Rev Saúde Pública 2007;41(Supl. 2)

Antônio José Costa Cardoso[I]

Rosane Harter Griep[II]

Heráclito Barbosa de Carvalho[III]

Alessandro Barros[IV]

Sônia Baptista da Silva[V]

Robert H. Remien[VI]

HIV infection among pregnant women attended in testing and counseling centers for AIDS

ABSTRACT

OBJECTIVE: To estimate HIV prevalence and identify high-risk sexual behavior for infection in pregnant women who were given prenatal assistance.

METHODS: Cross-sectional study based on attendance records of 8,002 pregnant women (25% of all municipalities) who lived in 27 municipalities in Southern Brazil in 2003 and had anti-HIV tests done in a testing and counseling center that performed prenatal assistance. Sociodemographic and behavioral data were gathered, as well as syphilis and HIV test results, during the individual counseling sessions registered in the data bank of the *Sistema de Informações dos Centros de Testagem e Aconselhamento* (Information System on Testing and Counseling Centers). Women who sought the centers for confirmation of previous serology or were referred to this service due to the presence of AIDS symptoms were excluded from the data base.

RESULTS: A total of 0.5% of all the pregnant women analyzed (CI 95%=0.3;0.6) were HIV positive. The only variable associated with HIV seropositivity was schooling. The majority of them were basically exposed through unprotected sexual intercourse with the only partner they had a steady relationship with. Younger pregnant women who were single, unemployed and had lower level of education constituted the group with highest exposure.

CONCLUSIONS: The *Sistema de Informações dos Centros de Testagem e Aconselhamento* turned out to be useful for the epidemiological surveillance of HIV infection and high-risk behavior among pregnant women and could also be useful as regards other populations.

KEY WORDS: Acquired immunodeficiency syndrome. HIV infections, epidemiology. HIV infections, prevention & control. Pregnant women. Prenatal care. Risk factors. Socioeconomic factors. Epidemiologic Surveillance. Cross-sectional studies.

INTRODUCTION

In Brazil, the national HIV/AIDS control policy corresponds to the work that has been performed by governments and civil society for over two decades. The epidemiological surveillance component of this policy has as its general purpose to follow the temporal and spatial tendencies of the occurrence of AIDS and HIV infection, aiming at guiding the epidemic control actions on all levels of administration of the *Sistema Único de Saúde* (SUS – National Health System).*

* Ministério da Saúde. Coordenação Nacional de DST e Aids. A Experiência do Programa Brasileiro de AIDS. Brasília; 2002.

[I] Diretoria Regional de Brasília. Fundação Oswaldo Cruz. Brasília, DF, Brasil

[II] Instituto Oswaldo Cruz. Fundação Oswaldo Cruz. Rio de Janeiro, RJ, Brasil

[III] Departamento de Medicina Preventiva. Faculdade de Medicina. Universidade de São Paulo. São Paulo, SP, Brasil

[IV] Secretaria de Vigilância em Saúde. Ministério da Saúde do Brasil. Brasília, DF, Brasil

[V] Centro de Testagem e Aconselhamento em Aids. Universidade Federal do Rio de Janeiro. Rio de Janeiro, RJ, Brasil

[VI] HIV Center for Clinical and Behavioral Studies. New York, NY, EUA

Correspondence:
Antônio José Costa Cardoso
SEPN 510 – Bloco A – 4º. Andar
Unidade II do Ministério da Saúde
70750-520 Brasília, DF, Brasil
E-mail: antoniocardoso@fiocruz.br

Received: 8/8/2006
Reviewed: 2/5/2007
Approved: 8/28/2007

In order to subsidize this control, the epidemiological surveillance needs to make available relevant, reliable, up-to-date information about the occurrence of AIDS and HIV infection at an opportune time, as well as high risk behavior associated with the epidemic. This, as a result, enables to promote actions and measure changes in the epidemiological situation, with an emphasis on populations that present higher risk of HIV infection, making use of data originating from diverse sources of information.[14]

During the first 20 years of the epidemic, however, the universal and compulsory notification of AIDS cases was the first strategy of the epidemiological surveillance in Brazil, included on the list of compulsory notification aggravations since December 22nd of 1986.[4,18,*] However, apart from problems related to the completion and quality of the information produced, it must be added that AIDS surveillance reflects the dynamics of transmission that occurred in the past (infection period).[19] The criteria of definition of cases have been subject to reviews throughout time and the antiretroviral treatment has been modifying the course of expression of the disease in populations, rendering this information even more difficult to be interpreted.[4,*]

With the purpose of overcoming such limitations, the *Ministério da Saúde* (Ministry of Health) recommended the incorporation of new strategies of HIV surveillance, among which is the experience of epidemiological surveillance using the records from the *Centros de Testagem e Aconselhamento em Aids* (CTA – AIDS Testing and Counseling Centers) that followed the *Sistema de Informação dos Centros de Testagem e Aconselhamento em Aids* (SI-CTA –Information System on AIDS Testing and Counseling Centers).*

The population of pregnant women is especially important to be considered as part of a system of HIV surveillance, not only due to the risk of their having had sexual intercourse with HIV infected men, but also because of the possibility of vertical transmission to their children.[13] The rates of HIV infection among pregnant women reported in several studies in Brazil are variable, but low, when compared to other developing countries.[6-8,16,18]

On the other hand, even though the Ministry of Health recommends that the prenatal services conduct serological tests and HIV/AIDS counseling, in a decentralized system such as the SUS, there are many assistance models in operation in the more than 5,000 Brazilian municipalities. In some of them, pregnant women have used or use the CTAs, usually as a decision made by the prenatal service itself.**

The objective of the present study was to estimate the HIV prevalence and identify high risk sexual behavior for infection among pregnant women who were given counseling and were serologically tested for HIV in the CTAs as part of the prenatal assistance routine.

METHODS

Cross-sectional study based on computerized attendance records of 8,002 pregnant women living in 27 municipalities of the Southern Brazil, who were given counseling and had anti-HIV tests done in a CTA as an integral part of their prenatal routine.

The south region was selected as a result of the high proportion of CTAs that already used the SI-CTA in 2003. Among the municipalities that used the *SI-CTA* to register their attendances in the CTAs, those that performed part of the prenatal service (the STD/AIDS counseling and the test) for at least 25% of the pregnant women in the CTA were selected. The average coverage of pregnant population in these 27 municipalities was 51% (±24%). For the calculation of this coverage, the number of live newborns in 2002 was used, obtained from the *Sistema de Informações de Nascidos Vivos* (SINASC – Information System on Live Newborns), as a proxy of the pregnant population in each municipality.

The data were collected in interviews during individual counseling sessions (before or after the test), with guaranteed privacy and confidentiality of information for the participants. The data collection was carried out by professionals of the services and the data were registered on the SI-CTA (during or after the session). Women who sought the CTAs for confirmation of previous serology and those who were referred to this service due to the presence of suggestive AIDS symptoms were excluded from the data bank.

Sociodemographic variables (age, marital status, level of education and situation in the work market), variables relative to sexual behavior (sexual orientation, number of sexual partners in the previous year, use of condoms with steady or occasional partners throughout life and in the last sexual relation), and the results of serological tests for syphilis (VDRL) and HIV were analyzed. As a norm from the Ministry of Health, two different analyses by ELISA and one confirmatory test for HIV detection were performed to define an HIV positive result.

Two synthetic variables were also built: "consistent use of condoms", with steady or occasional partners, and "exposure to HIV during sexual intercourse". "Consis-

* Ministério da Saúde. Coordenação Nacional de DST e Aids. A Experiência do Programa Brasileiro de AIDS. Brasília; 2002.
** Ministério da Saúde. Coordenação Nacional de DST e Aids. Sistema de Informações dos Centros de Testagem e Aconselhamento em DST-AIDS: Manual de utilização. Brasília; 2002.

Table 1. Operational model of HIV exposure level per sexual relation. Southern, Brazil, 2003.

Level of HIV exposure per sexual relation	Number of partners	Nature of sexual relation	Consistent use of condoms with steady partner	Consistent use of condoms with casual partner
Low	One	Steady	Yes	Not applicable
	One	Casual	Not applicable	Yes
	Two or more	Steady and casual	Yes	Yes
	Two or more	Only steady	Yes	Not applicable
Intermediate	One	Steady	No	Not applicable
	Two or more	Only casual	Not applicable	Yes
	Two or more	Steady and casual	Sim	No
	Two or more	Steady and casual	No	Yes
High	One	Casual	Not applicable	No
	Two or more	Only steady	No	Not applicable
	Two or more	Only casual	Not applicable	No
	Two or more	Steady and casual	No	No

tent use of condoms" was defined as the use of condoms in the last sexual relation and "every time" one has sexual intercourse with current partner.* On the other hand, "inconsistent use of condoms" was defined by one who has never used a condom with current partner or has used it "occasionally", or one who did not use a condom in the last sexual relation.

Regarding "HIV exposure during sexual intercourse" (Table 1), participants were classified as: "low exposure" – women with steady or casual partner who referred to consistent use of condoms; "intermediate exposure" – women with a single, steady partner who related inconsistent use of condoms or those with more than one partner who related consistent use of condoms with at least one of them; and "high exposure" – those with more than one partner who did not relate consistent use of condoms with any of them.

The statistical analyses were carried out by means of the SPSS software. The statistical associations were assessed by the prevalence ratio, using 5% as the statistical significance level. Differences in proportion were assessed by means of Pearson's Chi-square test.

RESULTS

The age of participants ranged from 12 to 55 years, the average age was 24.9 years (±6.76) and the median, 24 years, of which 58% were within the 12-25 year age group. Approximately 85% of participants related being married or living with a partner, of which 56.1% had eight or more years of formal education. A total of 47.4% of pregnant women related working, though 23.1% of these were unemployed (Table 2). Furthermore, a total of 87% of those who did not report working were housewives and 12.6%, students.

Regarding high risk behavior for HIV infection, 11.5% related having had two or more sexual partners in the last 12 months and 13.1% related having sexual intercourse with steady and occasional partners (not mutually exclusive). As for the use of condoms, 2.2% related the consistent use of condoms with a steady partner, and none of these women was infected by HIV. Among those with casual partners, 52% reported consistent use of condoms. The positive VDRL rate was 0.5% (Table 2).

The prevalence of HIV infection in the sample studied was 0.5% (CI 95%: 0.3;0.6%). The only variable associated with the occurrence of HIV was the level of education, nearly three times lower (PR=0.34; CI 95%: 0.14;0.83) among women with eight or more years of formal education (0.4%), when compared to those who have three or fewer years of education (1.1%). Statistical difference between other variables studied and HIV infection was not observed (Table 2).

Concerning HIV exposure during sexual intercourse, 2.1% of participants were classified as "low exposure", 87.1% as "intermediate exposure" and 10.8% as "high exposure" (Table 3). Women considered to be under high exposure were usually younger, single, unemployed, and had fewer years of formal education than those from the average and low exposure groups. Even though more HIV infected women had been classified in the high and average exposure groups and no cases had been observed in the low exposure group, differences were not statistically significant.

* Hearst N, Chen S. Condoms for AIDS prevention in the developing world: Is it Working? (monograph online). Geneva: UNAIDS; 2003. Available from: http://www.usp.br/nepaids/condom.pdf

Table 2. Prevalence rates of HIV infection and prevalence ratio according to sociodemographic and behavioral variables among pregnant women. Southern, Brazil, 2003. (N=8002)*

Variable	Pregnant women		HIV infection		PR
	N	%	N	Prevalence %	(95% CI)
Age group (years)					
12 to 25 years	4,630	58.0	24	0.5	1.0
26 to 55 years	3,355	42.0	16	0.5	0.92 (0.49;1.73)
Marital status					
Married/with a partner	6,837	85.5	30	0.4	1.0
Not married	1,159	14.5	10	0.9	1.97 (0.96;4.01)
Status in the work market					
Employed	2,899	76.9	12	0.4	1.0
Unemployed	873	23.1	7	0.8	1.94 (0.76;4.91)
Occupations of those who do not work					
Student	527	12.6	1	0.2	1.0
Housewife	3,666	87.4	20	0.5	2.88 (0.39;21.38)
Schooling (complete years)					
≤ 3	634	7.9	7	1.1	1.0
4 to 7	2,870	36.0	16	0.6	0.50 (0.21;1.22)
8 or more	4,478	56.1	17	0.4	0.34 (0.14;0.83)
Life conditions					
Urban	7,854	98.2	39	0.7	1.0
Rural	147	1.8	1	0.5	0.73 (0.10;5.28)
First HIV test in the CTA					
No	489	6.1	3	0.6	1.0
Yes	7,512	93.9	37	0.5	0.80 (0.25;2.59)
Number of sexual partners (in the last 12 months)					
One	7,061	88.5	32	0.5	1.0
Two or more	919	11.5	8	0.9	1.93 (0.89;4.16)
Nature of relationships					
Only steady partners	6,864	86.9	29	0.4	1.0
Casual partners or casual and steady partners	1,038	13.1	9	0.9	2.06(0.97;4.32)
Constant use of condoms with casual partner**					
Yes	541	52.0	3	0.6	1.0
No	500	48.0	6	1.1	1.86 (0.46;7.35)
Result of VDRL test					
Negative	5,089	99.5	31	0.6	1.0
Positive	24	0.5	1	4.2	7.0 (0.0;52.6)

* "No data" category excluded.
** Those who mentioned having steady or casual partners.
PR: Prevalence Ratio
CTA: Information System on AIDS Testing and Counseling
VDRL: Sorological test for syphilis

DISCUSSION

HIV prevalence rates comparable to the estimated ones in other Brazilian studies on pregnant women were observed.[7] In a study with pregnant women at 15 to 49 years of age, during labor performed in a public maternity ward in the Southern Brazil, HIV infection prevalence was estimated at 0.5%.[18] In another study conducted in Brazil, a 0.4% prevalence was registered among pregnant women at 13 to 24 years of age.* Both studies are from 1998 and their results fall under the same estimated confidence interval as the present study

* Veloso VG, Pilotto JH, Azambuja R, do Valle FF, Perez M, Grinsztein B, et al. High prevalence of HIV infection in low income pregnant women in Rio de Janeiro, Brazil. Int Conf AIDS. 1998;12:1167 (Abstract, 60913)

Table 3. Profile of pregnant women according to selected variables and level of HIV exposure. Southern Brazil, 2003.

Selected variable	Low (N=165)		Intermediate (N=6,883)		High (N=851)	
	N	%	N	%	N	%
Age group (years)*						
12 to 25	102	62.2	3,901	56.8	559	65.8
26 to 55	62	37.8	2,970	43.2	291	34.2
Marital status						
Married/with partner	125	75.8	6,077	88.3	565	66.5
Not married	40	24.2	804	11.7	285	33.5
Status in the work market						
Employed	20	12.2	698	10.2	145	17.1
Unemployed	60	36.6	2,521	36.8	286	33.7
Occupations of those who are not workers						
Student	18	11.0	441	6.4	57	6.7
Housewife	66	40.2	3,194	46.6	360	42.7
Schooling (complete years)						
≤ 3	6	3.6	537	7.8	82	9.6
4 to 7	57	34.5	2,439	35.5	338	39.7
8 or more	102	61.8	3,890	56.7	431	50.6
Life conditions**						
Rural	3	1.8	125	1.8	16	1.9
Result of VDRL test**						
Positive	0	0.0	21	0.3	3	0.4
Result of HIV test**						
Positive	0	0.0	30	0.4	8	0.9

* p<0.001; ** p<0.10

(CI 95%: 0.3;0.6). However, these rates are lower than the ones found in twelve Latin American and Caribbean countries, whose prevalences were equal to or higher than 1%, a prevalence of 2.9% found in the state of Rio Grande do Sul in 1999, and 3.4% in Southern Brazil in 1998.[7]

In the present study, the level of education was the variable most strongly associated with HIV prevalence, a fact that corroborates findings from other studies. In Brazil, the level of education is considered the best social status indicator, so that an association with the perception of the risk of getting infected by HIV has been suggested.[5,12,13,,20] In fact, a Brazilian study on sexual behavior and HIV/AIDS* perception, conducted in a representative sample of adult urban population, revealed that the educational level is the most relevant variable to characterize the degree of knowledge about HIV/AIDS, indicating that the higher this degree is, the more education one has. Apart from education, high risk sexual behavior was also associated with a low degree of knowledge and unemployment.

In the present study it was observed that younger and single pregnant women are probably more exposed to HIV infection according to the definition of sexual risk previously proposed here. The context of sexual intercourse between partners who do not live together appears to be linked to higher exposure to HIV than those of women who are either married or living with a partner. Furthermore, single women are more likely to have multiple sexual partners.* Frequent casual dates can increase the probability of their having intercourse with an HIV infected partner,** even though this may not be the case in Brazil.***

In spite of the variables "consistent use of condoms" and "HIV exposure during sexual intercourse" not permitting the effectiveness of condoms as a protective barrier to be assessed, nor significant statistical

* Ministério da Saúde. Coordenação Nacional de DST e Aids. Comportamento Sexual da População Brasileira e Percepções do HIV/AIDS. Brasília; 2000. (Série Avaliação, 4).

** HIV/AIDS Survey Indicators Database [base de dados na internet]. Wshington, DC: United States Agency for International Development. [s.d.] [acesso em 23/06/03]. Disponível em: www.measuredhs.com/hivdata

*** Ministério da Saúde. Coordenação Nacional de DST e Aids. A Experiência do Programa Brasileiro de AIDS. Brasília; 2002.

associations between exposure patterns and risk of HIV infection to be identified, they proved to be useful to describe high risk behavior and to characterize this populational segment in socioeconomic terms.

The validity of information on referred use of condoms has been questioned, which possibly harms the assessment of the impact of prevention policies that focus on their use.* Some studies validated the consistency of the self-account about use of condoms, relating it to HIV infection.[3,*] In the present study, it was not possible to identify significant statistical differences between women who related the consistent use of condoms with casual or steady partner and those who related non-consistent use. Pregnancy enables to infer that these women had unprotected sexual intercourse in the last nine months, which renders the analysis of this variable in the study more difficult.

The validation of the data produced has been the issue of national and international debate.[15,17] Nonetheless, there is a consensus on the need to inform possible bias concerning selection, information and confusion, in order to enable assessment of contributions.[11] In this sense, it is important to emphasize that the pregnant women attended to in the CTAs of the 27 municipalities in the south region of Brazil are not representative of the group constituted by Brazilian pregnant women, so that the results obtained cannot be extrapolated to other municipalities in this country as the inner validation limits compromise the outer validation.

Furthermore, even though the rates of prevalence found among pregnant women and women during delivery are commonly used to represent the population of women at reproductive age, it is important to observe the possibility of selection bias in this type of approach. Apart from the demand of and access to healthcare services being often associated with several factors of HIV infection risk, this can reduce fertility and, thus, underestimate the prevalence of the infection, especially among women at 30 years of age or older.[9,10,16] On the other hand, the association of the demand for prenatal care with high risk of infection could be minimized in areas with low HIV infection prevalence and high test coverage, something which would reduce the effect of selection bias.

The bias related to the trust regarding participants' responses to questions that could result in overestimation of the use of condoms or underestimation of less acceptable sexual behavior, for instance, could have been minimized in the present study. The interviews were conducted by qualified counselors, with guaranteed information confidentiality and privacy during the counseling sessions.

Another limitation of the present study refers to the cross-sectional design, which does not permit a temporal relation between events to be established.

Even though the data of health services cannot be extrapolated to the population as a whole, they are important for the epidemiological surveillance of HIV infection and high risk behavior in priority populations defined by the diverse levels of administration of the *SUS*. These data represent useful supplement for HIV/AIDS surveillance, currently performed by means of the *Sistema de Informação de Agravos de Notificação* (SINAN – Information System of Notification Diseases) and can subsidize the planning of preventive activities and assistance for groups under higher HIV exposure.

The precision of estimates could be improved by regular serological studies based on population and by behavioral studies, especially to monitor temporal tendencies. Furthermore, the use of CTA data as a source of information for epidemiological surveillance is low cost and easy to implement on a local level of healthcare administration.

Among the possibilities and advantages for the SI-CTA to perform this HIV epidemiological surveillance, the possibility to follow the infection stages in population sectors must be pointed out and, simultaneously, high risk behavior for infection among priority groups attended to in the CTAs must be focused on. Behavioral data help explain the epidemic tendencies, permitting a realistic perspective of potential vectors of change throughout time to be prepared.

ACKNOWLEDGMENTS

To the managers and technicians from the *Centro de Testagem e Aconselhamento* (Counseling and Testing Center) for the collection of the data analyzed; to Drs. Draurio Barreira, from the *Unidade de Epidemiologia* (Epidemiology Unit) and Cristina Possas, from the *Unidade de Pesquisa* (Research Unit), both from the *Programa Nacional de DST/Aids* (STD/AIDS National Program), for the support for the accomplishment of this study.

* Hearst N, Chen S. Condoms for AIDS prevention in the developing world: Is it Working? (monograph online). Geneva: UNAIDS; 2003. Available from: http://www.usp.br/nepaids/condom.pdf

REFERENCES

1. Alary M, Castel J. Risk factors for HIV seroposivity among people consulting for HIV antibody testing: a pilot surveillance study in Quebec. *CMAJ.* 1990;143(1):25-31.
2. Boisson E, Nicoll A, Rodrigues LC. Interpreting HIV seroprevalence data from pregnant women. *J Acquir Immune Defic Syndr Hum Retrovirol.*1996;13(5):434-9.
3. Catania JA, Coates TJ, Stall R. Bye L, Kegeles SM, Capell F, et al. Changes in condom use among homosexual men in San Francisco. *Health Psychol.* 1991;10(3):190-9.
4. Cruz MM, Toledo LM, Santos EM. O sistema de informação de AIDS do Município do Rio de Janeiro: suas limitações e potencialidades enquanto instrumento da vigilância epidemiológica. *Cad Saude Publica*. 2003;19(1):81-9.
5. Fonseca MG, Bastos FI, Derriço M, Andrade CL, Travassos C, Szwarcwald CL, et al. AIDS e grau de escolaridade no Brasil: evolução temporal de 1986 a 1996. *Cad Saude Publica*. 2000; 16(Sup.1):77-87.
6. Fylkesnes K, Ndhlovu Z, Kasumba K, Musonda RM, Sichone M. Studyng dynamics of the HIV epidemic: population-based data compared with sentinel surveillance in Zambia. *AIDS.* 1998;12(10):1227-34.
7. Calleja JM, Walker N, Cuchi P, Lazzari S, Ghys PD, Zacarias F. Status of the HIV/AIDS epidemic and methods to monitor it in Latin America and Caribbean region. *AIDS.* 2002;16(Supl 3):S3-12.
8. Glynn JR, Buvé A, Caraël M., Musonda RM, Kahindo M, Macauley I, et al. Factors influencing the difference in HIV prevalence between antenatal clinic and general population in sub-Saharan Africa. *AIDS.* 2001;15(13):1717-25.
9. Gray RH, Wawe MJ, Serwadda D, Sewankambo N, Li C, Wabwire-Mangen F, et al. Population-based study of fertility in women with HIV-1 infection in Uganda. *Lancet.* 1998;351(9096):98-103.
10. Gregson S, Zhuwau T, Anderson RM, Chimbadzwa T, Chiwandiwa SK. Age and religion selection biases in HIV-1 prevalence data from antenatal clinics in Manicaland, Zimbabwe. *Cent Afr J Med.* 1995;41(11):339-46.
11. Loannidis JP. Limitations are not properly acknowledged in the scientific literature. *J Clin Epidemiol.* 2007;60(4):324-9.
12. Laggarde E, Carael M, Glynn JR, Kanhonou L, Abega SC, Kahindo M, et al. Educational level is associated with condom use within non-spousal partnership in four cities of Sub-Saharan Africa. *AIDS.* 2001;15(11):1399-408.
13. Nemes MI, Carvalho HB, Souza MF. Antiretroviral therapy adherence in Brazil. *AIDS.* 2004;18(Supl 3): S15-20.
14. Rehle T, Lazzari S, Dallaberta G, Asamoah-Odei E. Second-generation HIV surveillance: better data for decision-making. *Bull World Health Organ.* 2004;82(2):121-7.
15. Reichenheim ME, Moraes CL. Alguns pilares para a apreciação da validade de estudos epidemiológicos. *Rev Bras Epidemiol.* 1998;1(2):131-48.
16. Schwartländer B, Stanecki KA, Brown T, Way PO, Monasch R, Chin J, et al. Country-especific estimates and models of HIV and AIDS: methods and limitations. *AIDS.* 1999;13(17):2445-58.
17. Szklo M, Javier-Nieto F. Epidemiology: Beyond the Basics. Aspen Publishers; 2000.
18. Szwarcwald CL, Castilho EA. Estimativa do número de pessoas de 15 a 49 anos infectadas pelo HIV, Brasil, 1998. *Cad Saude Publica.* 2000;16(Supl 1):135-41.
19. Valdisseri RO, Janssen RS, Buchler JW, Fleming PL. The context of HIV/AIDS surveillance. *J. Acquir Immune Defic Syndr.* 2000;25(Supl 2):S97-104.
20. The Joint United Nations Programme on HIV/AIDS. Key documents. The relationship between sexual behaviour and level of education. Geneva; 2000.
21. Zaba B, Gregson S. Measuring the impact of HIV on fertility in Africa. *AIDS.* 1998;12(Supl 1):S41-50.