Time at risk: use of data on transitions between risk categories to explain individual HIV status and community HIV prevalence levels

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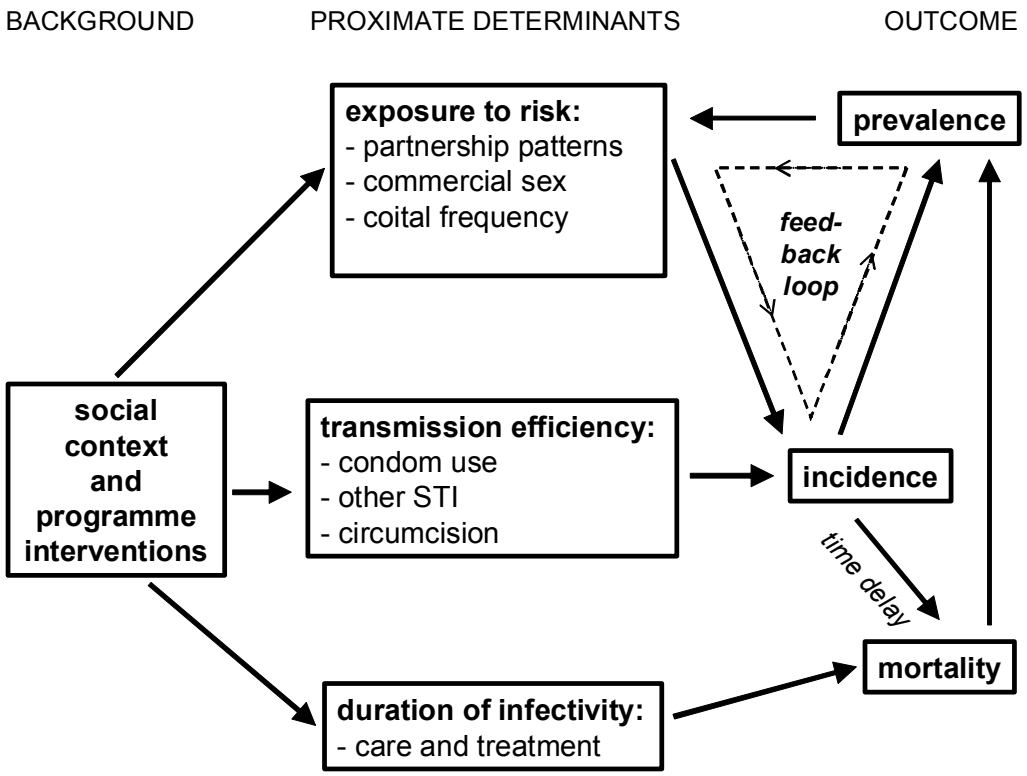
Background & conceptual framework



The simplified conceptual framework shown above illustrates the theoretical relationship between HIV prevalence and incidence and sexual behaviour variables, and is implicit in most efforts to explain differentials in infection rates that are believed to result from different levels of risky sexual behaviour in various communities, or to measure changes in infection rates that can be attributed to intervention programs that aim to modify sexual behaviour. One of the most important aspects of this conceptual framework is the presence of the feedback loop linking exposure to risk, incidence and prevalence. Clearly, prevalence is determined by the historical course of incidence, though it is also affected by HIV-related mortality which removes infected individuals from the population. But prevalence of HIV among the pool of persons from which an individual chooses his or her sexual partners is as important a determinant of the

probability of becoming infected as the individual's actual risk behaviour. The feedback loop implies that for individual level statistical analyses which seek to identify the importance of behavioural factors in determining HIV infection, it is necessary to include (prior) community level HIV prevalence as an explanatory variable if communities with different prevalence levels are included – in other words, multi-level analyses (which include both community-level and individual-level factors as explanatory variables) are more appropriate than simple individual level analyses. Such multi-level analyses can also include summary measures of sexual behaviour at the community level, that will indicate whether the behaviour in the community (particularly behaviour of the opposite sex) is an important determinant of risk once individual behaviour, and community prevalence have been accounted for.

Longitudinal study designs are ideal for explaining infection rates in terms of sexual behaviour, in which individual sexual behaviour and changes in HIV status over time can be monitored. However, such studies are very expensive and time consuming, so the few that are currently under way do not provide nationally representative data. Cross-sectional studies (such as DHS plus) are increasingly being used to measure sero-prevalence, and also collect indicators of recent sexual behaviour such as number and type of partners in the last year, and condom use with these partners. Since HIV is an incurable disease with long duration from infection to death, past behaviour is also important, but difficulties in obtaining accurate data on earlier partnerships have limited the usefulness of enquiries that relate to earlier partnerships.

Methods

An alternative approach to sexual risk measurement involves identifying critical memorable events (such as first sex, first marriage, break-up and re-marriage), identifying the various states marked by these transitions, estimating approximate time spent in each state, and categorising how they ended. A long time spent between first sex and first marriage, or being sexually active after the breakdown of a marriage, implies longer exposure to infection in more casual relationships, and (possibly) a larger number of such partnerships. Duration of a marriage is a measure of exposure to risk from the spouse, and break-up of marriage through separation often implies infidelity by one or other partner. Since AIDS currently accounts for between 40% and 70% of deaths of adults in reproductive ages, the break-up of a marriage through death is strongly correlated with HIV infection in the former spouse. So without asking explicitly about numbers and types of long-ago partnerships, well-designed questions about marital history can yield valuable proxy information about sexual behaviour.

This paper will show how suitable individual and community level indicators of risk can be obtained from marital history and marital status questions used in

DHS surveys. If the latest Kenya DHS data are released on time, allowing linkages of HIV status and behavioural data at the individual level a multi-level statistical analysis will be performed to show the effects of individual and community behavioural factors (summarised at a provincial level) on individual HIV outcome.

These kinds of questions on marital status, marital history and age at first sex have also been recently included in experimental Ante-Natal Clinic sentinel surveillance in Tanzania (11 clinics, 7,000 women) and Malawi (5 clinics, 5,000 women). These studies also allow behaviour and HIV outcome to be linked at an individual level. In one sense, these data are not as rich as the DHS data, as they refer only to pregnant women. However, they include a real time dimension at the community level, since two rounds of surveillance have been conducted in the Tanzanian study and five rounds in the Malawi study. These data will also be analysed using multi-level approaches.

Preliminary results

The results of the multi-variate analysis for women under 25 in the Tanzanian ANC study are shown in the table below. After allowing for all the other risk factors shown in the table, each additional year of exposure to pre-marital sexual activity was associated with an odds ratio of HIV infection of 1.12; and each year of marital exposure yielded an odds ratio of 1.08. Not enough of these young women had experienced marital dissolution and re-marriage for the effects of these to show in the analysis. Background community level HIV prevalence was estimated from prevalence in women aged 25 and over in the same clinic catchment areas, and emerged as a highly significant risk factor, with an odds ratio of 1.06 for every percentage point increase in community prevalence.

The Malawi multi-variate analysis results (not shown in detail) indicate that the adjusted odds ratio of HIV infection associated with marital breakdown was 2.1, the adjusted odds ratio associated with re-marriage was 4.9, and a first marriage lasting longer than 10 years had a protective effect, with an odds ratio of 0.65.

Conclusion

The use of information on episode duration and event histories brings a specifically demographic perspective to behavioural risk assessment, and it is possible to include simple questions on age at first sex, marital status and marital change in a variety of survey instruments, which can provide proxy indicators for the impact of individual and community level sexual behaviour on HIV outcome.

Crude and adjusted odds ratios for HIV infection in women under 25

Explanatory variables		Crude		Adjusted	
		OR	95% CI	OR	95% CI
Clinic site					
	Rural	1			
	Roadside	1.81	1.09-2.99		
	Town	1.56	1.34-1.80		
	City	2.36	1.87-2.96		
Residence					
	Current urban	1.59	1.15-2.19		
	Past urban	1.77	1.39-2.25	1.37	1.08-1.86
Age					
	age *	1.11	1.07-1.15		
Marriage					
	never married	1.37	1.01-1.89		
	currently married	1			
	ex-married	1.23	0.46-3.27		
Childbearing					
	low parity-for-age	2.43	1.78-3.31	2.01	1.47-2.75
Education					
	none	1			
	incomplete primary	1.46	0.86-2.50		
	complete primary	1.32	0.93-1.86		
	some secondary	2.00	1.05-3.79		
Occupation					
	peasant	0.60	0.45-0.80		
Sexual precautions					
	ever used family planning	1.31	1.05-1.64		
	ever used condom	1.85	1.27-2.69	1.58	1.01-2.49
Sexual partners					
	partner < 10 years older	0.60	0.48-0.75	0.63	0.49-0.81
Sexual exposure					
	years pre-marital exposure *	1.15	1.09-1.22	1.12	1.05-1.18
	years since first marriage *	0.97	0.93-1.02	1.08	1.02-1.14
	total years since sexual debut *	1.10	1.06-1.14		
Risk of encountering infected partner					
	clinic HIV prevalence in women>25 *	1.08	1.05-1.12	1.06	1.02-1.11

* continuous variables