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Purple Paper

Perspectives on HIV Prevention in Canada

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1. The Concept of Prevention

Prevention is defined as "measures to promote health, to preserve health, to restore health when it is impaired and to minimize suffering and distress" [1]. In the context of HIV prevention, it can be interpreted to include measures to prevent the acquisition of HIV infection, to reduce transmission from an HIV-infected person and to minimize the disease and disability caused by HIV infection. A hypothetical antimicrobial agent which could cure HIV infection would be an effective form of prevention since it could theoretically eliminate prevalent infections.

Primary HIV prevention reduces the risk of acquisition of HIV infection and thus limits its spread in a population. There are inherent challenges in preventing HIV infection which are not limited to Canada or even to industrialized countries. A recent review examined why prevention programs are failing in the United States [2]. In 2006, *Lancet* published a special supplement which critically examined the complex challenge of HIV prevention [3-10]. Though prevention is clearly critical in controlling the HIV epidemic, across Canada it has not always been accorded the high priority many believe it requires, in part due to lack of effective leadership in promoting prevention and the competing need for services to the HIV-infected.

There are many ways to conceptualize HIV prevention. A useful comprehensive approach to classifying preventive interventions was undertaken under by the Joint United Nations Programme on HIV/AIDS (UNAIDS) [11].

2. The Scope of HIV Prevention

Many factors mediate the conditions for the acquisition of HIV infection; some are described in more detail in Section 3 below. There is little doubt, though, that the "cause" of HIV infection is not only the virus but also the circumstances and factors that lead to its transmission. These can be seen in a causal pathway of four principal stages: (1) cultural, social and economic conditions as contextual factors; (2) individual factors including knowledge, attitudes and skills; (3) "risky" behaviours; and (4) HIV acquisition.

There has been considerable debate about the importance of mitigating cultural, social, and economic factors to reduce HIV incidence. The late Jonathan Mann spoke eloquently about the causes of the HIV epidemic in that sense [12]. He argued that, until we resolve inequities which form the fertile soil for HIV spread, we will not address the true roots of the HIV pandemic.

This approach, although attractive from a systematic conceptual perspective, needs to be examined critically in its application to prevention policy. Though a comprehensive understanding of the causes of HIV certainly includes environmental factors, it is debated to what extent HIV prevention efforts should be focused on these "root causes". Undoubtedly, a better understanding of these factors is an important component of HIV research since we must understand causal factors to effectively intervene. These factors are often referred to in Canada as the "social determinants of health" and, in the United States, although slightly different, as "structural factors". In planning effective preventive interventions, however, we must carefully prioritize given the limited resources available to HIV prevention for several reasons:

1. The role of individual, community, societal and environmental factors in the causal pathway for HIV acquisition is not always clearly understood;
2. Such factors are usually deeply ingrained and not readily subject to change, at least in the short-term;
3. Responsibility for mitigating these factors is usually not within the authority of those responsible for HIV prevention programs;
4. Dedicating significant resources could limit our capacity to undertake more direct HIV interventions that could have a greater and

more immediate impact. Effective preventive interventions should be selected taking into account opportunity costs and cost-effectiveness.

In conclusion, it cannot be assumed that investing substantial resources in changing structural conditions to prevent new HIV infections is necessarily feasible, practical or cost-effective. However, there is no doubt a role for advocacy with respect to policies related to income, employment, housing and civil rights. There is also a place for a long-term perspective in the control of HIV in populations in Canada. The modification of social norms with respect to risky sexual behaviours and condom use is an example of this.

There, however, is another dimension to structural determinants in the prevention of HIV transmission. A clear understanding of the role of such factors helps to target and adapt preventive activities to maximize their effectiveness. The role of structural approaches in HIV prevention is discussed in detail by Gupta *et al* [8] included in the *Lancet* supplement referred to above.

3. Prevention Targets and Objectives

For a program, or a constellation of activities, to be considered a prevention program, objective criteria should be applied. I propose that the principal criterion in this regard should be that the proposed HIV prevention programs have clearly stated objectives that include mitigating or reducing the factors that lead directly or indirectly to HIV infection. Targets for intervention might include the following:

1. Other bacterial and viral sexually transmitted infections (STIs) which may potentiate HIV transmission;
2. Sexual behaviour (e.g. age at sexual debut, selection and number of partners);
3. Injection drug use, especially needle sharing;
4. Substance use mediating risky sexual behaviour;
5. Condom, use and proper application;
6. Discordant sexual partnerships;
7. Knowledge, attitudes and skills;
8. Self-esteem and empowerment;
9. Disclosure of HIV-positive status and partner notification;
10. Access to, and appropriate use of, health services by HIV-infected and at risk populations;
11. STI diagnostic and treatment services;
12. HIV testing and counseling; and
13. Drug dependency.

These targets must be quantified and the success of achieving them monitored (see Section 9 below).

4. Populations Targeted by Preventive Interventions

To meet the formidable challenge of reducing HIV transmission, populations at increased risk must be defined, identified and targeted for interventions. Populations at high risk for HIV manifest high levels of sexual and other types of behaviour (e.g. needle-sharing) putting them at risk of acquiring HIV and have high HIV incidence or prevalence. Some examples:

Men who have sex with men (MSM)
Injection drug users
Sex trade workers
Specific ethnoracial groups (e.g. from HIV-endemic countries)
Incarcerated persons
Persons testing positive for HIV
Persons testing repeatedly negative for HIV
Persons diagnosed with a STI

It is also sometimes strategic to prioritize youth because their risk of HIV and STI is often higher than in older persons and patterns of sexual behaviour are established during this time of life which may be more difficult to change later.

The above list of target populations is illustrative only. Planning strategic HIV prevention interventions requires the careful selection of populations based on available evidence on HIV and STI incidence and prevalence but also on the potential for effective and cost-effective interventions. Rates of HIV infection and at risk behaviour often vary significantly by geographic region and the planning of interventions needs to take this into consideration.

There is also a role for preventive interventions at the general population level. For example, broad-based informational campaigns can reach members of a vulnerable population who may be inaccessible because of their specific behavioral factors and characteristics that increase HIV risk. In addition, although some groups are not at high risk for HIV

and STIs, they are not necessarily at no risk. The impact at the population level may be substantial given the large number of persons involved. In effect, the goal of population-level prevention interventions is to reduce the overall risk to HIV of an entire population by shifting societal norms.

5. Levels of HIV Preventive interventions

Preventive interventions may take place at the individual level, the group level, and the population level. A combination of approaches at different levels will generally constitute a coordinated, effective plan to control HIV infection.

Intervening at the individual and group levels makes sense logically. Within target populations are persons at higher risk than the group as a whole who could benefit from personalized interventions for which there is growing evidence of impact. The Centers for Disease Control and Prevention have developed such interventions in the context of their Dissemination of Effective Behavioral Interventions (DEBI) [13].

At the population level, interventions may attempt to change social norms, influencing individual behaviours only indirectly. One such successful approach is the Popular Opinion Leaders intervention developed by Kelly in the United States [14]. This approach systematically identifies, recruits, trains, and engages popular opinion leaders to serve as behaviour change endorsers and has been found to reduce risky sexual behaviour among MSM in the United States by up to 30%.

6. Setting of Preventive Interventions

Settings, venues and contexts must be selected in which to reach target populations where the conditions are favorable for effective intervention. Some settings for HIV preventive interventions:

- *Media:* Print and electronic media with both wide and segmented audiences to reach persons at increased HIV risk;
- *Clinical settings:* For strategic provider-initiated testing [15] and secondary prevention among HIV-infected persons;
- *First Nation communities:* High rates of notifiable sexually transmitted infections, and more recently HIV infection, have been reported in some First Nation communities [16];
- *Schools/universities:* Students represent an important target population because they are in a formative stage of development and interventions may have more impact than they might after patterns of sexual behaviour are established. Also, students represent a "captive" population who can be reached at modest expense.

7. Selecting Preventive Interventions

This must be done by broad consultation, taking into account the local epidemiology of HIV and STIs and the direct and indirect evidence of their potential effectiveness. The considerations should include: (1) the evidence of efficacy and effectiveness, (2) the feasibility of carrying out the intervention in the population of interest, (3) the relative opportunity cost of selecting one intervention over another. The selection of the most effective and most efficient intervention mix will require careful analysis and a certain degree of objectivity. Selecting interventions based on their popularity, appeal, acceptability at the political level is not an appropriate basis.

Interventions may be behavioural or biomedical. A listing of some of the interventions for each of these approaches follows:

7.1 Behavioural

Behavioural interventions have been reviewed in the international context [7, 17, 18]. The following types of preventive interventions have been found effective in a variety of contexts:

Social marketing
Outreach in high-risk settings
Individual intervention
Small group interventions (often multi-session)
Distribution of preventive materials (e.g. condoms, clean needles)
Improved access to prevention materials
Partner notification
Counseling during HIV testing and treatment

7.2 Biomedical interventions

Biomedical approaches to prevent HIV were reviewed in the special supplement of *Lancet* noted above [6].

- *Antimicrobial agents* to treat STIs have been found to be effective in reducing HIV transmission in some studies.
- *Antiretroviral prophylaxis to prevent mother-to-infant HIV transmission* [19];
- *Antiretroviral treatment to reduce infectivity:* Treating HIV-infected persons reduces HIV viral load and infectivity and, in turn, transmission rates [20];
- *Post-exposure prophylaxis (PEP):* Antiretroviral agents immediately after a high risk exposure may prevent infection [21]; and
- *Pre-exposure prophylaxis (PreP): Antiretroviral agents* to persons with ongoing high risk to prevent HIV acquisition [22].

Other potential biomedical interventions include:

- *Vaccines:* This is the ideal option to significantly reduce HIV incidence in large populations. However, producing an effective HIV vaccine has been elusive to date and it is not known when such a vaccine will be developed, if ever. The HIV epidemic may not be fully controllable without an effective vaccine [23].
- *Microbicides:* Microbicides are products that deactivate HIV locally without causing significant adverse effects [24]. Vaginal microbicides could theoretically be used by women without the knowledge of her sex partner. Rectal microbicides could prevent HIV transmission through anal sex.
- *Circumcision:* There is now convincing evidence that male circumcision decreases the risk of acquiring HIV from a female sex partner by 60-70% [25-27]. The benefits are greatest in countries with high rates of HIV infection and low rates of circumcision and its role in reducing HIV transmission in Canada is not clear [28]. Circumcision is likely not effective in preventing HIV transmission in MSM since most infections are transmitted by receptive anal intercourse [29].
- *Condom technology:* Research to improve the quality, cost and effectiveness of condoms could increase their use and help to reduce HIV transmission.

7.3 HIV prevention in the context of other viral and bacterial STIs and bloodborne infections

Preventing other STIs may have direct and important benefits for primary and secondary prevention of HIV. First, most STIs share the same behavioural risk factors for transmission. Thus, synergies can be achieved by integrating prevention activities for multiple pathogens. Also, STIs, especially ulcerative STIs such as genital herpes, chancroid and syphilis, are known to increase both the susceptibility to, and transmissibility of, HIV.

In addition to the prevention of sexual transmission, synergies can also be achieved through programs to prevent bloodborne transmission through injection drug use. Programs to prevent hepatitis B and C, in particular, can be integrated with those targeted at HIV for greater effectiveness and efficiency.

8. The HIV Prevention Planning Process

The most effective approach to planning programs and activities ensures that the selected interventions will not only result in substantial and demonstrable impact but will also optimize the degree of this impact in the population.

To be effective, planning of HIV prevention programs must meaningfully involve key stakeholders including public health authorities, health care providers, researchers and representatives of the affected communities. Such involvement should be at each stage of the planning process.

Planning effective HIV prevention involves several key elements:

1. Characterizing the population and patterns of infection

This involves quantifying and characterizing the populations at risk, determining HIV incidence and prevalence, patterns of risky behaviours and access to, and acceptability of, proposed interventions. UNAIDS has put considerable emphasis on “knowing your epidemic” as the first stage in HIV prevention program planning [4, 18].

2. Priority setting

Since it will not be possible to carry out all possible intervention to reduce HIV transmission, programs must be selected strategically and rigorously.

3. Define prevention objectives

The short- and long-term objectives of HIV prevention programs must be defined. Such objectives must be realistic, be critical for reducing HIV transmission and where possible be

quantifiable. Objectives may include both direct and indirect indicators to monitor transmission.

9. Research and Evaluation

Prevention programs must be evaluated. Because of the uncertainty of the impact and pattern of effectiveness, it is critical that key indicators related to the proposed interventions be tracked so that success and failure can be recognized as soon as possible and resources deployed or redeployed appropriately. Unfortunately, data to evaluate interventions are not always available and this presents a major challenge. Some useful sources of data include notifiable disease reports, dedicated enhanced surveillance programs, population-based surveys, studies in specific populations, data collected in the context of the implementation of interventions and, finally, statistical modeling.

A theoretical basis for defining and using evaluative indicators has been proposed by Boerma [30]. The importance of monitoring and evaluation in managing effective HIV prevention, as well as approaches to integrate indicators into the programs themselves, is presented in prevention guidelines by UNAIDS [18].

Before programs are implemented, the data requirements for evaluation should be defined and integrated into the program to the extent possible. However, evaluation activities should not unduly impede program effectiveness. Historically, few prevention programs have been rigorously evaluated in Canada.

The issue of prevention research is beyond the scope of the present framework but clearly a comprehensive and robust program of innovative and operational research is critical to a successful national HIV prevention effort.

10. HIV Prevention in Canada: Responsible Agencies

The agencies primarily responsible for supporting, planning and implementing prevention programs may be considered as follows:

10.1 Federal government / Public Health Agency of Canada

Since the beginning of the HIV/AIDS epidemic and the national strategy, funds have been allocated to community-based organizations in Canada. In recent years, approximately $12 million is allocated annually through the AIDS Community Action Program (ACAP) of the Public Health Agency of Canada. It is unclear, however, to what extent the funding allocated to community-based organizations (CBOs) is earmarked for prevention. This appears to be a more serious consideration of ACAP funding in recent years. A more rigorous analysis of service delivery data would help determine the regional allocation of such funding, the target populations, the degree to which prevention is a protected activity within the grants and programs systematically evaluated.

Although PHAC funded and rigorously monitored and evaluated excellent site-specific initiatives across Canada, unfortunately, in my opinion neither PHAC, nor any other national body, has developed comprehensive national prevention policies nor has it effectively coordinated prevention efforts at the local and provincial/territorial levels.

10.2 Provincial ministries of health

Undoubtedly, the most important contribution to HIV prevention and support in Canada is made by provincial health ministries. However, there appears to be considerable variability in the investment and commitment to HIV among the provinces and territories. Some of the variability is related to the extent of the HIV epidemic; three provinces, Ontario, Quebec and British Columbia account for about 40%, 30%, and 20% of estimated HIV infections, respectively, constituting together about 90% of infections in Canada. Therefore, it would be expected that these provinces would be making the most considerable investments. Nevertheless, it is not clear that the scope and scale of commitment to HIV prevention is in direct proportion to the public health importance of the HIV epidemic in a given region.

As is the case for federal funding agencies, it is unclear to what extent the HIV primary and secondary prevention efforts historically been protected and specifically monitored. However, primary HIV prevention has become a greater priority more recently and many innovative and potentially effective programs have been instituted in the past few years.

10.3 Local/regional public health departments

Local public health departments have a major responsibility in controlling HIV transmission. The three major urban centres, Montreal, Toronto and Vancouver have relatively high rates of HIV infection and represent about 50% of the Canadian epidemic. These cities have developed specific grant programs to support local CBOs in their various activities, including HIV prevention.

10.4 Community-based organizations

CBOs have been critical to efforts to prevent and control the HIV epidemic in Canada in carrying out primary and secondary prevention activities. There are several hundred such organizations in Canada. These organizations often span multiple target populations although some may be dedicated to specific groups, such as persons from Africa and the Caribbean or injection drug users. As with government agencies, there appears to have been a shift in recent years from support and service towards prevention, though this impression is not yet supported by objective evidence. There has been a major thrust by CBOs and other institutions to seriously address the issue of HIV in Aboriginal populations.

CBOs also include community organizations not specifically dedicated to HIV issues (e.g. social, sports or cultural organizations) for whom HIV has become an important preoccupation.

11. Research and Evaluation

Defining HIV prevention for the purpose of planning and reviewing HIV prevention activities is a challenge. For an activity to have relevance with respect to HIV prevention, there need to be clear and quantifiable specific objectives which directly or indirectly reduce HIV transmission. These objectives must, if possible, meet the highest standard of rigour, since it is only in the proper conception and planning of prevention activities that there is the serious prospect of program effectiveness.

I propose the following definition: “HIV prevention is the undertaking of specific and dedicated programs that impact on the proximal and distal factors mediating HIV transmission”. Clearly, a sophisticated and rigorous analysis must be carried out to determine which causal factors are most amenable to change, as well as the impact these changes will ultimately have on HIV transmission. However, any operational definition cannot by itself answer the question as to what prevention is likely to be effective, optimal and cost-beneficial. This is an integral part of HIV prevention planning process. Mathematical models characterizing HIV transmission as well as health economic analyses may be extremely useful in this regard. However, for definitional purposes, the concept of HIV prevention can remain relatively broad and inclusive with the actual selection of prevention activities in any given jurisdiction more specific and critical.

12. Inventory of HIV Prevention and Programs in Canada

It would be extremely useful for public health authorities and decision-makers to have a clear idea of the scope and scale of prevention activities undertaken to date in Canada. This has never been systematically carried out and would add immeasurably to our ability to advocate for the necessary resources as well as to scientifically and rigorously allocate resources. There would of course be important challenges in defining the reference period, defining functional criteria for selecting interventions and establishing mechanisms to identify relevant programs and activities, and developing data collection instruments that would lend themselves to valid analysis.

13. Advocacy and Resources

An important but potentially problematic component of the public health effort to control HIV involves the marshaling of resources on the scale necessary to achieve success. This will involve advancing arguments of cost-effectiveness and relative cost-effectiveness. There is little doubt that, even in a relatively low incidence country such as Canada, HIV has a major impact on health, health services, disability and cost at a level that could justify a substantially higher investment at all levels of government as well as in the voluntary sector. The HIV epidemic at present likely costs the Canadian health care and public health system over one billion dollars annually and likely much more if indirect costs are included. (The actual cost of the HIV epidemic in Canada is unknown but an order of magnitude estimate can be obtained by adding the annual costs of caring for HIV-infected patients receiving and not receiving antiretroviral therapy to

the costs of federal, provincial and local HIV prevention, support and research programs. Obtaining a rigorous estimate of the cost of the epidemic could help to influence decision-makers in making informed decisions about the allocation of resources). In any case, given the inordinate cost of treating and caring for an HIV-infected person, preventive interventions do not have to be highly effective to be cost-effective or even potentially cost-beneficial.

Controlling HIV in Canada remains a formidable challenge. Effective policies and programs will require a high level of commitment and collaboration across the three levels of government, integration of activities across programmatic areas and, of course, investment of the resources necessary to achieve this goal.

NCCID Comments

Some three decades after the virus we now know as the human immunodeficiency virus (HIV) was first recognized as a cause of serious human illness, we still have much to learn about preventing new infections. Should HIV prevention programs be "bundled" with initiatives to prevent other sexually transmitted and bloodborne infections or should they "stand alone"? How much can we/should we attempt to address the upstream determinants of infection? Will that dilute our efforts to deal with more proximal determinants? Whose responsibility is prevention? Local, provincial and federal public health agencies all have a role to play as do community-based organizations and all are playing a role. Are these efforts adequately coordinated and whose role is that? Or is it a shared role? This Purple Paper provides one perspective on these and other issues and will hopefully stimulate reflection and discussion.

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