Seroprevalence of Sexually Transmitted Infections among Accepted and Deferred Blood Donors in Jamaica

IE Vickers[1], AR Brathwaite[2], M Levy[1], JP Figueroa[2]

ABSTRACT

Critical donor selection and testing increases the safety of blood transfusion by excluding donors at risk of transmitting infections. This study investigated the seroprevalence of and risk factors for sexually transmitted infections (STIs) among accepted and deferred blood donors in Jamaica. A total of 1015 blood donors consisting of 794 (78%) accepted donors and 221 (22%) deferred donors presenting at the Central Blood Bank, Jamaica, over a six-month period, were recruited for this study. A standardized questionnaire was administered to each participant and a sample of blood obtained for detection of hepatitis B surface antigen, antibodies to Treponema pallidum, *human immunodeficiency virus (HIV) and human T-cell lymphotrophic virus type-1 (HTLV-1). Deferred donors were three times more likely to be seropositive for STI than accepted donors (16.3%* vs *5.2%, OR 3.57, 95% CI 2.16 – 5.90,* $p < 0.0001$*). Males had significant association between STI seropositivity and having fathered children with two or more women (*$p = 0.0085$*), unprotected sexual intercourse with several persons (*$p = 0.0326$*),and history of genital herpes (*$p = 0.0121$*). Significant risk factors identified among females were unprotected sex with several partners (*$p = 0.0385$*); having more than ten lifetime partners (*$p = 0.0105$*); and use of depoprovera (*$p = 0.0028$*). This study confirms higher rates of STI among deferred blood donors and supports the donor deferral system in Jamaica.*

Seroprevalencia de las Infecciones Transmitidas Sexualmente entre los Donantes de Sangre Aceptados y Diferidos en Jamaica

IE Vickers[1], AR Brathwaite[2], M Levy[1], JP Figueroa[2]

RESUMEN

La prueba y selección crítica del donante aumenta la seguridad de la transfusión de sangre, excluyendo a los donantes con riesgo de transmitir infecciones. Este estudio investigó la seroprevalencia de las infecciones transmitidas sexualmente (ITS) entre los donantes de sangre aceptados y diferidos en Jamaica. Un total de 1015 donantes de sangre consistente en 794 (78%) donantes aceptados, y 221 (22%) donantes diferidos que acudieron al Banco de Sangre Central en Jamaica por un periodo de seis meses, fueron reclutados para este estudio. A cada uno de los participantes se le aplicó una encuesta estandarizada, y se obtuvo una muestra de sangre para la detección del antígeno de superficie de la hepatitis B, los anticuerpos del Treponema pallidum, *el virus de la inmunodeficiencia humana (VIH), y el virus linfotrópico humano de células T tipo 1 (HTLV-1). Los donantes diferidos presentaron una probabilidad tres veces mayor de ser seropositivos que los donantes aceptados (16.3% frente a 5.2%, OR 3.57, 95% CI 2.16 - 5.90,* $p < 0.0001$*). En los varones se dio una asociación significativa entre la seropositividad de ITS y el haber engendrado hijos con dos o más mujeres (*$p = 0.0085$*), el intercambio sexual desprotegido con distintas personas (*$p = 0.0326$*), y una historia de herpes genitales (*$p = 0.0121$*). Los factores de riesgo significativos identificados entre las hembras fueron el sexo desprotegido con diferentes parejas (*$p = 0.0385$*), el haber tenido más de diez parejas a lo largo de su vida (*$p = 0.0105$*), y el uso de depo-provera (*$p = 0.0028$*). Este estudio confirma que las tasas de ITS*

From: Department of Microbiology,[1] The University of the West Indies, Kingston 7 and Ministry of Health,[2] Kingston, Jamaica, West Indies.

Correspondence: Dr IE Vickers, Department of Microbiology, The University of the West Indies, Kingston 7, Jamaica. Fax: (876) 977-1265, e-mail: ilv2@hotmail.com.

entre los dotantes de sangre diferidos son más altas, y respalda el sistema de aplazamiento de donantes en Jamaica.

West Indian Med J 2006; 55 (2): 90

INTRODUCTION

Blood donors play a very important role in a country's blood transfusion services and act as the core around which the entire service is organized. The screening of donors is vital to ensure the delivery of safe blood to the public. Selection guidelines are therefore designed based on the nature of endemic infections and include specific selection and deferral criteria. Essentially, some clients are deferred if they are assessed as being at high risk for infectious diseases. This category includes persons with a history of recent sexually transmitted infection (STI), jaundice, miscarriage, body piercing less than a year, and men who have sex with men or with prostitutes. Other clients are deferred if they have a medical condition for which the donation of blood might be hazardous such as low haemoglobin, chronic disease, recent donation of blood, recent pregnancy, age less than 17 years, age more than 60 years and bodyweight less than 32 kilograms. Yearly, a high proportion of clients, usually about 20%, are rejected by the National Transfusion Services in Jamaica (1). The donor deferral process in Jamaica involves questionnaire interview, medical examination and education for self-deferral.

Blood transfusion remains an important mode of transmission of infections such as hepatitis B, hepatitis C, and human immunodeficiency virus (HIV). The advent of HIV has impacted strongly on the use of blood and it is believed that this played a major role in the initiation of donor deferral criteria based on self-reported risk factors (2). HIV screening of all donated blood is now mandatory worldwide.

While the prevalence of various STIs among routinely accepted blood donors is well documented (3–5), there is a paucity of information about the profile of deferred donors. The aim of this study was to determine, and compare, the prevalence rates of blood borne STI and associated risk factors among Jamaican blood donors who were accepted and those who were deferred because of STI risk.

SUBJECTS AND METHODS

All rejected blood donors and one in four consecutive accepted blood donors were invited to participate in this study which was conducted at the Central Blood Bank, Jamaica, between September 1998 and March 1999. Donors who were rejected because they were screened by the blood bank to be at increased risk for blood borne infections were included in this study (and hereafter referred to as deferred donors). Those donors who were rejected because of medical risks, other than STI, were excluded.

A standardized questionnaire containing 47 questions was administered to each participant who consented. The questionnaire solicited demographic data as well as risk factors for STI. A sample of blood was collected from each participant and screened for hepatitis B surface antigen (HBsAg), antibodies to HIV and human T-cell lymphotrophic virus type-1 (HTLV-1) by enzyme immunoassay (Murex, Abbott Diagnostic Laboratories, Abbott Park, IL,USA). Reactive HTLV-1 and HIV were confirmed by Western immunoblot assays (DuPont, Wilmington, DL, USA). The Venereal Disease Research Laboratory (VDRL) test (Difco, Becton Dickinson, Sparks, Maryland, USA) and the microhaemagglutination for *Treponema pallidum* (MHA-TP) test (Fugirebio Diagnostics, Malvern, PA, USA) were used as screening and confirmatory tests respectively in the diagnosis of syphilis. All tests were carried out using the above-mentioned commercial kits in accordance with the manufacturers' instructions.

The statistical package SPSS version 10 (SPSS Inc, Chicago, USA) was used for data entry and analyses while charts were done using Microsoft Office (Microsoft, Washington, USA). A p value less than 0.05 (2-tailed) was considered statistically significant. The frequency data were compared by chi-square and Fisher's exact test where appropriate. Odd ratios (OR) were first examined by using univariate analyses. Those variables that were significantly associated with STI seropositivity from univariate analyses were entered (males and females separately) into a forward multiple logistic regression model to assess independence of variables.

RESULTS

The 1015 persons who participated in this study comprised 794 (78%) accepted blood donors and 221 (22%) deferred blood donors. There was a high response rate as only three persons declined participation. The sociodemographic profile is shown in Table 1. The median age of donors was 27 years (range 17–60 years) with most (78%) being in the 20–39-year age group. There were more males than females in both the accepted (95%) and deferred (81%) groups. Females comprised a greater proportion of the total deferred donors (19%) than total accepted donors (5%). Most donors had received a secondary school education (83%) but significantly less of the deferred group (3%) were educated to the tertiary level than the accepted group (13%) ($p < 0.05$). The majority of donors were either single (49%) or living in a common law relationship (30%). Donors giving blood for replacement predominated (94%) while first time donors accounted for nearly 50%.

The deferrable risk factors admitted to by the potential donors based on risk for possible sexually transmitted infections are shown in Table 2. For deferred donors, history of recent STI (55%) was the most frequent reason followed by body piercing by a non-medical person within the pre-

Table 1: Sociodemographic characteristics of blood donors

Variable no (%)	Accepted no (%)	Deferred no (%)	Total no (%)	STI+
Age group				
< 20	56 (7)	30 (14)	86 (9)	3 (3.8)
20–29	343 (43.2)	122 (55)	465 (46)	36 (46.2)
30–39	277 (34.9)	51 (23)	328 (32)	25 (32.3)
40 or more	118 (14.9)	18 (8)	136 (13)	13 (16)
Gender				
Male	752 (95)	180 (81)	932 (92)	69 (90)
Female	42 (5)	41 (19)	83 (8)	8 (10)
Last school				
Primary	52 (6.5)	16 (7)	68 (7)	6 (7.7)
Secondary	642 (80.9)	199 (90)	841 (83)	66 (85.9)
Tertiary	100 (12.6)	6 (3)	106 (10)	5 (6.4)
Occupational status				
Employed	691 (87)	171 (77.4)	862 (85)	68 (88)
Unemployed	66 (8)	38 (17.2)	104 (10)	9 (12)
Student	37 (5)	12 (5.4)	49 (5)	0
Union status				
Married	174 (22)	19 (8.6)	193 (19)	12 (15.4)
Common Law	243 (30.6)	61 (27.6)	304 (30)	24 (30.8)
Single	358 (45)	141 (63.8)	499 (49)	41 (53.8)
Separated	19 (2.4)	0 19	(2) 0	
No children				
0	335 (42.2)	107 (48.4)	442 (43.5)	26 (33.8)
1	163 (20.5)	45 (20.4)	208 (20.5)	17 (22.0)
2	130 (16.4)	33 (14.9)	163 (16.1)	15 (19.5)
3 or more	166 (20.9)	36 (16.3)	202 (19.9)	19 (24.7)
fathered/mothered children with:				
0 woman/man	335 (42.2)	107 (48.4)	442 (43.5)	26 (33.7)
1 woman/man	258 (32.5)	62 (28.1)	320 (31.5)	21 (27.3)
2 women/men	126 (15.9)	39 (17.6)	165 (16.3)	17 (22.1)
≥ 3 women/men	75 (9.4)	13 (5.9)	88 (8.7)	13 (16.9)
Ever donated blood				
Yes	451 (57)	59 (27)	510 (50.2)	34 (44)
No	343 (43)	162 (73)	505 (49.8)	43 (56)
Reasons for donation				
Volunteer	52 (7)	7 (3)	59 (6)	3 (5)
Replacement	742 (93)	214 (94)	956 (94)	74 (78)
Total	**794 (100)**	**221 (100)**	**1015 (100)**	**7 (100)**

STI+ = positive serological test for sexually transmitted infection

vious year (21%), unprotected sex with multiple partners (14%) and history of jaundice (9%).

The differences for the above risk factors between deferred and accepted donors were statistically significant as shown in Table 2. A total of 67 of the accepted donors were found to have deferrable risks as identified by the questionnaire thus giving a deferrable risk prevalence of 8.4%. Fifty of these had sex with prostitutes, 10 had unprotected sex with multiple partners and four reported same sex behaviour. The efficacy of the blood bank's interview as a screening method for excluding STI seropositive donors was evaluated as having a sensitivity of 49%, specificity of 80%, positive predictive value of 17% and a negative predictive value of 95%.

The prevalence of HTLV-1, HBsAg and VDRL seropositivity among deferred donors (8.6, 4.8 and 2.7 percent respectively) were significantly higher than those for

Table 2: Prevalence of deferrable risk factors among blood donors

Factor	Accepted no (%)	Deferred no (%)	*p* value
H/o recent STI	3 (0.38)	122 (55)	<0.0001
Body piercing < 1yr	0	46 (21)	<0.0001
Unprotected sex with several persons	10 (1.3)	32 (14)	<0.0005
H/o jaundice	0	18 (9)	0.0016
Sex with prostitutes	50 (6.3)	2 (0.9)	NS
Men who have sex with men	4 (0.52)	1 (0.1)	NS
None	727 (91.5)	0	
Total	**794 (100)**	**221 (100)**	

H/o = history of STI = sexually transmitted infection.
NS = not significant

accepted donors (3.0, 0.6 and 0.5 per cent respectively) as shown in Table 3. The seroprevalence of HIV, however,

Table 3: Prevalence of markers of STI among blood donors

Marker	Accepted No (%)	Deferred No (%)	*p* value
HIV	5 (0.6)	2 (0.9)	NS
HTLV-1	30 (3.8)	19 (8.6)	0.005
HBsAg	5 (0.6)	11 (5.0)	< 0.0001
VDRL/MHATP	4 (0.5)	6 (2.7)	0.02
None	753 (94.8)	185 (83.7)	< 0.0001
Any one	41 (5.2)	36 (16.3)	< 0.0001
Total	794 (100)	221 (100)	

NS = not significant. Four persons were positive for multiple tests. One person (HIV and HTLV-1), one (HBsAg, HIV and HTLV-1), one (HBsAg and HTLV-1) and one (HIV and HTLV-1).

showed no significant difference between both groups (0.6% and 0.9%). Based on the overall prevalence of STI, deferred donors were over three times more likely to be seropositive for STI than accepted donors (16.3% *vs* 5.2%, OR 3.57, 95% CI 2.16, 5.90, $p < 0.0001$).

Four persons were positive for multiple tests. One person was seropositive for HIV and HTLV-1, one person for HBsAg, HIV and HTLV-1, another for HBsAg and HTLV-1 and a fourth person for HIV and HTLV-1. Several donors (46%) admitted to marijuana use, four to cocaine use, and none admitted intravenous drug use. Marijuana use was not associated with STI seropositivity.

By univariate analysis for male donors, there were significant associations found between seropositivity for STI and donors who reported the following risk factors: having fathered children with two or more women, unprotected sex with multiple partners, history of gonorrhoea and/or chlamydia infection more than four times, and history of genital herpes (Table 4). Significant female risk factors were unprotected sex with several partners, having more than 10 lifetime partners and use of depo-provera injection (Table 5). As expected, these risk factors were not independent when tested by multiple logistic regression analysis.

DISCUSSION

Most donors were men but the proportion described here (92%) has increased above that of a previous report of 80% (6). The figure for female donors (8%) is comparable to the less than 5% for women reported in Nigeria (7). The rate of STI for repeat and first time donors was not significantly different in this study although it has been reported that first time donors were more likely to be infected (8, 9).

Most rejected donors had a recent history of STI (55%) or body piercing by a non-medical person within the past year (21%). Although these variables are routinely used by blood banks and remain valid reasons for rejection of blood donors, they were not found to be associated with STI seropositivity in this study. This may reflect the general prevalence of these conditions in the communities and strategies to

Table 4. Univariate analyses of risk factors for positive STI among male blood donors

Variable	STI	OR	95% C.I.	*p* value
Fathered children with				
< 2 women	43/703			
≥ 2 women	26/229	0.51	0.3 – 0.88	0.0086
Unprotected sex with several partners				
No	15/306			
Yes	54/610	0.53	0.28 – 0.99	0.0326
H/o of gonorrhoea / chlamydia				
No	41/589			
Yes	28/343	1.19	0.70 – 2.01	NS
H/o genital herpes				
No	57/844			
Yes	12/88	0.43	0.21 – 0.90	0.0121
H/o bruising				
No	28/477			
Yes	41/455	0.63	0.37 – 1.07	NS
Lifetime partners				
≤ 10	41/553			
>10	28/379	1.00	0.59 – 1.70	NS
Sex with prostitutes				
No	66/841			
Yes	3/75	2.08	0.61 – 8.49	NS
Body piercing < 1 year				
No	65/881			
Yes	4/51	0.94	0.31 – 3.16	

NS = not significant STI = sexually transmitted infection
OR = odds ratio CI = confidence interval

Table 5: Univariate analyses of risk factors for positive STI among female blood donors

Variable	STI	OR	95% C.I.	*p* value
Mothered children with				
< 2 men	4/59			
≥ 2 men	4/24	0.36	0.07 – 1.95	NS
Unprotected sex with several partners				
No	2/49			
Yes	6/32	0.18	0.02 – 1.13	0.0386
H/o of gonorrhoea /chlamydia				
No	5/65			
Yes	3/18	2.40	0.4 – 13.58	NS
H/o genital herpes				
No	7/78			
Yes	1/5	0.39	0.03 – 10.59	NS
H/o bruising				
No	5/61			
Yes	3/22	0.57	0.1 – 3.35	NS
Lifetime partners				
≤ 10	5/77			
>10	3/6	0.07	0.01 – 0.59	0.0105
Use of depo provera injection				
No	3/69			
Yes	5/14	0.08	0.01 – 0.59	0.0028
Body piercing < 1 year				
No	7/75			
Yes	1/8	0.72	0.07 – 17. 48	NS

NS = not significant STI = sexually transmitted infection
OR = odds ratio CI = confidence interval

reduce these would increase the pool of blood being made available to the blood bank. Cases of hepatitis B, hepatitis C and possible HIV have been reported after body piercing but these cases were not found among blood donors in this study (10, 11).

It is well established that voluntary blood donors are more desirable than replacement donors. In this study, however, replacement donors were not associated with an increased likelihood of parenteral STI. The blood bank does not pay donors for giving blood and remunerated donors are generally regarded as unsafe (12–14). Bharucha found that the anti-HIV reactivity rate was three times higher in paid donors as compared to non-remunerated donors in India (14).

The finding of 8.4% of donors with deferrable risks seems high. This may be because some individuals who respond to questions about risk factors for STI before donating blood may respond differently after having given blood. Williams *et al* found that by using an anonymous mail survey, 1.9% of blood donors reported a deferrable risk that was present at the time of donation and 0.04% had a deferrable risk within the previous three months (15). Retrospective donor profiling is one such tool to assess this impact and to enhance blood safety (16).

The blood bank's interview as a screening tool showed low sensitivity (49%) and positive predictive value (15%) but reasonably good specificity (80%) and high negative predictive value (95%). These figures suggest that it is not a good tool in identifying persons likely to be infected with blood borne STI but it does better in identifying persons free of infection. Given the inherent drawbacks of face to face interviews these values may be reasonable. The predictive values will however vary with the prevalence of the individual infections (17). Schultz in evaluating the sensitivity, specificity and positive predictive value of specific criteria for excluding HIV infection in West Africa got values ranging from 15% to 98%, 38% to 91% and 17% to 30% respectively (18). The efficacy of a structured interview was assessed in the present study and not the individual criteria as was employed by Schultz. The HIV prevalence in his study was much higher (11.4%) than in this study (0.6%–0.9%). The use of computer-based interviews is believed to improve accuracy, privacy, and completeness of information. Locke *et al* found that computer-based screening elicited more HIV risk factors in the health histories of donors than did standard questionnaires and interview methods (19).

The prevalence of HIV and VDRL in the present study among routinely accepted donors (0.60%, 0.50% respectively) was similar to values (0.59%, 0.55% respectively) reported for 1996 (1). HBsAg and HTLV-1 prevalence of 0.6% and 3% respectively was lower and higher respectively than previous report (1.0%, 2.6% respectively) at the Central Blood Bank, Jamaica (1). Hepatitis C screening was not yet routinely available at the blood bank for the period under study and so was not included. HTLV-1 accounted for the highest prevalence in all the above settings and is a reflection of the national profile.

The deferred donors had an overall significantly higher prevalence of STI (16.3%) than accepted donors (5.2%) and validates the donor screening process. The lowest prevalence among deferred donors was for HIV (0.9%) and the highest for HTLV-1 (8.6%). A similar pattern was also seen among accepted donors. This may reflect the varying degree of transmissibility of the individual agents of infection and the local prevalence.

The HIV prevalence among deferred donors (0.9%) was not significantly different from accepted donors (0.6%) and was definitely much less than that reported for other risk groups such as sexually transmitted disease clinic attendees (6%), female prostitutes (10–21%) and homosexuals (30%) in Jamaica (20). Self-deferral due to public health awareness and fear of a positive test may help to explain the relatively low rates among deferred donors.

Having fathered children with two or more women was significantly associated with greater likelihood of seropositivity for STI than those who were not fathers or who reported fathering children with one woman. Although number of sex partners was not an identified risk factor, multiple baby mothers may reflect less condom use among the latter compared with the former. Lack of condom use and the small number of women in this sample may also explain why the reported use of depo-provera injection was also identified as a risk factor for STI in this study.

The finding that unprotected sex with multiple sex partners was a significant risk factor for both male and female donors is not surprising since this is a well documented risk factor for STI (21, 22). Multiple partners increase the likelihood of contracting STI. A history of genital herpes was significantly associated with increased risk for STI seropositivity on univariate analysis for males but not females. This gender difference may be because females with genital herpes, unlike males, are less likely to participate in penetrative sex. It is, however, established that ulcerative and non-ulcerative STI may increase the risk of HIV transmission by about three to ten-fold (23).

This study found no significant risk association of gender and sex with prostitutes with STI positivity although male gender and paying for sex have been found in other studies, among blood donors, to be associated with HIV seropositivity (5, 24).

The ethical procedures relating to counselling and preventive measures applied were according to the policy of the National Transfusion Services in Jamaica and in keeping with international standards (25–26). All patients who were tested positive for a STI were referred either to the STI/HIV clinic at the Comprehensive Health Centre, Kingston, or to the parish medical officer of health for management and follow-up care.

Although the data reported in this study relate to the blood donor population of 1998–1999, this is the first re-

ported study in Jamaica to look at the profile of both accepted and deferred donors together. This study was also limited by the small number of women and persons who were seropositive for STI. The findings, however, should not be negated as they confirm the higher rates of selected blood borne sexually transmitted infectious agents in deferred blood donors and support the blood donor deferral practice in Jamaica. Similar studies should be carried out periodically.

ACKNOWLEDGEMENTS

The authors wish to thank the staff of the Central Blood Bank, Jamaica, for facilitating this study. This study was funded by the United States Agency for International Development (USAID).

REFERENCES

1. Ministry of Health, Jamaica. National Transfusion Service 1999. Ministry of Health, Jamaica.
2. Sawanpanyalert P, Uthaivoravit W, Yanai H, Limpakarnjanarat K, Mastro TD, Nelson KE. HIV-related risk factors of blood donors in northern Thailand before and after knowing HIV test results. Int J Epidemiol 1997; **26:** 408–13.
3. Ministry of Health, Jamaica. Surveillance report 1999, 2000 and 2001. Ministry of Health, Kingston, Jamaica.
4. Brady-West DC, Buchner LM. Retrospective audit of blood donation at a hospital-based blood centre. Implications for blood product supply and safety. West Indian Med J 2000; **49:** 226–8.
5. Ampofo W, Nii-Trebi N, Ansah J, Abe K, Naito H, Aidoo S, et al. Prevalence of blood-borne infectious diseases in blood donors in Ghana. J Clin Microbiolol 2002; **40:** 3523–5.
6. Ministry of Health, Jamaica. Annual Report National Blood Transfusion Service. 1991. Ministry of Health, Kingston Jamaica.
7. Emeribe AO, Ejele AO, Attai EE, Usanga EA. Blood donations and patterns of use in southeastern Nigeria. Transfusion 1993; **33:** 330–2.
8. McFarland W, Kahn JG, Katzenstein DA, Mvere D, Shamu R. Deferral of blood donors with risk factors for HIV infection saves lives and money in Zimbabwe. J Acquir Immune Defic Synd Hum Retrovirol 1995; **9:** 183–92.
9. Sandler SG, Popovsky MA. New Technologies for a safer blood supply. Technology Review 1997; **93:** 22.
10. Tweeten SSM, Rickman LS. Infectious complications of body piercing. Clin Infect Dis 1998; **26:** 735–40.
11. Pugatch D, Mileno M, Rich JD. Possible transmission of human immunodeficiency virus type 1 from body piercing. Clin Infect Dis 1998; **26:** 767–8.
12. Key KK. Nations meet on securing safe blood. AIDS Weekly Plus 1995 Sept 20:18.
13. Britten AFH, Ala FA, El-Nageh M, eds. Blood Transfusion: A Basic Text. Geneva: WHO regional publications, 1994: 9–12.
14. Bharucha ZS. Towards increasing blood safety. Int Conf AIDS 1994; **10:** 256.
15. Williams AE, Thompson RA, Schreiber GB, Watanabe K, Bethel J, Lo A et al. Estimates of infectious disease risk factors in US blood donors. Retrovirus epidemiology Donor study. JAMA 1997; **277:** 967–72.
16. Goodwin DJ. Retrospective donor profiling: A tool for enhancing blood safety. Am J Infect Control 1999; **27:** 388–91.
17. Mausner JS, Kramer S. Epidemiology: An introductory text. Philadelphia: WB Saunders; 1985: 203–38.
18. Schultz R. Excluding blood donors at high risk of HIV infection in a West African city. BMJ 1993; **307:** 1517–9.
19. Locke SE, Kowaloff HB, Hoff RG, Safran C, Popovsky MA, Cotton DJ, et al. Computer-based interview for screening blood donors for risk of HIV transmission. JAMA 1992; **268:** 1301–5.
20. Figueroa JP, Brathwaite AR, Wedderburn M, Ward E, Lewis-Bell K, Amon JJ, et al. Is HIV/STD control in Jamaica making a difference? AIDS 1998; **12 (suppl 2):** 89–98.
21. Stone KM, Timyan J, Thomas EL. Barrier methods for the prevention of sexually transmitted diseases. In: Holmes KK, Mardh P, Sparling PF et al, eds. Sexually Transmitted Diseases.3rd ed. New York: McGraw-Hill; 1999. 1307–21.
22. WHO, Control of Sexually Transmitted Diseases. Technical Report Series 810, Geneva, 1985.
23. Calderon MR (ed.) STD syndromic management. Virginia: AIDSCAP/Family Health International; 1997. 6–8.
24. Sawanpanyalert P. Donation deferral criteria for human immunodeficiency virus positivity among blood donors in Northern Thailand. Transfusion 1996; **36:** 242–9.
25. Statement on the ethics of voluntary, non-remunerated blood donation: third International Colloquium on Recruitment of Voluntary Blood Donors, Hanover, August 1990; amended at the 19th meeting of the International Group of Red Cross Blood Transfusion Experts, Los Angeles, November 1990.
26. Code of ethics for blood donation and transfusion: International Society of Blood Transfusion, General Assembly, Montreal, 1980 and 24th International Conference of the Red Cross, Manila, 1981.