Trends in risk of transfusion-transmitted viral infections (HIV, HCV, HBV) in France between 1992 and 2003 and impact of Nucleic Acid Testing (NAT)

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Background

Monitoring trends in residual risk of transfusion-transmitted viral infections is important to assess improvements in blood safety and to adapt the reduction risk policies.

These trends were analysed over 10 overlapping periods of 3 years from 1992 to 2003.

The 2001-03 estimates were compared to the results of HIV-1 and HCV NAT implemented on all blood donations in July 2001.

Method

As the major source of risk is associated with the window period, a seroconversion incidence model was used to estimate residual risks:

Residual risk = Incidence rate x Window period duration.

Incidence rate is the number of donors who underwent seroconversion during a 3-year period divided by the number of person-years calculated by summing time intervals between the first and the last donation of each donor during the study period. If the previous seronegative donation was not transfusable due to a positive result for another marker (elevated ALT, anti-HBc,...), the incident case was excluded from the analysis. Because of the transient presence of HBsAg, an adjustment was made to estimate the incidence rate for HBV.

For each virus, the length of the window period was derived from published data: 22 days for anti-HIV Ab, 66 days for anti-HCV Ab and 56 days for HBsAg. With the use of minipool NAT, window periods were estimated at 12 days for HIV and 10 days for HCV.

For the first 7 periods, Incidence rates were calculated from data collected by the blood centers belonging to the Transfusion-Transmissible Agents Working Group which collect more than 50% of blood donations in France, and for the 3 last periods, on the overall blood supply.

Chi-square for linear trends was used for trends analysis.

Results

I. Incidence rates

The incidence rates of HIV, HBV and HCV seropositivity decreased significantly over time (table 1). The most important decrease was for HCV: incidence rate on the last period was 7 times lower compared with the first one. For HBV, incidence rate on the last period was near 6 times lower compared with the first one. For HIV, the decrease was important until the 1995-97 period but was weaker afterwards.

Since the 1998-2000 period, HIV incidence rates are higher than HCV incidence rates.

Table 1. Incidence rates (IR) of HIV, HCV and HBV in France

		1992-94	1995-97	1998-00	2001-03	p
HIV	Incident cases	24	15	17	22	
	IR per 10^5 P-Y (95% CI)	**2.78** (1.8-4.2)	**1.36** (0.8-2.3)	**1.21** (0.7-2.0)	**0.97** (0.6-1.5)	0.0006
HCV	Incident cases	11	22	9	8	
	IR per 10^5 P-Y (95% CI)	**2.54** (1.3-4.7)	**2.00** (1.3-3.1)	**0.64** (0.3-1.3)	**0.35** (0.2-1.3)	$<10^{-4}$
HBV*	Incident cases	52	35	20	23	
	IR per 10^5 P-Y (95% CI)	**5.78** (4.4-7.7)	**3.22** (2.3-4.5)	**1.39** (1.0-2.7)	**1.02** (0.7-1.6)	$<10^{-4}$

*data were adjusted for transient antigenemia

II. Residual risks

Trends analysis showed a significant decrease in residual risks for HBV and HCV (table 2 and figure 1). Although residual risk appeared to decrease for HIV, this trend is not statistically significant.

On the 2001-03 period, residual risks without NAT were estimated at 1 in 1,700,000 donations for HIV, at 1 in 1,560,000 for HCV and at 1 in 640,000 for HBV.

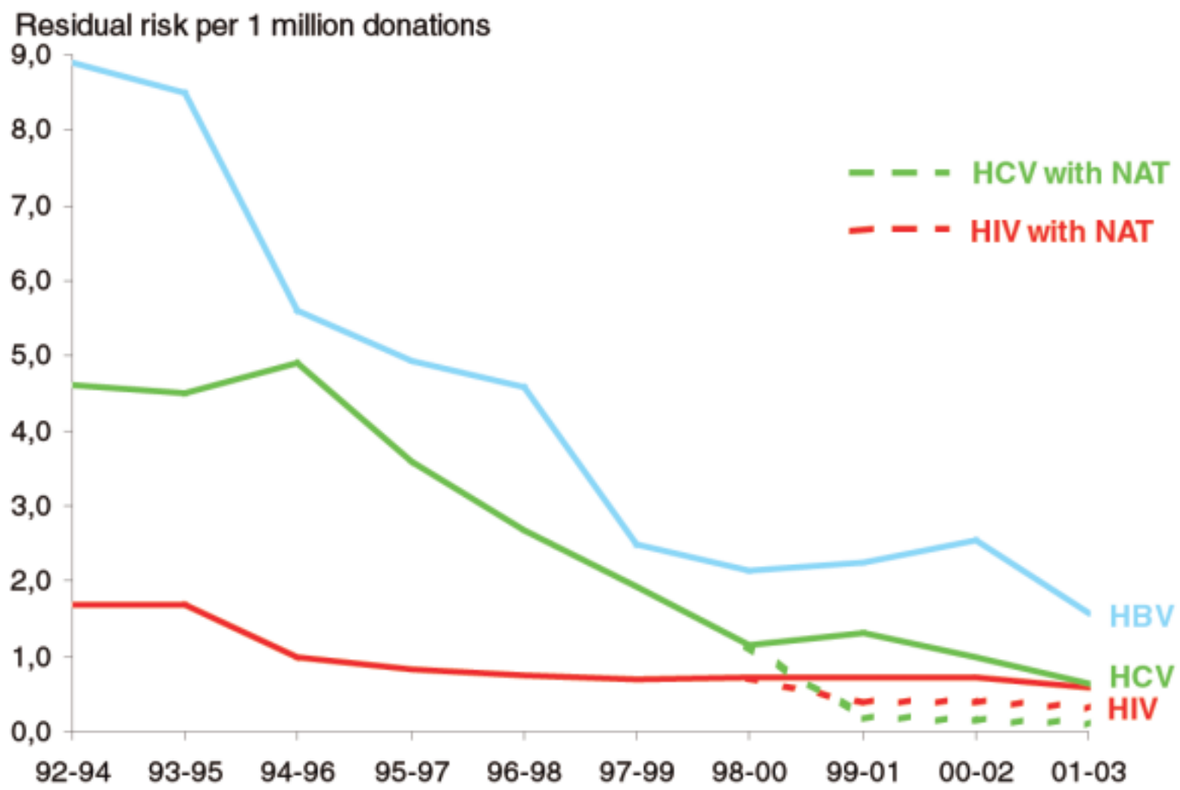
With minipool NAT, the residual risk is currently estimated at 1 in 3.15 million donations for HIV and 1 in 10 million for HCV.

Table 2. Residual risk (RR) of transfusion-transmitted viral infections in France

		1992-94	1995-97	1998-00	2001-03*	p
HIV	RR p.10^6 (95% CI)	**1.68** (0.3-4.4)	**0.82** (0.1-2.4)	**0.73** (0.1-2.1)	**0.32** (0.0-1.1)	0.1
HCV	RR p.10^6 (95% CI)	**4.59** (1.4-12)	**3.61** (1.3-7.9)	**1.16** (0.3-3.3)	**0.10** (0.0-0.8)	$<10^{-3}$
HBV	RR p.10^6 (95% CI)	**8.87** (3.0-23)	**4.94** (1.6-13)	**1.81** (0.7-7.6)	**1.57** (0.5-4.7)	$<10^{-4}$

*with NAT for HIV and HCV

Figure 1. Residual risk of transfusion-transmitted viral infections by period of time in France



III. Impact of Nucleic Acid Testing (NAT)

Of the 6.13 million donations screened with NAT between July 2001 and December 2003 in France, 2 HIV and 3 HCV were discarded thanks to the NAT, which is consistent with the expected yield of NAT for both HIV and HCV (table 3).

Table 3. Predicted versus observed yield of NAT (July 01-Dec. 03)

	Predicted yield of NAT* (95% CI)	Observed yield of NAT between July 2001 and Dec. 2003	
		No. of donations NAT pos/Ab neg	Per 1 million donations**
HIV	0,27 p. 10^{-6} donations (0,0 - 1,1)	2	0,33 p.10^{-6} donations
HCV	0,54 p. 10^{-6} donations (0,2 - 1,5)	3	0,49 p.10^{-6} donations

* obtained by difference between residual risks with and without NAT

** 6,13 million donations collected in France between July 01 and Dec.03

Conclusion

Given the improvements in donor recruitment and selection, the continuous progress in screening assays and the preventive measures taken in the community to control infections, the current residual risk of transfusion-transmitted viral infections is very low.

Without NAT, the overall residual risk for the 3 viruses combined (HIV, HCV, HBV) decreased **from 1 in 65,000 to 1 in 350,000 donations between 1992 and 2003.** Since the implementation of NAT, the current **overall residual risk is 1 in 500,000 donations** (30% less than without NAT).

For HIV-1 and HCV, Nucleic Acid Testing results observed between July 2001 and December 2003 confirm the validity of residual risk estimates. Furthermore, these results show the limited benefit of genomic screening.

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