APPENDIX B

DISCUSSION OF THE METHODOLOGY USED IN THE ECOLOGICAL STUDY

The effectiveness of NSPs reducing HIV incidence was estimated by first fitting for each city a linear regression line, on a logit scale, to give an estimate of the overall average annual rate of change of prevalence for each city. Effectiveness of NSPs was then estimated by comparing those cities which ever had NSPs with those cities which never had NSPs.

The justification for this approach lies in the fact that an estimate for HIV incidence in a given city can be taken approximately to be the change in prevalence. Fitting a simple linear regression line, over the entire available time period, for each city therefore gives an estimate of the average annual HIV incidence for that city over the whole available time period. Regression lines were fitted on a logit scale to avoid problems with fitted lines becoming negative or greater than one. There are several advantages to this approach:

1. This methodology was adopted in a peer-reviewed publication in a top-ranking medical journal, and as such represents the most widely accepted standard approach (Hurley et al. 1997).
2. The approach is simple, transparent, unbiased and clearly defined. Fitting a simple linear regression line can be done for each city in a completely consistent fashion without introducing any arbitrary decisions into the fitting procedure which would need either further data or assumptions to be made, and which could introduce biases. The approach also gives a well-defined, single summary statistic, namely the rate of change in HIV prevalence (the slope of the regression line) which can be compared between cities with and without NSPs.
3. The approach is robust in the sense that a simple linear regression gives an overall average estimate of annual change in HIV prevalence over the entire time period considered.
4. The approach is conservative in that by comparing cities which never had NSPs with cities which ever had NSPs, the effectiveness of NSPs will tend to be underestimated.

There are however some possible problems with this approach. First, the estimated annual rate of change in HIV prevalence for a given city will depend upon where in the HIV-epidemic natural history HIV-prevalence surveys were first conducted. In cities which started surveys after a HIV-epidemic was established among injecting drug users (IDUs), HIV prevalence would tend to be high initially, and fitted slopes therefore somewhat low. In cities which started surveys before an epidemic was established, there is the potential for much larger fitted slopes. Furthermore, the effectiveness of NSPs in reducing established HIV-epidemics might not apply to the effectiveness of NSPs in preventing HIV-epidemics among IDUs. In Australia, NSPs were introduced while HIV-prevalence among IDUs was low. The extent to which estimates of NSP effectiveness based on changes in HIV-seroprevalence from all cities, including those cities with HIV-epidemics which were well established, should be applied to Australia is arguable. In order to address this point, secondary analyses estimating the effectiveness of NSPs based only on those cities which had an initial HIV-seroprevalence estimate below 10% were conducted, corresponding broadly to the state of the HIV-epidemic among IDUs in Australia. These analyses gave qualitatively very consistent results to the overall analysis including all cities (see Table 3.1.2), suggesting that the results are relatively robust to this point.

A second criticism of the approach is that fitting simple linear regression lines to each city's HIV-seroprevalence survey estimates is unnecessarily simplistic. It may be that there is a general form to the HIV-epidemic natural history among IDUs, with a rapid increase in seroprevalence early in an epidemic, followed by a plateau as prevalence attains high rates, and possible even a gradual decline as other preventive measures, such as general HIV-education programs, are introduced. A much better fit to the data in each city might be achieved by fitting a more flexible regression curve, for example introducing a quadratic term. An estimate of the rate of change in HIV-prevalence for each city could then be obtained by choosing a time-period, for each city, which corresponded to the epidemic in Australia, and using the fitted curve at the start and end of this period to estimate an average annual rate of change during the period. There are two disadvantages to this procedure. First, the choice of curve fitted to each city becomes somewhat arbitrary. Second, the choice of time period for each city corresponding to the epidemic in Australia would have to depend on further data (which in this case were unavailable) or further assumptions, which could be used to introduce bias into analyses. For these reasons, estimates of NSP effectiveness on reducing HIV incidence were based on the simple linear regression approach described above. However, more complex curve fitting procedures might be the subject of future research.