

# Effectiveness and Cost-effectiveness of HIV Screening Strategies Across Europe

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## Abstract (modified)

### OBJECTIVE

In the eras of both Treatment as Prevention and PrEP, HIV testing has become critical to control the epidemic. We evaluated the clinical impact, costs, and cost-effectiveness of different testing strategies for both high-risk individuals and the general population in three European countries with different epidemic profiles.

### METHOD

We used a mathematical model of HIV disease, the Cost-Effectiveness of Preventing AIDS Complications (or "CEPAC") Model, with country-specific clinical & economic data to project discounted life expectancy, cost and incremental cost-effectiveness ratios (ICERs) of alternative HIV screening strategies in Estonia, France, and Spain. We compared these strategies to current HIV testing practices in adults aged 18-69 among MSM, PWID, and the overall population. Input data by country included: HIV prevalence, incidence, mean CD4 at ART initiation, current screening performance including acceptance and linkage-to-care rates; and costs for ART, HIV tests, and HIV care (Table 1). We considered a strategy "cost-effective" if its ICER in 2015€ per year of life saved (YLS) was less than the annual per capita GDP of the country.

### RESULTS

Frequent HIV testing among high-risk groups increased life expectancy in people living with HIV (Table 2). Among MSM, one test every 12 months in Estonia and France, and every 3 years in Spain, had an ICER of 16,200; 18,600; and 25,300€/YLS. Among PWID, testing every three months in Estonia, every 3 years in France, and every 6 months in Spain had ICERs of 7,000; 19,700; and 18,300€/YLS, respectively. In the general population, one additional lifetime test in France and Spain, and testing every 3 years in Estonia, had ICERs of 37,100; 28,100; and 13,000€/YLS (Figure 1). Our findings were most sensitive to uncertainty in rates of HIV incidence, the current CD4 at diagnosis, and HIV test costs.

### CONCLUSIONS

In France and Estonia, MSM should have additional HIV testing every 12 months; and in Spain every 36 months. In Spain and France, PWID should be tested every 6 and 36 months, while in Estonia, the frequency could be even higher. HIV testing in the general population is also cost-effective in these countries. For optimal value, HIV screening strategies in Europe should be tailored to each country's epidemic.

Table 1: Base case key-input parameters for analyses in Estonia, France, and Spain

Parameter	Estonia	France	Spain
<b>Undiagnosed prevalence (%)</b>			
Overall Population	0.40	0.07	0.10
MSM	2.00	2.95	0.62-1.24
PWID	6.00	0.62	3.31-6.62
<b>Incidence /100PY</b>			
Overall Population	0.033	0.017	0.007
MSM	0.08	1.00	0.28-1.00
PWID	6.00	0.13	1.90-3.00
<b>Mean CD4 count at initiation</b>			
Overall Population		419	414
MSM	289	465	450
PWID		316	275
<b>Screening characteristics</b>			
Test acceptance rate	95.0%	79.0%	96.0%
Linkage to care rate	50.0%	75.0%	83.1%
Cost of HIV test	€ 8.00	€ 41.77	€ 18.45
<b>Cost of ART (annually)</b>			
1st line	€2,920	€11,810	€8,640
2nd to 4th line	€4,750	€13,960	€10,210
5th line	€7,720	€19,740	€14,450
<b>GDP per capita</b>	€ 20,000	€ 29,000	€ 24,300

Table 2: High-risk groups - Results of different HIV testing strategies in Estonia, France, and Spain for MSM and PWID

Testing strategies: <sup>1</sup>	Estonia GDP=€20,000			France GDP=€29,000			Spain GDP=€24,300		
	LE <sup>3</sup>	Costs (€)	ICER (€/YLS) <sup>2</sup>	LE <sup>3</sup>	Costs (€)	ICER (€/YLS) <sup>2</sup>	LE <sup>3</sup>	Costs (€)	ICER (€/YLS) <sup>2</sup>
<b>MSM</b>									
Current frequency	359.7	€ 1,736	--	280.9	€ 45,276	--	332.2	€ 12,640	--
Every 10 years	360.2	€ 2,110	dominated	281.8	€ 46,390	15,100	332.7	€ 13,233	13,700
Every 3 years	360.4	€ 2,277	7,800	282.2	€ 47,011	dominated	332.9	€ 13,595	25,300
Every 12 months	360.6	€ 2,589	16,200	282.9	€ 48,135	18,600	333.2	€ 14,218	31,200
Every 6 months	360.8	€ 2,918	30,000	283.4	€ 49,366	28,700	333.4	€ 14,899	32,500
Every 3 months	360.9	€ 3,458	49,700	283.9	€ 51,014	38,900	333.5	€ 15,940	133,600
<b>PWID</b>									
Current frequency	267.5	€ 36,010	--	332.9	€ 6,761	--	320.4	€ 36,163	--
Every 10 years	273.4	€ 39,795	dominated	333.4	€ 7,640	dominated	325.7	€ 43,875	dominated
Every 3 years	279.5	€ 42,748	dominated	333.7	€ 8,133	19,700	327.8	€ 46,129	dominated
Every 12 months	286.4	€ 46,384	dominated	334.1	€ 9,035	30,900	329.4	€ 48,111	16,000
Every 6 months	289.7	€ 48,054	6,500	334.2	€ 10,070	94,400	330.2	€ 49,299	18,300
Every 3 months	292.3	€ 49,536	7,000	334.4	€ 12,002	177,400	330.5	€ 50,530	47,900

<sup>1</sup> Current testing was included in each strategy, so each testing frequency was in addition to current practice (baseline); MSM: Men who have sex with men; PWID: People who inject drugs; LE: Life Expectancy; YLS: Year of Life Saved. <sup>2</sup> ICER = Incremental Cost-Effectiveness Ratio in Euros per year of life saved (YLS); calculated from the 3% discounted outcomes in the total cohort (i.e. HIV- and HIV+) in Estonia and Spain (in France we used a 4% discount rate); the comparator strategy is always the next lowest, non-dominated, alternative. <sup>3</sup> Discounted Life Expectancy in months for the total cohort (i.e. HIV- and HIV+)

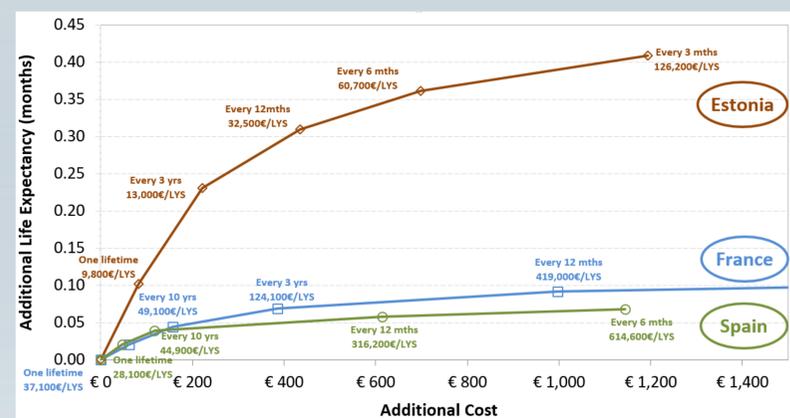


Figure 1: Overall population - Efficiency frontiers (Additional Cost vs. Efficacy)

- More frequent HIV testing consistently produced increases in life expectancy and cost in overall populations in Estonia, France, and Spain
- The life expectancy benefits of more frequent testing were greatest in Estonia.

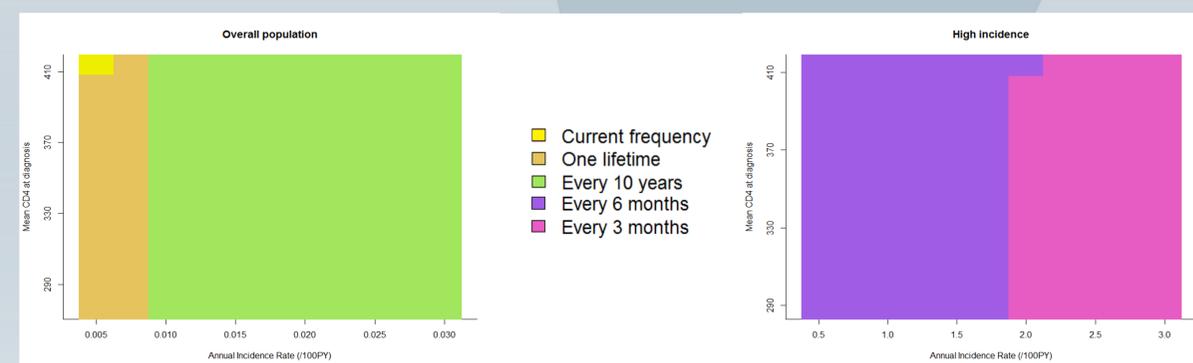


Figure 2: Two-way sensitivity analyses varying the HIV incidence rate and the mean CD4 at diagnosis. Each area presents the most cost-effective testing frequency for a GDP willingness to pay threshold of €30,000

- For the overall population, one additional lifetime test was cost-effective for incidence below 0.009/100PY; above that, an additional test every 10 years was cost-effective.
- For high incidence groups, an additional test every 6 months was cost-effective for an incidence below 1.9/100PY; above that rate, every 3 month testing became cost-effective.