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SAFETY OF BLOOD SUPPLY FOR INFECTIOUS DISEASES IN LATIN AMERICAN COUNTRIES, 1994–1997

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Abstract. The potential risk of acquiring a transfusion-transmitted infection by the human immunodeficiency virus (HIV), hepatitis B (HBV) virus, hepatitis C (HCV) virus, or *Trypanosoma cruzi* was estimated for seven South American and five Central American countries during the period 1994–1997. The estimates were based on official national reports of the number of donors, blood screening coverage, and prevalence of serologic markers for infectious diseases. Coverage of screening in 1997 was 100% in 12 and 11 countries for HIV and HBV respectively. Complete screening for HCV was reported by only one country in 1994 and by six in 1997. For *T. cruzi*, the number of countries with 100% screening coverage increased from two in 1994 to four in 1997. In 1994, three countries showed risk of transfusion-transmitted infections for HIV, seven for HBV, eight for HCV, and seven for *T. cruzi*. The risk of receiving an infected blood unit and acquiring a transfusion-transmitted infection has been reduced with time in 10 of the 12 countries due to improvements in screening coverage. In Uruguay, the risk was theoretically nil from 1994–1997 because at the beginning of the study period they already had 100% blood donor screening for all infectious diseases transmitted by blood. In 1994, Colombia and Venezuela had the highest health risk associated with blood transfusion (spreading index of 101 and 62, respectively); during the period 1996–1997, Costa Rica presented the highest figures (spreading index of 53 and 83, respectively). The analysis of the potential risk associated with transfusion of tainted blood highlights the need for continuous monitoring of the safety of blood supply.

INTRODUCTION

In developing countries the risk of transfusion-transmitted infectious diseases can be minimized by appropriate selection of donors, promoting altruistic voluntary repeat donation, improving serologic screening, and by reducing the number of blood transfusions in accordance with appropriate standards of medical practice.[1] In developed countries, where screening for infectious diseases is universal, there is still a potential risk of transmitting viral infections during the serologic window period early after infection when antibodies are still not detectable.[2,3] To determine such a risk would require following seronegative repeat donors to estimate incidence rates, to analyze the duration of the window period for specific infectious agent, or to investigate clinical cases occurring after transfusion.[4] Unfortunately, none of these approaches are possible in Latin American countries, since no follow-up of blood donors or recipients is done routinely, and the majority of donors are relatives or friends of patients and not repeat donors.[5,6] The lack of a national registry of donors does not allow proper evaluation of seroconversion rates.

The review of blood donations records, quality of screening methods, and prevalence of serologic markers for infectious diseases can provide proxy estimates of the risk of blood transmitted infections.[1] In a recent report, the status of the blood supply in nine Latin American countries in 1993 and in two countries in 1994 was considered far from satisfactory, and there was the possibility that tainted units of blood were transfused in those countries.[1]

This paper estimates the risk of receiving a tainted transfusion and of acquiring an infectious disease in seven countries in South America and five countries in Central America during the period 1994–1997. In all of these countries, screening of some of the blood donors for human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and *Trypanosoma cruzi* was routinely done. Estimates for the total number of potential cases of transfusional infection with HIV, HBV, HCV, and *T. cruzi* are also presented.

MATERIALS AND METHODS

Source of information. Data were obtained from published reports on the total number of donors, screening coverage, and the prevalence of serologic markers for HIV, HBV, HCV, and *T. cruzi* for the period 1994–1997.[5–7] Figures for HIV in Uruguay and El Salvador in 1996 refer to confirmed cases only.[5–7] The identities of the persons providing the samples used were unknown. Estimates for syphilis were not included because it was assumed that the storage of blood at 4°C for 24 hr ensures complete inactivation of spirochetes. No information was available on transfusion of platelets, which are stored at 20–24°C.

Assumptions for the estimates. The comparison of prevalence estimates between countries is not straightforward since reagents and laboratory procedures used in the different countries varied in sensitivity and specificity. Thus, to calculate the potential risk of blood transfusion-related transmission of infectious diseases, the best possible scenario was considered. The following four assumptions were made. 1) Personnel and blood bank procedures were appropriate and periodically evaluated. 2) Reagents for serologic tests were of good quality. 3) Fractionation indices used were those published elsewhere,[5,6] except for Chile where the reported fractionation index for 1993 was used.[1] When data were not available on the fractionation index of blood units, it was assumed that each blood donation was used for a single transfusion to one recipient. 4) The prevalence of serologic markers for the non-screened population was assumed to be equivalent to that reported for the screened donors. The only exception was for Chile, where information was available on the seroprevalence rates for *T. cruzi* in blood donors from non endemic areas (0.6–1.5 per 1,000).[8–10] For the estimates

it was assumed that the seroprevalence of *T. cruzi* in areas with no vector transmission was 1.0 per 1,000, 10 times lower than in endemic areas.[1]

Figures for sensitivity and specificity of reagents were those in the upper range of values reported in the literature,[11–14] and those mentioned in the insert package of the assays commercially available in Latin America. The sensitivities and specificities of the different tests for blood donors screening were assumed as follows: HIV: third-generation enzyme immunoassay (EIA), sensitivity = 99.99%, specificity = 99.90%;[11] HBV: fourth-generation assay, sensitivity and specificity = 99.90%;[11] HCV: second-generation EIA used in 1994, sensitivity = 90%, specificity = 99.84%,[11] followed by a third-generation EIA (used from 1995 onward), estimated sensitivity = 98.52% and estimated specificity = 99.40%.[12–14] Serology for *T. cruzi* was assumed to have a sensitivity of 90% and a specificity of 95% by EIA or an indirect hemagglutination test (IHA) in 1994–1995.[15,16] In 1996–1997 with improved reagents for the EIA and IHA, the sensitivity was assumed to be 99.72%, and the specificity was assumed to be 98.82%.[17,18]

The reported prevalence rates for all serologic markers were adjusted to take into account an expected false-negative rate (for the test sensitivity less than 100%) and false-positive rate (for specificity less than 100%) for each test. The multiplier correction factor was 0.9991 for HIV prevalence; 1.009 and 1.098 for HCV prevalence with second- and third-generation tests, respectively; and for 1.05 for *T. cruzi* prevalence in 1994 and 1.001 in later years, reflecting the improvement in the quality of commercial reagents. Prevalence rates for HBV were not corrected, given that estimates for both false-positive and false-negative rates were the same (0.1%). There are no official statistics on single/repeat blood donors in Latin America. However, replacement donors which are one-time donors accounted for 74% to 100% in 1996 and 58% to 100% in 1997 of the donors from the countries mentioned in this report.[5,6] Therefore, it was assumed that there was no real difference between rates estimated by donors or by donations, and the two terms are then used interchangeably.

Estimates. All data were rounded to the nearest tenth of a unit using conventional methods. Screening coverage rates were calculated as the percentage of donors screened for each marker. The probability of receiving a tainted transfusion unit P(R) was calculated by multiplying the prevalence of a specific serologic marker by the proportion of unscreened donors (1 − screening coverage rate).[1] The probability of getting a transfusion-transmitted infection P(I) was calculated as the result of the probability of receiving a potentially infected transfusion P(R) multiplied by an infectivity risk.[1] Infectivity risks, defined as the likelihood of getting an infection when receiving an infected transfusion unit, were assumed to be 90% for HIV,[19] 90% for HBV,[3] 90% for HCV,[20] and 20% for *T. cruzi*.[21] The absolute number of potential infections induced by transfusion was estimated as the number of donors in a given year × P(I).[1]

An index of the spread of infectious diseases via blood transfusion was calculated by dividing the estimated total number of transfusion-related infections, for any one of the infectious agents considered, by the total number of donations. This index give an indication of the health risks associated with blood transfusion.[1]

TABLE 1
Total number of blood donations by country and year*

Country	1994	1995	1996	1997
Chile	NA	NA	218,291	220,686
Colombia	332,540	370,815	NA	422,300
Costa Rica	NA	45,311	44,754	58,436
Ecuador	98,473	100,774	104,452	110,619
El Salvador	49,550	52,365	55,069	34,091
Honduras	31,275	31,937	33,032	27,963
Nicaragua	44,840	48,030	43,606	46,539
Panama	26,333	37,107	41,888	42,342
Paraguay	32,893	34,216	37,054	39,904
Peru	81,103	82,656	NA	203,690
Uruguay	110,309	111,518	116,127	115,490
Venezuela	202,247	202,515	266,828	262,295

* NA = no information available.

RESULTS

Table 1 shows the total number of blood donations by country and year. The absolute number of donations increased from 1994 to 1997 (from 10% to 150%) in 7 countries, decreased in 2, and remained relatively constant in the others. The number of donations previously reported from Peru was 52,909 from the capital of Lima in 1993.[1] Thus, it was reasonable that the higher number of donors reported during the study period (from 81,103 in 1994 to 203,690 in 1997) originated in the improvement of an information system that collected information nationwide.

In 1994, the HIV screening coverage was 100% in all countries except Colombia (72.0%), Ecuador (89.5%), and Peru (60.0%) (Table 2). By 1997, all countries reported complete HIV coverage. Screening for HBV was 100% in only three of the 10 countries reporting in 1994, in six of 11 in 1995, and in 11 of 12 in 1997. Coverage for HCV was limited; only one country had a coverage of 100% in 1994, two in 1995; and four and six in 1996 and 1997, respectively. However, by 1997, Paraguay, Peru, and Nicaragua screened between 25% and 62% of the blood donations. Screening for *T. cruzi* increased over time; complete screening in 1994 was reported by two of nine countries and in 1997 by four of 11.

Table 3 shows the prevalence rate of serologic markers for infectious diseases by country and year. No obvious trend could be found in the prevalence of the serologic markers of infection. In 1997, prevalence rates ranges from 0.7 to 3.6/1,000 for HIV, from 1.5 to 10.2/1,000 for HBV, from 1.3 to 8.5/1,000 for HCV, and from 1.3 to 37.7/1,000 for *T. cruzi.* The highest rates for HIV were Honduras, Colombia, and Venezuela; the highest rates for HBV were in Peru, Colombia, and Venezuela; the highest rates for HCV were in Colombia, Chile, and Venezuela; and the highest rates for *T. cruzi* were in Paraguay, Costa Rica, and El Salvador.

The risk of receiving an infected unit or acquiring an infection through transfusion is related to the completeness of screening and the prevalence of infection. Estimates of the risk of receiving a tainted transfusion and of acquiring a transfusion-transmitted infection are shown in Table 4. Since

TABLE 2
Screening coverage (%) among blood donors in Latin America (1994–1997)*

Country	HIV				HBV				HCV				*Trypanosoma cruzi*			
	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997
Chile	NA	NA	100	100	NA	NA	100	100	NA	NA	100	100	NA	NA	59.8	79.8
Colombia	72.0	100	NA	100	75.0	100	NA	100	67.0	99.8	NA	100	7.7	46.0	NA	99.9
Costa Rica	NA	100	100	100	NA	100	100	100	NA	100	100	100	NA	13.0	7.6	6.9
Ecuador	89.5	100	100	100	88.0	99.0	100	100	33.0	42.6	68.2	90.0	51.0	75.4	91.0	72.3
El Salvador	100	100	100	100	100	100	100	100	46.0	74.0	89.6	100	65.0	99.0	100	100
Honduras	100	100	97.3	100	84.0	92.0	98.0	97.2	30.0	73.0	72.2	86.2	85.0	90.0	97.1	99.0
Nicaragua	100	99.0	99.4	100	95.0	96.0	97.5	100	55.0	51.0	65.5	62.0	68.0	51.0	55.7	62.1
Panama	100	83.0	100	100	85.0	100	100	100	21.0	65.0	87.6	94.0	24.0	2.0	1.8	NA
Paraguay	100	100	98.0	100	93.0	93.0	99.8	100	NA	14.8	15.2	25.0	87.0	83.0	98.0	100
Peru	60.0	60.0	NA	100	60.0	60.0	NA	100	43.0	50.0	NA	60.0	NA	4.0	NA	60.0
Uruguay	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Venezuela	100	100	100	100	100	100	100	100	32.0	57.0	100	100	100	100	100	100

* HIV = human immunodeficiency virus; HBV = hepatitis B virus; HCV = hepatitis C virus; NA = no information available.

screening coverage increased progressively during the study period, the risk of transfusion transmitted infections decreased during the same period.

For example, in Colombia, the risk of receiving an HCV-positive blood unit decreased by more than 25-fold (25.4 to 0/10,000 donations), and for *T. cruzi* by more than 2,000-fold (249.1 to 0.1/10,000). Major improvements were seen in both HBV and *T. cruzi* screening. However, the risk for *T. cruzi* transfusional infection increased in Panama more than 10-fold (10.4 to 112.1/10,000) and more than three-fold in Costa Rica (73.1 to 239.5/10,000) (Table 4). The highest number of transfusion-transmitted infections was estimated in Colombia and Venezuela in 1994; in Peru and Venezuela in 1995; in Costa Rica and Paraguay in 1996; and in Costa Rica and Peru in 1997. There was an important decrease in the estimated number of cases that could have originated by transfusion in Latin America from 1994 to 1997. This was most marked in Colombia, El Salvador, and Venezuela, with a reduction of the number of potential cases by 99.95–100% (Table 5).

The index of infectious diseases spreading through blood transfusion decreased steadily over time in 9 of the 11 countries, in which screening of blood donors was less than 100% at the beginning of the follow up. This finding parallels countries' increase in screening coverage. However, no decrease was seen in Costa Rica or Nicaragua due to limited screening for *T. cruzi*. In 1997, the health risk associated with blood transfusion as indicated by the spreading index ranged from 0 in El Salvador to 83 in Costa Rica (Table 6).

DISCUSSION

The control of transfusion-transmitted infectious diseases is a key public health issue in Latin America. Great progress has been achieved in the last five years in expanding screening coverage and improving the quality of laboratory procedures. The commitment of both government and private sectors is essential for successful control. Given the fact that laboratory procedures and reagents used in blood banks operating in different countries vary, it is possible that the risk figures presented in this paper may be underestimated or overestimated.[5,6] The results may also have been influenced by the lack of a quality control system and routine performance evaluations for serologic testing in blood banks. However, even when these facts are considered, the data presented here provide a good overall estimate of the problem.

A potential cause of underestimation of the risk of transfusion of infected blood or blood components is the lack of information on the fractionation of blood for 1994 and 1995; information was available for only 5 countries in 1996 and 9 in 1997.[5–7] The same infected blood unit could have generated several by-products, and more than one recipient could have been exposed to the risk of receiving a tainted transfusion.[1] In addition, no consideration was given to the potential risk of transmission of viral diseases during the window period, when antibodies are not detectable, even when 100% of the donors are screened.[2,3] The reported average window period for the assays used for screening are 20−25 days, 82–84 days, and 51 days for HIV, HBV, and HCV respectively.[2,3,11] Transmission during the window period can be estimated by studying the seroconversion of do-

TABLE 3
Seroprevalence for infectious diseases (×1,000) among blood donors in Latin America (1994–1997)*

	HIV				HBV				HCV				*Trypanosoma cruzi*			
Country	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997
Chile	NA	NA	0.7	1.3	NA	NA	1.0	1.5	NA	NA	6.0	6.8	NA	NA	10.0	9.7
Colombia	3.4	3.0	NA	2.9	9.0	8.9	NA	6.8	7.0	9.6	NA	8.5	25.7	13.0	NA	11.1
Costa Rica	NA	1.0	0.9	1.0	NA	4.0	5.0	3.8	NA	3.0	2.9	4.6	NA	8.0	13.9	25.7
Ecuador	1.0	1.8	1.5	1.5	3.8	4.7	4.1	3.9	1.4	1.0	1.6	2.1	2.0	1.0	0.7	1.3
El Salvador	1.5	1.5	1.6†	1.2	6.0	6.0	4.7	3.8	1.7	1.8	3.0	1.3	23.0	23.0	22.0	19.0
Honduras	6.4	5.0	6.8	3.6	9.8	5.0	5.3	3.5	0.6	1.7	4.4	1.9	14.1	17.0	16.7	11.9
Nicaragua	0.7	1.1	1.2	1.4	8.1	3.7	3.2	3.1	6.0	5.7	4.3	4.1	4.0	5.0	5.0	3.9
Panama	1.0	1.2	0.6	0.7	4.0	5.0	6.0	6.7	4.0	3.5	5.0	5.0	1.3	10.0	11.4	NA
Paraguay	0.7	0.5	1.7	2.5	13.0	14.0	6.1	5.6	NA	3.0	5.7	4.3	45.0	58.0	40.9	37.7
Peru	2.2	2.8	NA	2.0	7.6	7.0	NA	10.2	6.3	6.8	NA	3.1	NA	0.3	NA	2.0
Uruguay	0.8†	1.1†	1.3†	0.8†	4.1	4.8	4.4	4.1	4.2	4.6	5.0	4.9	6.2	5.9	6.0	6.5
Venezuela	2.2	3.8	2.7	2.7	14.6	10.5	9.2	7.5	9.3	8.5	7.5	6.6	13.3	8.4	7.7	7.8

* HIV = human immunodeficiency virus; HBV = hepatitis B virus; HCV = hepatitis C virus; NA = no information available.
† Prevalence of confirmed cases.

nors and recipients over time. However, only a small number of donors are repeated donors. In 1996–1997, more than 90% of blood donations in Chile, Paraguay, Peru, Uruguay, and Venezuela came from one time donors, relatives, or patient's friends. In Colombia, Ecuador, El Salvador, Honduras, Nicaragua, and Panama, this proportion varied between 56% and 83%. Even in Costa Rica (1997), where 100% of the donors were reported to be altruistic donors[6] (supposedly repeat donors), analysis of conversion rates would have been difficult to carry out, considering the time required and the large number of individuals to be enrolled.

Prevalence rates and infectivity risk also could have been underestimated for HBV, assuming that no test for anti-core antibodies were reported. Only two countries reported nationwide results of screening for HBV anti-core antibodies in 1996.[5] No doubt the number of infections caused by transfusion was underestimated in Peru in 1995, since the number of donors reported and used for the calculations, was less than half of the number reported in 1997.

Blood-transmitted infections in Costa Rica were by *T. cruzi* only. It may be possible that the incidence was overestimated due to the high prevalence of the infection among blood donors which, in turn, was based on the small sample of donors tested. The probability that a person infected with *T. cruzi* may donate blood during the window period is remote. Most infections occur during childhood or in adolescence, and in rural areas. However, a few *T. cruzi*-positive cases may have been missed when only one test for screen-

TABLE 4
Probability of receiving an infected transfusion P(R) and probability of acquiring a transfusion-transmitted infection P(I) by country and year × 10,000 donors*

	HIV				HBV				HCV				*Trypanosoma cruzi*			
Country	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997	1994	1995	1996	1997
Chile	NA	NA	0	0	NA	NA	**0**	0	NA	NA	0[1]	0	NA	NA	**4.0**	**2.0**
															0.8	*0.4*
Colombia	**9.5**	0	NA	0	**22.5**	0	NA	0	**25.4**	**0.2**	NA	0	**249.1**	**73.7**	NA	**0.1**
	8.6				*20.2*				*22.8*	*0.2*		0	*49.8*	*14.7*		0
Costa Rica	NA	0	0	0	NA	0	0	0	NA	0	0	0	NA	**73.1**	**128.6**	**239.5**
														14.6	*25.7*	*47.9*
Ecuador	**1.0**	0	0	0	**4.5**	**0.5**	0	0	**10.3**	**5.8**	**5.2**	**2.1**	**10.3**	**2.6**	**0.6**	**3.6**
	0.9				*4.1*	*0.4*			*9.3*	*5.2*	*4.7*	*1.9*	*2.1*	*0.5*	*0.1*	*0.7*
El Salvador	0	0	0	0	0	0	0	0	**10.0**	**4.7**	**3.2**	0	**84.5**	**2.4**	0	0
									9.0	*4.3*	*2.8*		*16.9*	*0.5*		
Honduras	0	0	**1.8**	0	**15.7**	**4.0**	**1.1**	**1.0**	**4.6**	**4.6**	**12.3**	**2.6**	**22.2**	**17.8**	**4.7**	**1.2**
			1.6		*14.1*	*3.6*	*0.9*	*0.9*	*4.2*	*4.2*	*11.1*	*2.4*	*4.4*	*3.6*	*0.9*	*0.2*
Nicaragua	0	**0.1**	0	0	**4.1**	**1.5**	**0.8**	0	**29.7**	**28.2**	**15.0**	**15.7**	**13.4**	**25.7**	**22.2**	**14.8**
		0.1			*3.0*	*1.1*	*0.7*		*26.7*	*25.4*	*13.0*	*14.2*	*2.7*	*5.1*	*4.4*	*2.9*
Panama	0	**2.0**	0	0	**6.0**	0	0	0	**34.7**	**12.4**	**6.2**	**3.0**	**10.4**	**102.9**	112.1	NA
		1.8			*5.4*				*31.2*	*11.1*	*5.6*	*2.7*	*2.1*	*20.6*	*22.4*	
Paraguay	0	0	**0.3**	0	**9.1**	**9.8**	0	0		**25.8**	**48.8**	**32.5**	**61.4**	**103.5**	**8.2**	0
			0.3		*8.2*	*8.8*				*23.2*	*43.9*	*29.3*	*12.3*	*20.7*	*1.6*	
Peru	**8.8**	**11.2**	NA	0	**30.0**	**28.0**	NA	0	**39.4**	**34.3**	NA	**12.5**	NA	**3.0**	NA	**8.0**
	7.9	*10.1*			*27.3*	*25.2*			*35.5*	*30.9*		*11.3*		*0.6*		*1.6*
Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	0	0	0	0	0	0	0	0	**69.5**	**36.9**	0	0	0	0	0	0
									62.5	*33.2*						

* Bold numbers are P(R) values. Italic numbers are P(I) values. Fractionation index in 1996: Costa Rica = 2.05; Ecuador = 1.34; El Salvador = 2.05; Nicaragua = 1.39; Uruguay = 1.67; Venezuela = 1.62; in 1997: Colombia = 1.69; Costa Rica = 1.74; Ecuador = 1.17; El Salvador = 1.48; Nicaragua = 1.55; Panama = 1.38; Peru = 1.09; Uruguay = 1.35; Venezuela = 1.64. The fractionation index for Chile was estimated to be 1.85, which was the fractionation index known for 1993. When estimates were 0, it was not considered the residual infectivity because of the false-negative results of the serology. HIV = human immunodeficiency virus; HBV = hepatitis B virus; HCV = hepatitis C virus; NA = no information available.

TABLE 5
Estimates of potential transfusion-transmitted infectious diseases cases by country and year*

Country	1994				1995				1996				1997			
	HIV	HBV	HCV	*T. cruzi*	Total	HIV	HBV	HCV	*T. cruzi*	Total	HIV	HBV	HCV	*T. cruzi*	Total	HIV	HBV	HCV	*T. cruzi*	Total
Chile	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0	0	0	32	32	0	0	0	16	16
Colombia	285	673	759	1,657	3,374	0	0	6	547	553	NA	NA	NA	NA	NA	0	0	0	2	2
Costa Rica	NA	NA	NA	NA	NA	0	0	0	66	66	0	0	0	236	236	0	0	0	487	487
Ecuador	9	40	91	20	160	0	4	53	5	62	0	0	65	2	67	0	0	25	9	34
El Salvador	0	0	45	84	129	0	0	22	3	25	0	0	32	0	32	0	0	0	0	0
Honduras	0	44	13	14	71	0	11	13	11	35	5	3	37	3	48	0	2	7	1	10
Nicaragua	0	16	120	12	148	0	6	122	25	153	0	4	82	27	113	0	0	102	21	123
Panama	0	14	82	5	101	7	0	41	76	124	0	0	23	94	117	0	0	16	NA	16
Paraguay	0	27	NA	40	67	0	30	79	71	180	1	0	163	0	164	0	0	117	0	117
Peru	64	222	288	NA	574	83	208	255	5	551	NA	NA	NA	NA	NA	0	0	250	36	286
Uruguay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Venezuela	0	0	1,264	0	1,264	0	0	672	0	672	0	0	0	0	0	0	0	0	0	0

* Fractionation index in 1996: Costa Rica = 2.05; Ecuador = 1.34; El Salvador = 2.05; Nicaragua = 1.39; Uruguay = 1.67; Venezuela = 1.62. In 1997, Colombia = 1.69; Costa Rica = 1.74; Ecuador = 1.17; El Salvador = 1.48; Nicaragua = 1.55; Panama = 1.38; Peru = 1.09; Uruguay = 1.35; Venezuela = 1.64. The fractionation index in Chile was considered 1.85, which was the one in 1993. When estimates were 0, it was not considered the residual infectivity because of the false-negative results of the serology. HIV = human immunodeficiency virus; HBV = hepatitis B virus; HCV = hepatitis C virus; NA = no information available.

TABLE 6
Spreading index by country and year†

Country	1994	1995	1996	1997
Chile	NA	NA	1.4	0.7
Colombia	101	15	NA	0
Costa Rica	NA	12	53	83
Ecuador	16	6	6	3
El Salvador	26	5	6	0
Honduras	23	11	15	4
Nicaragua	33	32	26	26
Panama	38	33	28	4
Paraguay	20	53	44	29
Peru	71	67	NA	14
Uruguay	0	0	0	0
Venezuela	62	33	0	0

† Spreading index = number of transfusion-transmitted infections ÷ total number of donations × 10,000. NA = no information available.

ing was used. Even if a very high sensitivity test for *T. cruzi* is used, a second assay would be necessary because the different assays detect antibodies of different specificities. No single test has been shown to be sensitive enough to prevent transmission of *T. cruzi* in urban centers, and the use of a parallel test would increase the sensitivity of diagnosis.[21–23]

Estimates were based on results of the screening and no confirmatory serology results for viral infections were available. Some positive samples by screening are likely to retest as negative on confirmatory assays. Country-wide results of the screening, as well as of confirmed serologic rates for HIV, were available for only five countries in 1996 and three countries in 1997.[5,6] The proportion of samples positive for HIV by serologic screening that were also positive by a confirmatory test varied widely from country to country. In 1996, Chile confirmed 25% of those positive by this screening, Costa Rica 29%, Ecuador 78%, and Nicaragua 8%.[5] In 1997, Chile confirmed 46% of its seropositive donors by screening, El Salvador and Panama, 100%, while Nicaragua confirmed only 10.3%.[6] Nationwide results of confirmatory tests for HBV or HCV were not available for the period 1994–1997. However, in limited studies of blood donors from Argentina, half of those seropositive for HCV by screening were considered false-positive.[24] Records from testing more than 1.4 million donors in Spain indicated that only 5.7%, 38.8%, and 34.8% were confirmed for HIV, HBV, and HCV, respectively.[25]

Another source of overestimation of the risk of transfusion-transmitted infections is the possibility that some potential blood recipients may have already been infected. If one assumes that the overall prevalence of infectious disease among blood recipients is similar to that in the donor population, the estimated number of potential new infections induced by transfusion would be reduced by the proportion of recipients already positive.

The situation in other Latin American countries not reported here is somewhat variable. Mexico did not report national screening coverage or prevalence of serologic markers up to 1997. Data from 1994 suggest that 12,750 individuals would have received a *T. cruzi*-tainted transfusion and approximately 1,912 individuals would have been infected by *T. cruzi*.[26] In 1997, Brazil reported 100% screening for infectious diseases in the public sector covering approximately

1.6 million donations.[27] However, no official national information was available for donors from the private sector.

In Argentina, screening coverage was higher in the private sector.[28] During the period 1995–1997, screening increased from 84.5% to 98.0% for HIV, from 83.7% to 98.5% for HBV, and from 69.9% to 97.8% for HCV. Screening coverage for *T. cruzi* has been 100% for the period 1995–1997. In 1995, the probability of a recipient receiving an HIV-infected blood unit was 8.6 per 10,000 donations; the probability of acquiring an infection was estimated to be 7.7 per 10,000 donations in the public sector and 0 in the private sector.[28] The risk of *T. cruzi* infection from 1995 to 1997 was in theory 0, given a full coverage of 100% screening. In spite of the overall improvements, HCV screening is still insufficient.[28]

Although the use of secondary data for public health policy decisions has some limitations, the figures presented here are the best national estimates of the risk associated with transfusion of tainted blood in Latin America. A thorough analysis would certainly reveal areas and services with excellent performance and other with sub-optimal performance. Overall screening coverage has increased, but there is still room for improvement, especially for HCV and *T. cruzi.* Continued monitoring and reporting is considered a priority to maintain the safety of blood supply in this region.[1,28]

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