



Post-exposure prophylaxis after  
non-occupational HIV exposure : a  
cost-effectiveness analysis in the  
French case

L. Coudeville, C. Bercez, JC. Saily

LABORES-CRESGE

Université Catholique de Lille

e-mail : [l.coudeville@cresge.fupl.asso.fr](mailto:l.coudeville@cresge.fupl.asso.fr)

# Objectives

---

- To assess the value of post-exposure prophylactic (PEP) treatment to prevent HIV transmission following non-occupational exposure in France

# Methodology (1)

---

- Cost-effectiveness analysis from a collective viewpoint limited to direct medical costs
- Criterion used : cost per life-year gained
- Results expressed in 2000 Euros
- Use of 2 different discounting methods : discounting both costs and life-years or discounting only costs (discount rate : 2.5% varying from 0% to 5% in sensitivity analysis)
- Assessment of the value of PEP treatment including either individual and collective consequences

# Methodology (2)

---

6 different kinds of exposure considered

- Sexual exposures without condom :
  - Insertive anal intercourse
  - Receptive anal intercourse
  - Insertive vaginal intercourse
  - Receptive vaginal intercourse
- Intravenous drug users : needle sharing
- Accidental exposure : needle prick

# Methodology (3)

---

Usefulness of PEP treatment at an individual level :

- To prevent seroconversion following an exposure to the risk to contract HIV
- To benefit from an early detection and management of HIV if PEP has not prevented seroconversion
- To benefit from an early detection and management of HIV in the case which PEP has not been given

$$C / LYG_I = \frac{Costs_{PEP^+} - Costs_{PEP^-}}{Life\ expectancy_{PEP^+} - Life\ expectancy_{PEP^-}}$$

# Methodology (4)

---

## Impact of PEP treatment at a collective level

- Individual benefits for those who have consulted to benefit from PEP treatment
- Overall prevented seroconversions in the population due to the impact of PEP treatment on HIV dynamics (decrease of the number of seropositive susceptible to transmit HIV)

$$C / LYG_C = \frac{N_{TP} * (C_C - C_{NC}) - (I_{NTP} - I_{TP} - N_{TP} * P_{VIH} * P_{TP} * E_{TP}) * CVIH_{DDI}}{N_{TP} * (EV_C - EV_{NC}) + (I_{NTP} - I_{TP} - N_{TP} * P_{VIH} * P_{TP} * E_{TP}) * (EV_{VIH-} - EV_{DDI})}$$

# Methodology (5)

---

## HIV dynamics model used in the evaluation

- SI -type model with a distribution of the population in 9 compartments according to the frequency of contacts at risk for HIV transmission
- Random choice of partners within and among compartments
- Data adapted to the French situation (size of the population at risk for HIV transmission : 100 000)
- Transmission rates estimated from French incidence data
- Assessment of the impact of PEP treatment over a period of 20 years

# Methodology (6)

---

## Sensitivity analysis

- Probabilistic sensitivity analysis based on naive bootstrapping
- Use of piecewise uniform distributions
- Calculation of 95% confidence intervals based on 10000 Monte Carlo simulations



# Methodology (7)

---

## Threshold criterion

- Use of Cost per life-year gained associated to an HIV treatment from a CD4 rate  $\leq 500/\text{mm}^3$  as an (indicative) threshold to assess the interest of PEP treatment
- Cost per life-year derived from data gathered for this evaluation

### Cost per life-year gained associated to HIV treatment

	Discounting method	
	Costs + Life-years gained	Only costs
<b>Treatment from a CD4 rate <math>\leq 500/\text{mm}^3</math></b> <i>(95% confidence interval)</i>	24 733 € [17316-42095]	16 036 € [8581-31362]

# Data (1)

## Risk of HIV transmission according to the type of exposure considered

Type of exposure	Risk of HIV transmission when the partner or liquid is infected		Probability of the infectious status of the partner or liquid	
	Mean value	Variation interval	Mean value	Variation interval
<b><u>Sexual exposure</u></b>				
Insertive anal intercourse	0.0006	[0.0003-0.0009]	0.18	[0-1]
Receptive anal intercourse	0.02	[0.008-0.032]	0.18	[0-1]
Insertive vaginal intercourse	0.0006	[0.0003-0.0009]	0.0019	[0-1]
Receptive vaginal intercourse	0.001	[0.0005-0.0015]	0.0019	[0-1]
<b><u>IV drug use</u></b>				
Syringe sharing	0.0067	[0.0030-0.0119]	0.20	[0-1]
<b><u>Accidental exposure</u></b>				
Needle prick	0.00016	[0.00002-0.00046]	0.5	[0-1]

- Data used in this analysis are based on a literature review

# Data (2)

## Life expectancy and overall direct medical costs according to HIV status

Parameter	Mean value	Variation interval
<b><u>Life expectancy (at 32 years old)</u></b>		
Seronegative individual	47.3	[47.3-47.3]
Seropositive individual treated from a CD4 rate $\leq 500/\text{mm}^3$	22.6	[15.1-36.3]
Seropositive individual for which no data is available about the stage at which HIV is detected	18.5	[14.0-26.7]
<b><u>Overall cost of HIV management</u></b>		
Seropositive individual treated from a CD4 rate $\leq 500/\text{mm}^3$	232 404 €	[103172-485361]
Seropositive individual for which no data is available about the stage at which HIV is detected	144 568 €	[60923-312189]

- HIV costs are based on French recommendations as regards HIV management

# Data (3)

---

## Data related to PEP treatment

	Mean value	Variation interval
<u>Consultations for PEP treatment</u>		
Cost of the consultation	150 F	[150-150]
Annual number of consultation	6500	[3000-10000]
<u>PEP treatment</u>		
Efficacy of PEP treatment	0.79	[0.43-0.94]
Compliance of PEP treatment	0.595	[0.45-0.74]
Cost of PEP treatment	5445 F	[3130-6099]
<u>HIV screening</u>		
Sensitivity	1	[0.96-1]
Sensitivity	1	[1-1]
Screening costs for individuals HIV+	427 F	[427-484]
Screening costs for individuals HIV-	731 F	[727-731]

# Results (1)

## Cost per life-year gained associated to HIV treatment - Individual benefits only -

Certainty of partner seropositivity – HIV treatment carried out from CD4  $\leq$  500/mm<sup>3</sup>

	Discounting method	
	Costs & Life-years gained	Only costs
<b><u>Sexual exposure</u></b>		
Insertive anal intercourse (95% confidence interval)	140685 € (51498-440162)	68821 € (34733-171002)
Receptive anal intercourse (95% confidence interval)	5946 € (-2500-34645)	2909 € (-1392-19081)
Insertive vaginal intercourse (95% confidence interval)	140685 € (51498-440162)	68821 € (34733-171002)
Receptive vaginal intercourse (95% confidence interval)	85122 € (31423-270793)	41641 € (14451-64039)
<b><u>IV drug use</u></b>		
Syringe sharing (95% confidence interval)	14218 € (1822-54619)	6955 € (2711-9177)
<b><u>Accidental exposure</u></b>		
Needle prick (95% confidence interval))	522676 € (111420-4116375)	255688 € (56468-531614)

➤ Receptive anal intercourse and syringe sharing are the only types of exposure for which C/LYG is lower than the one associated to standard HIV treatment

# Results (2)

## Cost per life-year gained associated to PEP treatment - Individual benefits only -

Uncertainty about partner seropositivity – HIV treatment carried out from  $CD4 \leq 500/mm^3$

	Discounting method	
	Costs & Life-years gained	Only costs
<b><u>Sexual exposure</u></b>		
Insertive anal intercourse (95% confidence interval)	773478 € (84052-19452540)	378378 € (54014-7867412)
Receptive anal intercourse (95% confidence interval)	24930 € (1416-543419)	12195 € (673-224144)
Insertive vaginal intercourse (95% confidence interval)	73110161 € (93400-1780902632)	35764751 € (58295-806318384)
Receptive vaginal intercourse (95% confidence interval)	43866808 € (55136-1132643768)	21459199 € (32343-491917269)
<b><u>IV drug use</u></b>		
Syringe sharing (95% confidence interval)	63975 € (7585-1461944)	31296 € (4716-669677)
<b><u>Accidental exposure</u></b>		
Needle prick (95% confidence interval)	1043573 € (175574-31514011)	510505 € (110383-14249718)

- Increase of C/LYG whatever the type of exposure
- Larger confidence intervals
- Receptive anal intercourse is the only type of exposure remaining cost-effective

# Results (3)

**Impact of PEP treatment on HIV dynamics**

	Annual number of new HIV seroconversions	Annual number of consultations	Annual number of seroconversions prevented
<b>PEP treatment not available</b>			
Base case (95% confidence interval)	4816.7 (4816.7-4816.7)	0.0 (0-0)	0.0 (0-0)
<b>PEP treatment available</b>			
<b><u>Sexual exposure</u></b>			
Insertive anal intercourse (95% confidence interval)	4815.4 (4812.4-4816.7)	6535.6 (3192.4-9878.7)	1.2 (0-4.2)
Receptive anal intercourse (95% confidence interval)	4775.2 (4669.2-4815.9)	6535.1 (3192.4-9875.2)	41.2 (0.8-145.7)
Insertive vaginal intercourse (95% confidence interval)	4815.4 (4812.4-4816.7)	6535.6 (3192.4-9878.7)	1.2 (0-7)
Receptive vaginal intercourse (95% confidence interval)	4814.6 (4809.6-4816.6)	6535.6 (3192.4-9878.6)	2.1 (0-4.3)
<b><u>IV drug use</u></b>			
Syringe sharing (95% confidence interval)	4802.8 (4763.4-4816.4)	6535.4 (3192.4-9877.6)	13.8 (0.3-52.7)
<b><u>Accidental exposure</u></b>			
Needle prick (95% confidence interval))	4816.3 (4814.8-4816.7)	6535.6 (3192.4-9878.7)	0.3 (0-1.9)

- Very low impact of PEP treatment on HIV dynamics
- Contribution of indirect effects on overall number of prevented seroconversions lower than 1% whatever the type of exposure

# Results (4)

## Cost per life-year gained associated to HIV treatment - Individual benefits + collective benefits -

Certainty of partner seropositivity – HIV treatment carried out from  $CD4 \leq 500/mm^3$

	Discounting method	
	Costs & Life-years gained	Only costs
<b><u>Sexual exposure</u></b>		
Insertive anal intercourse (95% confidence interval)	139738 € (33947-369566)	53959 € (22181-103635)
Receptive anal intercourse (95% confidence interval)	5865 € (110-12415)	2264 € (70-5255)
Insertive vaginal intercourse (95% confidence interval)	139738 € (33947-369566)	53959 € (22181-103635)
Receptive vaginal intercourse (95% confidence interval)	84602 € (21951-230208)	32656 € (14621-61544)
<b><u>IV drug use</u></b>		
Syringe sharing (95% confidence interval)	14089 € (1258-32979)	5439 € (2832-9013)
<b><u>Accidental exposure</u></b>		
Needle prick (95% confidence interval)	519292 € (105948-1575164)	200521 € (61413-535372)

➤ Very low improvement of C/LYG when costs and benefits are discounted

➤ Increase when only costs are discounted ⇒ inadequacy of this discounting method when the health intervention studied refers to a population on a given period



# Discussion (1)

---

Accurate use of PEP treatment according to these results

- Receptive anal intercourse or syringe sharing + partner HIV<sup>+</sup> ⇒ PEP treatment
- Other types of exposure + partner or liquid HIV<sup>+</sup> ⇒ HIV detection except specific risk factors
- HIV status of the partner or liquid unknown ⇒ HIV detection except except exposure at high risk

Results obtained similar to those of Pinkerton et al. (AIDS 1998) for the US case

# Discussion (2)

---

Impact on HIV dynamics doesn't contribute to justify PEP treatment

- After an epidemic period, HIV seems to have reached an endemic stage in France
- Limits of the model used : Random mixing
- Interactions between HIV risk and behavior not taken into account

# Discussion (3)

---

Use of PEP treatment in France very different from the accurate use considered here (INVS [2001]) :

- Prescription of PEP treatment after a consultation : 82% in case of sexual exposure, 90% in case of syringe sharing
- Risk considered as mild to intermediate in 48% of the the consultations after a sexual exposure
- Unknown HIV status of the partner in 75% of the consultations after a sexual exposure

Contributions to the social effort to fight against AIDS regardless of cost-effective considerations ?