male sexual partners in the two years before entry to the study, seropositivity was 17.6%. For those reporting more than 50 partners, seropositivity was 70.8%. Only receptive anal/genital contact had a significantly elevated risk of HIV infection."

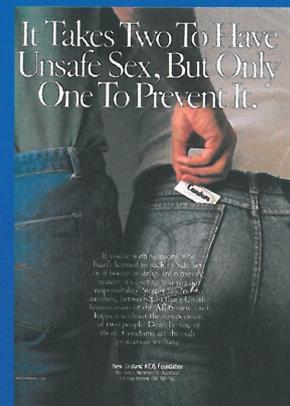
Winklesstein, W., et al. JAMA 1987; 257: 321-6.

Retroviruses do not pass through intact condoms

Sample	Condom	Material	Virus Inoculum (Infectious Particles per Milliliter)*	
			Mouse Retrovirus (10 ^{7.0})	ARV-2† (10 ^{7.0})
1	Trojan ENZ‡	Latex	—	—
2	Trojan ENZ‡	Latex	—	—
3	Fourax‡	Natural lambskin	—	—
4	Ramona Extra§§	Latex	—	—
5	Skinless Skin‡	Synthetic skin	—	—

*Minus indicates no virus detected.
†ARV indicates acquired immunodeficiency syndrome-associated retrovirus.
‡Lubricated.
§Spermicidal drug added.

Conant, M., et al. JAMA 1986; 255: 1706.

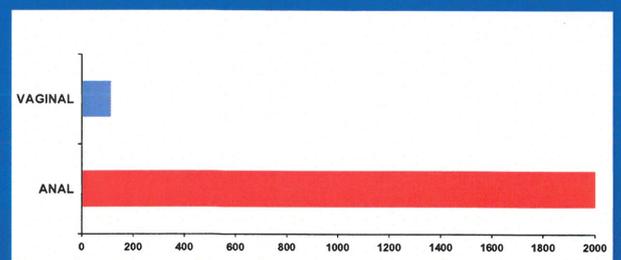


New Zealand AIDS Foundation health promotion poster. OUI Magazine Issue 73: June 1987.

Short summary of HIV biology in the gut

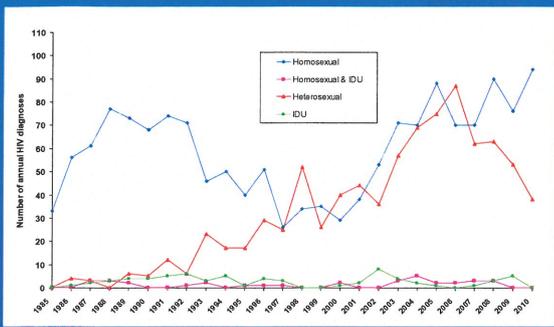
1. The largest number of cells that are directly susceptible to HIV infection are found in the gut (70% of the immune system is located there).
2. HIV has very rapid and substantial effects on these cells from soon after infection.
3. High viral loads are found in gut mucosa, with higher levels of HIV shedding than in blood or semen, even with antiretroviral therapy.
4. Significant damage to the mucosal immune system in the gut persists despite long term antiretroviral therapy, and this increases STI risk.
5. Recently a new receptor for HIV was identified in the gut which further explains the very high transmission risk through receptive anal sex.
6. Damage to the mucosal immune system in the gut not only lowers host defences but also increases HIV replication in blood.

HIV transmission risk for receptive anal and vaginal intercourse without condoms in developed countries



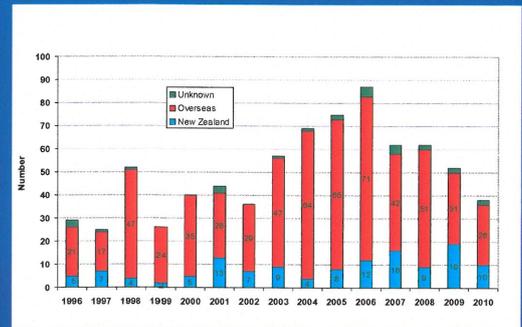
Boggadey, Write and Bolly (2010); Bolly et al (2009); Jim et al (2010).

Exposure category: Annual HIV diagnoses in New Zealand by antibody testing, 1985-2010



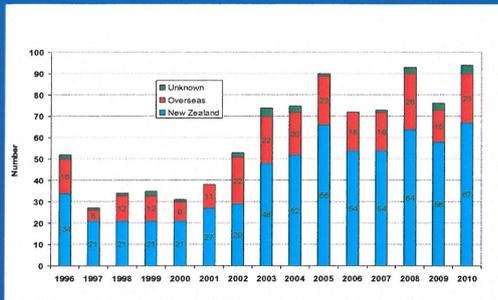
Data provided by AIDS Epidemiology Group, Department of Preventive and Social Medicine, University of Otago (updated May 2011). Graph produced by Research, Analysis and Information Unit, New Zealand AIDS Foundation (2011).
 Note: Does not distinguish between infections obtained in NZ and overseas.

Place of infection: Annual heterosexual HIV diagnoses in New Zealand, 1996-2010



Data provided by AIDS Epidemiology Group, Department of Preventive and Social Medicine, University of Otago (updated May 2011). Graph produced by Research, Analysis and Information Unit, New Zealand AIDS Foundation (2011).

Place of infection: Annual HIV diagnoses by antibody testing in homosexual/bisexual males in New Zealand, 1996-2010

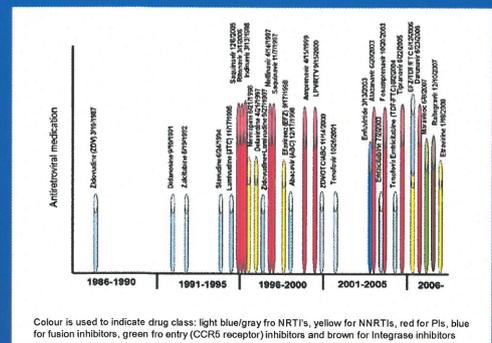


Data provided by AIDS Epidemiology Group, Department of Preventive and Social Medicine, University of Otago (updated May 2011). Graph produced by Research, Analysis and Information Unit, New Zealand AIDS Foundation (2011).

Note (1) Includes both homosexual/bisexual and homosexual/bisexual/IDU.

Note (2) The most recent estimates (June and December 2010) indicate that 1400-1500 people are under treatment for HIV in New Zealand. On this basis that this represents 80% of all people alive with diagnosed HIV, the estimated total of those living with HIV in New Zealand in January 2011 is around 1800 (AIDS, New Zealand issue 67, February 2011).

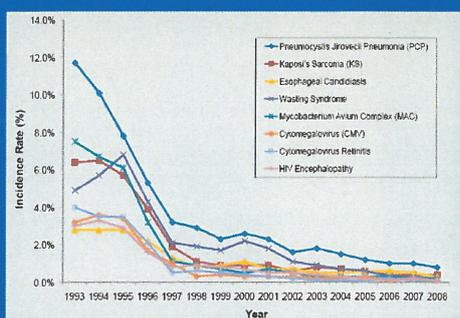
Detailed timeline for the introduction of antiretroviral medication in San Francisco



Colour is used to indicate drug class: light blue/gray for NRTIs, yellow for NNRTIs, red for PIs, blue for fusion inhibitors, green for entry (CCR5 receptor) inhibitors and brown for Integrase inhibitors.

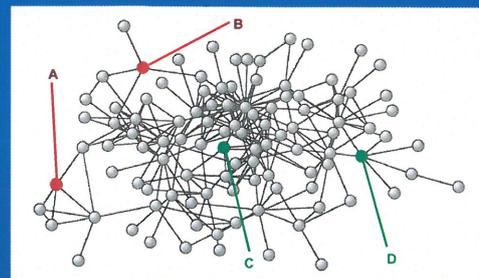
Smith, R.J. et al., Science, 14 January 2010.

Incidence rate of opportunistic illnesses among adults and adolescents with AIDS, 1993-2008, San Francisco



HIV/AIDS epidemiology annual report 2010, Department of Public Health, San Francisco 2011, Pg 63

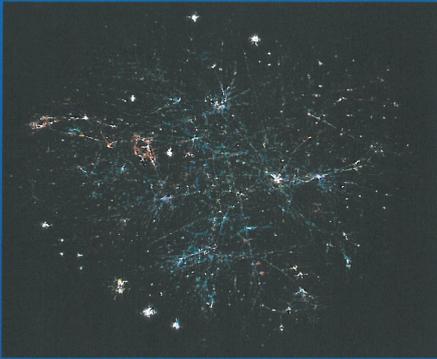
Network of close friendships among 105 college students living in the same dormitory



Each circle represents a student, and each line a mutual friendship. Even though A and B both have four friends, A's four friends are more likely to know one another, whereas none of B's friends know each other. Also, even though C and D both have six friends, they have very different locations in the social network, and C is much more central. C's friends have many friends themselves whereas D's friends tend to have few or no friends.

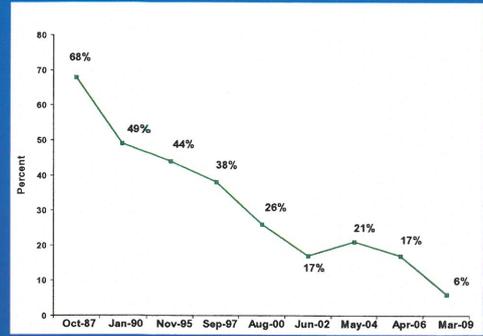
Adapted from: Christakis, N.A., Fowler, J.H., "Connected: the surprising power of our social networks and how they shape our lives," Little, Brown and Company, 2009.

Role of the internet in increasing partner availability



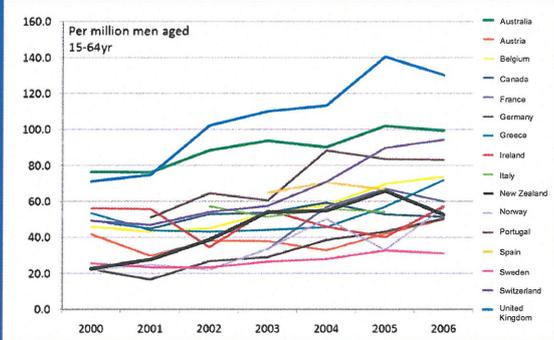
<http://www.cbpe.org/maps/test>

Percent naming HIV/AIDS as the most urgent health problem facing the United States



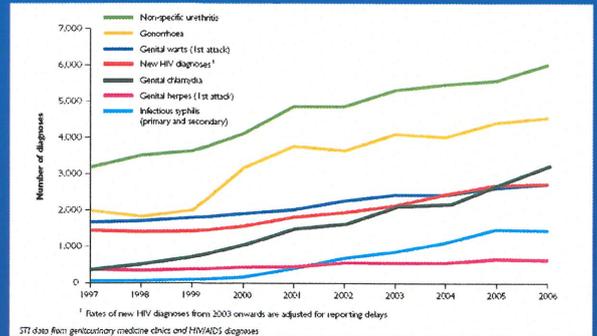
Source: Gallup Fall 1987; Kaiser Family Foundation surveys, 1990-2002. http://hivaidy040209_almon.cfm

HIV diagnosis rate among MSM in major Western European countries plus Australia, Canada and New Zealand



Adapted from: Dickson, N.P. "HIV/AIDS epidemic update". Presented at: HIV clinical update meeting, Auckland City Hospital, 20 Feb 2009.

Diagnoses of HIV and selected STIs among MSM in the United Kingdom, 1997-2006

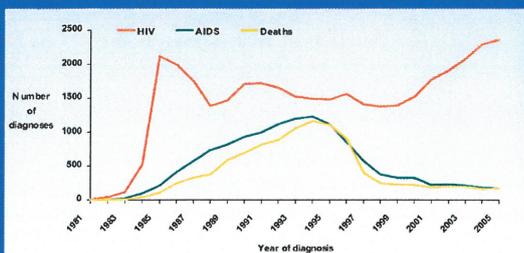


¹ Rates of new HIV diagnoses from 2003 onwards are adjusted for reporting delays.

STI data from genitourinary medicine clinics and HIV/AIDS diagnoses.

Health Protection Agency. "Testing times: HIV and other sexually transmitted infections in the United Kingdom, 2007."

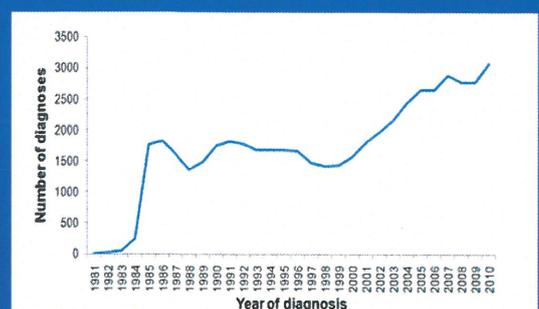
Annual HIV diagnoses and deaths for MSM, United Kingdom, 1981-2005



Numbers will rise for recent years as further reports are received
Clinician reports of new HIV/AIDS diagnosis

HART, G. "Epidemiology of HIV acquisition and transmission in MSM." Expert seminar on partnering patterns and HIV prevention amongst MSM. National AIDS Trust, June 2009.

Annual HIV diagnoses among MSM, United Kingdom, 1981-2010



Health Protection Agency. "30 years on: people living with HIV in the UK: about to reach 100,000." Health Protection Report, 2011, 5, 14-22.

“It is very important to recognise that everyone who transmits HIV increases the future infection risk for other gay men. Over time one single episode of unprotected anal sex can be the direct cause of a large network of new infections.”

“The corollary also applies. A significant reduction in HIV transmission will spark a self-propagating decrease in spread over time because there will be less people who can pass HIV on to others.”

Behavioural prevention: The vaccine analogy



Condoms and HIV prevention: Position statement by UNAIDS, UNFPA and WHO, 19 March 2009

“Condom use is a critical element in a comprehensive, effective and sustainable approach to HIV prevention and treatment. Prevention is the mainstay of the response to AIDS. Condoms are an integral and essential part of comprehensive prevention and care programmes, and their promotion must be accelerated.”

“The male latex condom is the single, most efficient, available technology to reduce the sexual transmission of HIV and other sexually transmitted infections. The search for new preventive technologies such as HIV vaccines and microbicides continues to make progress, but condoms will remain the key preventive tool for many, many years to come.”

UNAIDS, UNFPA, WHO 2009, Condoms and HIV prevention: Position statement, 19 March, 2009



Conclusion

- (a) Maximise condom use for HIV and STI prevention in the MSM population.
- (b) Ensure early HIV and STI treatment for care in the MSM population.
- (c) Evaluate research that measures the individual-level *efficacy* of treatment to prevent the transmission of HIV in MSM.
- (d) Await the development of a research programme that establishes the *effectiveness* of treatment to prevent the transmission of HIV at population level for MSM.