
Erasmus MC



Viroscience lab

**Presented at dagnä
Workshop 2017**



Cost-effectiveness of PrEP in Germany

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Virology, Erasmus MC**

In collaboration with University of Duisburg-Essen, dagnä and the RKI- Berlin

Novel prevention methods

- HIV epidemic continues to grow
 - 3900 new diagnoses per year (RKI)
- Urgent need for novel prevention methods
 - Used alongside condoms, behavior change
- Pre-exposure prophylaxis (PrEP)
 - Tenofovir and emtricitabine

PrEP



- Most recent randomized trials:
 - 85% reduction of new HIV infections among high-risk MSM
- Approved in Europe in summer of 2016
 - Not reimbursed due to high costs

PrEP

- PrEP is expensive
 - €9 000 per year
- Treatment is also expensive
 - Treating HIV for 40 years costs €700 000
- Cost-effectiveness studies
 - Key for policy makers

Aim

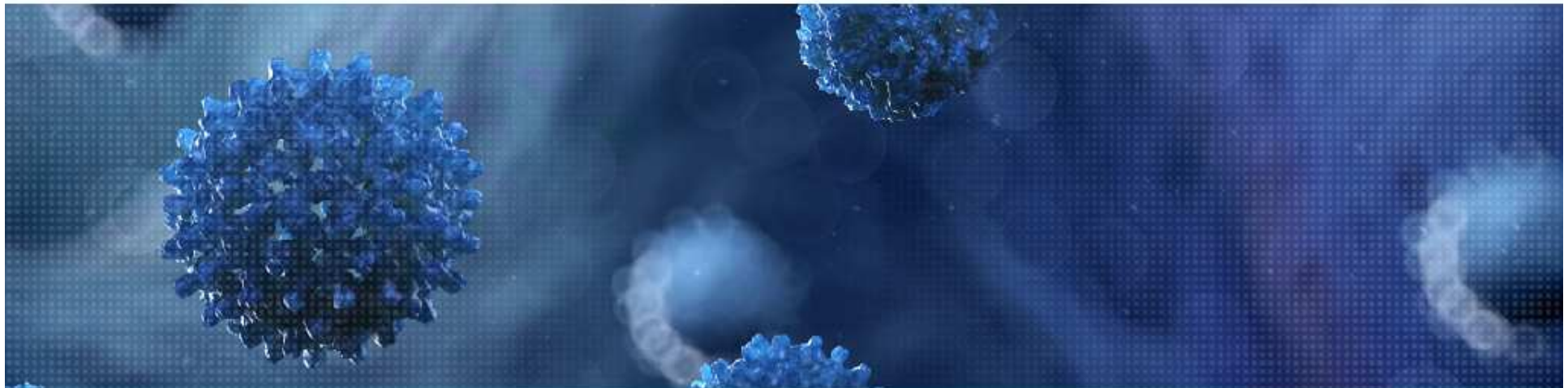
- What is the impact of PrEP on the HIV-1 epidemic among MSM in Germany?
 - Number of infections averted
 - Cost-effectiveness of PrEP
- Based on previous publication for the Netherlands
 - Nichols et al. Lancet Infect Dis 2016

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Methods



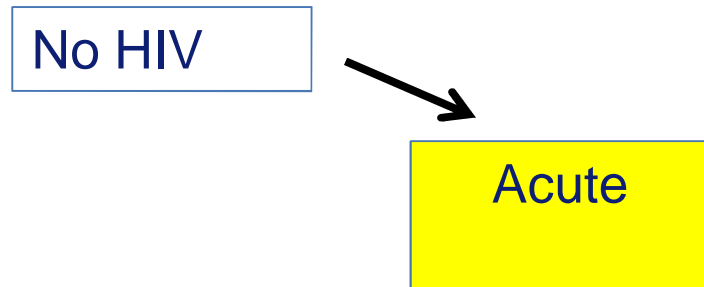
Cost effectiveness is complex

- PrEP prevents HIV on an individual level
 - 85% risk-reduction
- PrEP prevents HIV on a population level
 - Sexual partners of people on PrEP are also protected
- A transmission model can evaluate the complex dynamics of PrEP

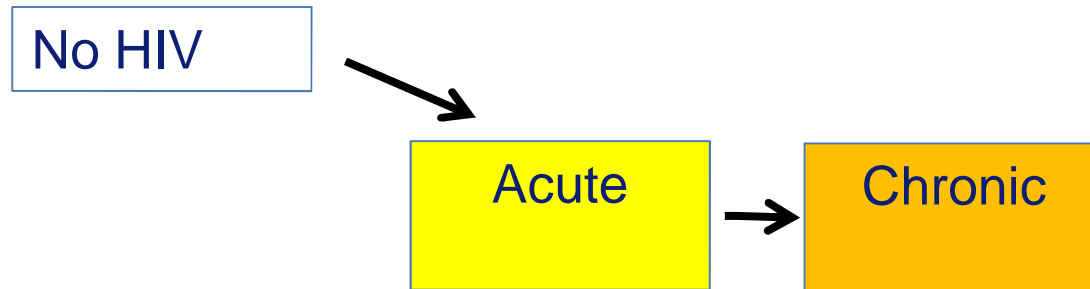
HIV- transmission model

No HIV

HIV- transmission model



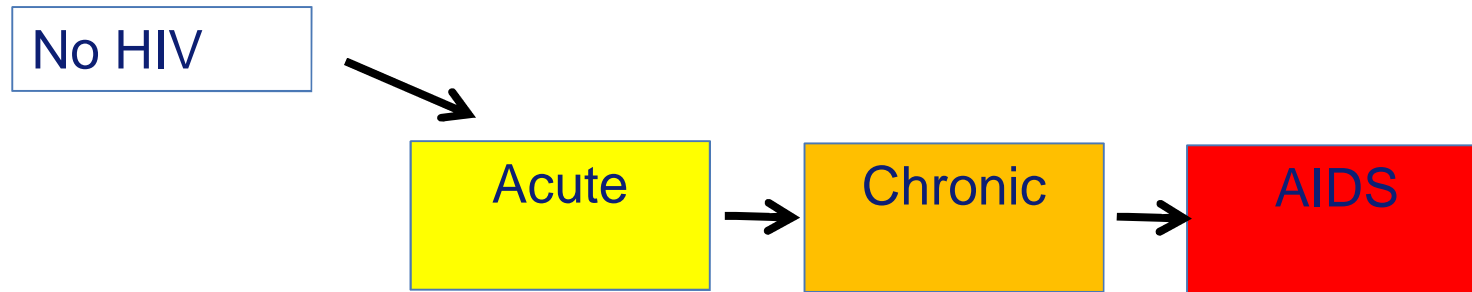
HIV- transmission model



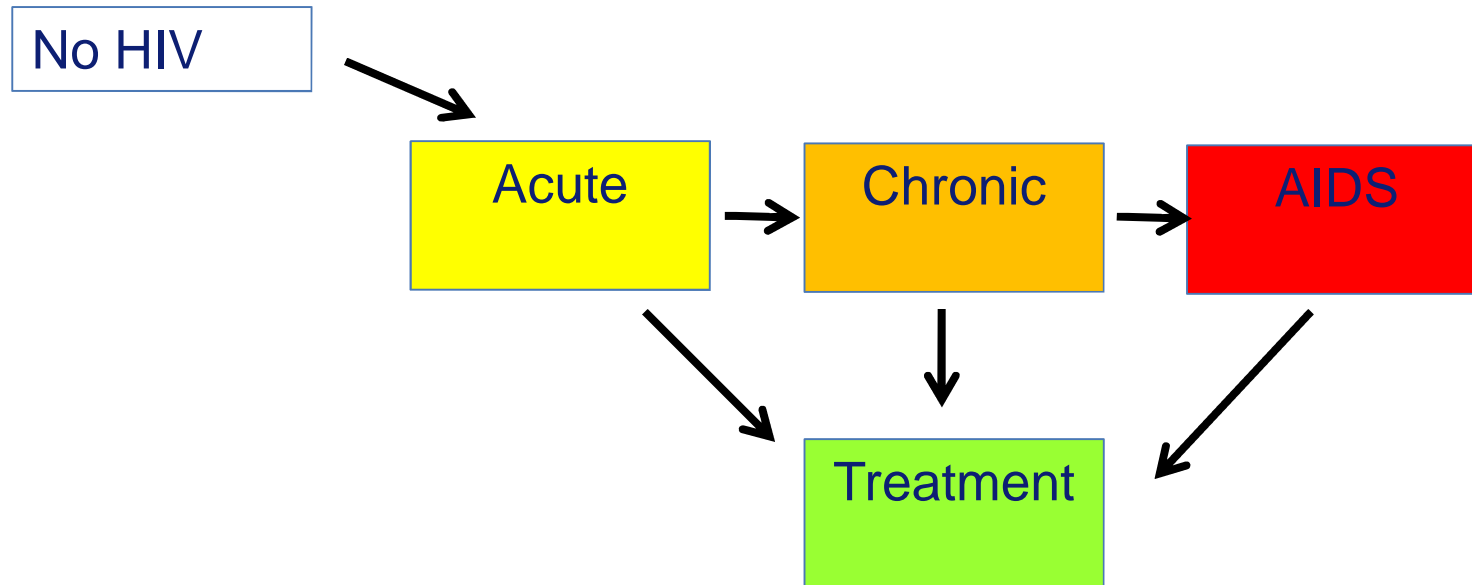
Chronic stage stratified based on CD4 cell count in three categories:

- 1) >500 cells/ μ l
- 2) between 350 and 500,
- 3) between 200 and 350

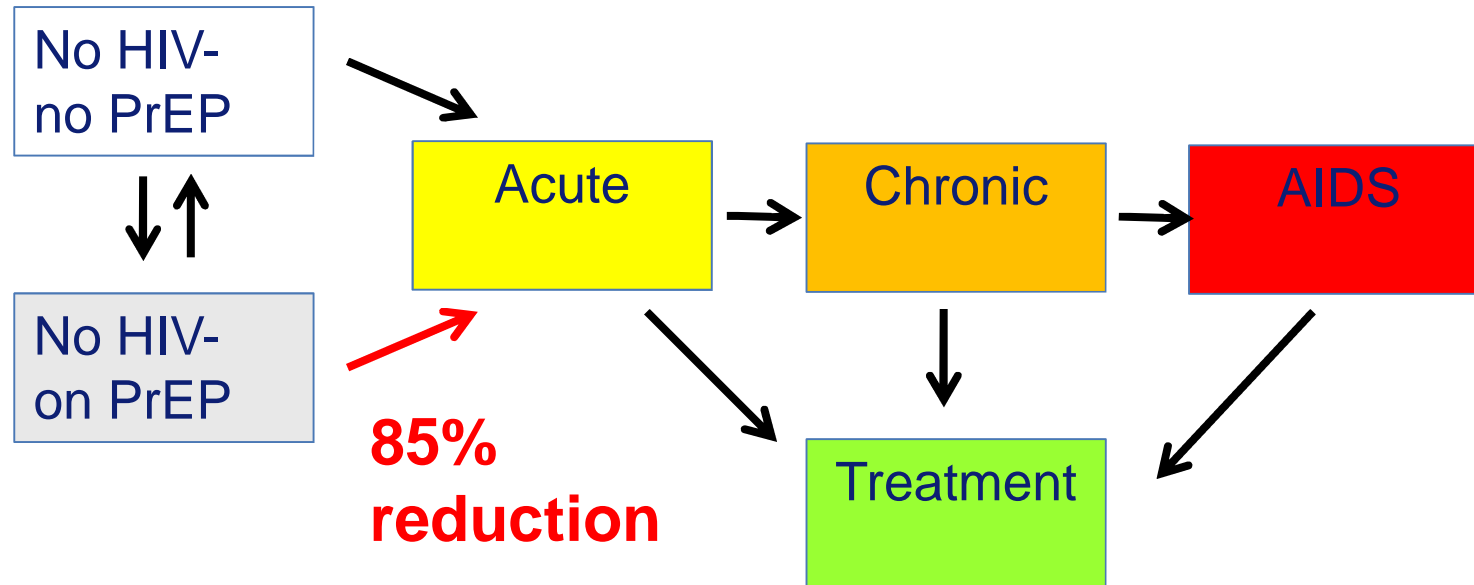
HIV- transmission model



HIV- transmission model



HIV- transmission model



Key assumptions of model, see:
Nichols et al. Lancet Infect Dis 2016

Calibrated to German epidemic

Characteristic*	Values	Source
MSM in Germany living with HIV	850 000 54 100	Marcus BMC Publ Health RKI

**For brevity only data from 2015*

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Calibrated to German epidemic

Characteristic*	Values	Source
MSM in Germany living with HIV	850 000 54 100	Marcus BMC Publ Health RKI
New infections	2200	Estimate, RKI

**For brevity only data from 2015*

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Calibrated to German epidemic

Characteristic*	Values	Source
MSM in Germany living with HIV	850 000 54 100	Marcus BMC Publ Health RKI
New infections	2200	Estimate, RKI
New diagnoses	1851	RKI
CD4>500	30%	
CD4 200-500	40%	
CD4<200	30%	

**For brevity only data from 2015*

Assumptions PrEP

- The efficacy of PrEP is 85%
 - Molina et al. New Engl J Med 2015, McCormack et al. Lancet 2015
- PrEP available as of 2018
 - Scale-up period of 2 years
- PrEP only to sexually most active MSM
 - ~22 000
- HIV testing every three months

Annual costs



- PrEP
 - € 9512
 - Costs of care included (kidney function, HIV testing, €139)
- Treatment with antiretroviral drugs
 - € 17016
 - Includes costs for care (€ 2000)

Quality of life

- Measuring effectiveness
 - Quality Adjusted Life Years (QALY)



Quality of life



- Measuring effectiveness
 - Quality Adjusted Life Years (QALY)

QALY	Value
PrEP	1
HIV, CD4 >350	0.94
HIV, CD4 between 200 & 350	0.82
HIV, AIDS	0.7
On treatment	0.94

Nichols et al. Lancet Infect Dis 2016 based on Simpson 2004

Cost effectiveness

- Compared to when PrEP is not available:

$$\frac{\text{Extra costs}}{\text{Gain in QALYs}}$$

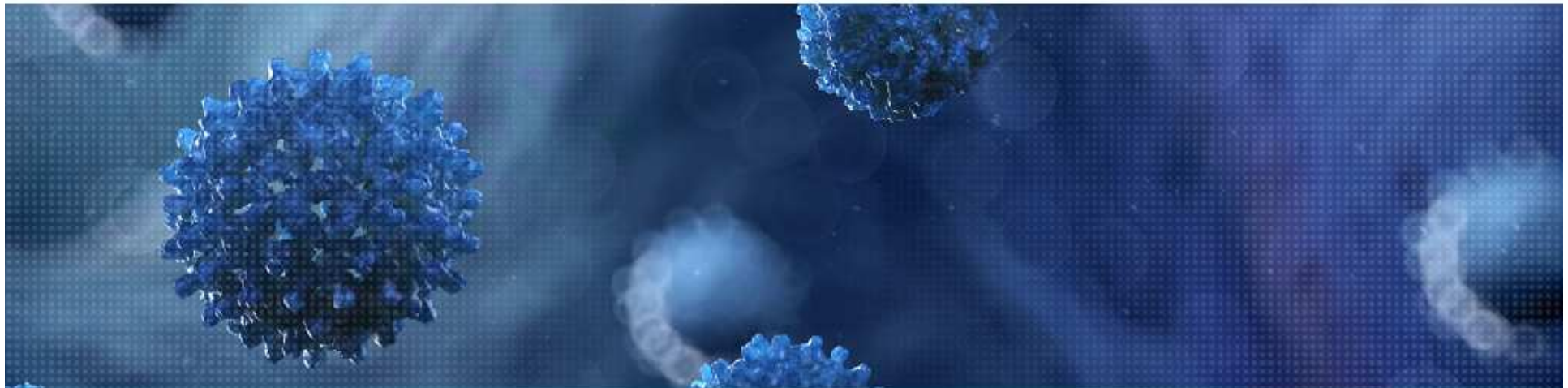
- Discounting of 3%
 - 40 year time horizon
 - Willingness-to-pay: < €20 000 / QALY gained

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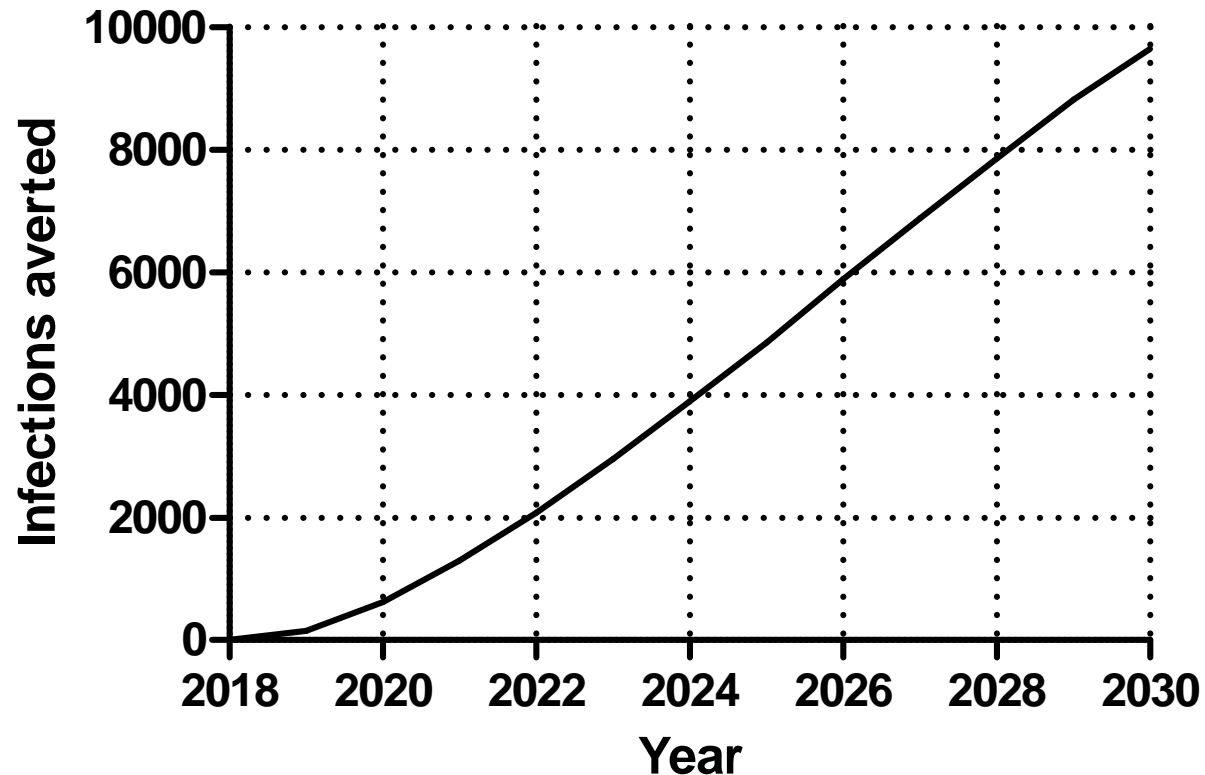


Results



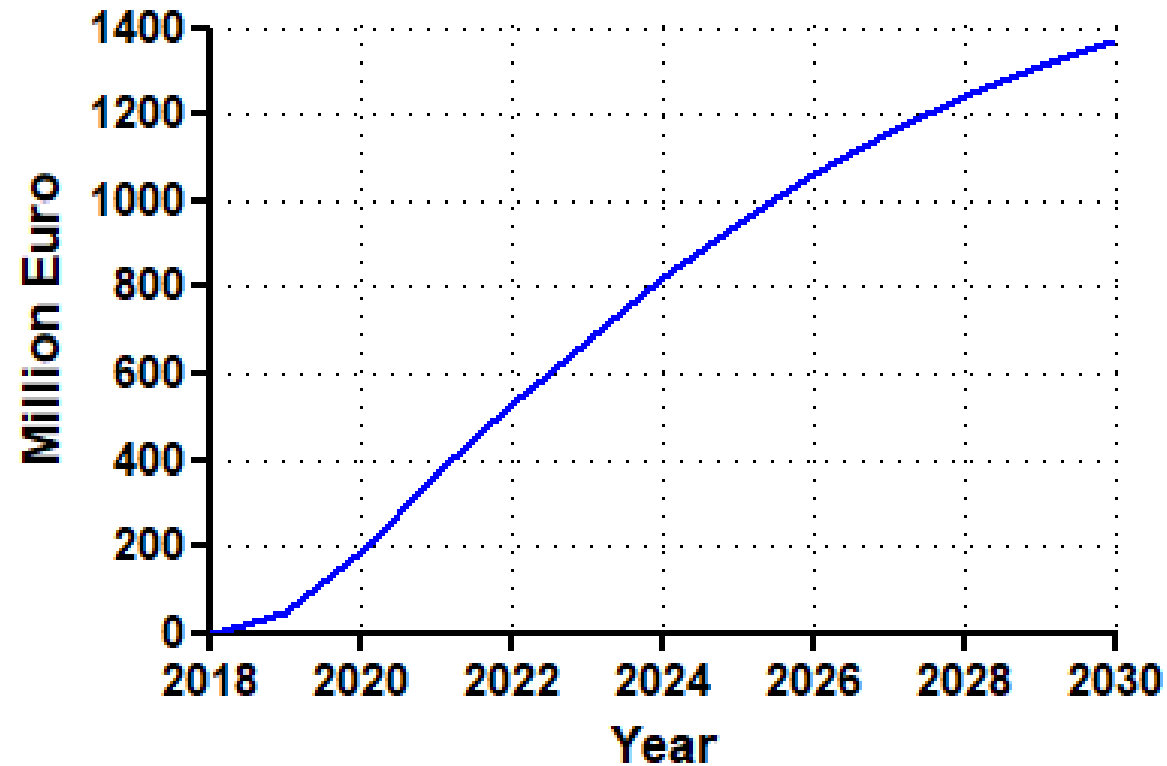
Epidemiological impact PrEP

Median number of infections averted



Costs and PrEP

Additional costs due to PrEP



Introduction of PrEP will result in lower costs after 17 years

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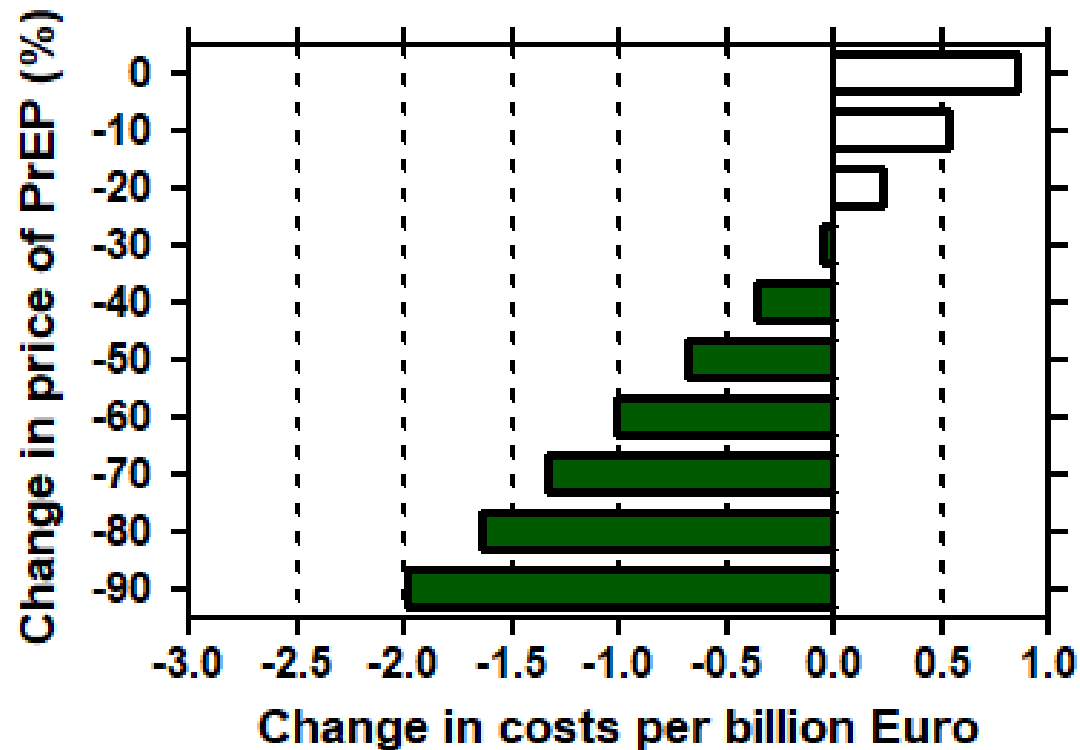


Economic outcomes

Costs HIV Care (40 years) per billion	35.7
Change costs if PrEP is available, per billion	+ 0.8
Proportional change in costs	+2.3%
Cost effectiveness ratio	10,800

Change in price of PrEP

Budget impact of PrEP over forty years

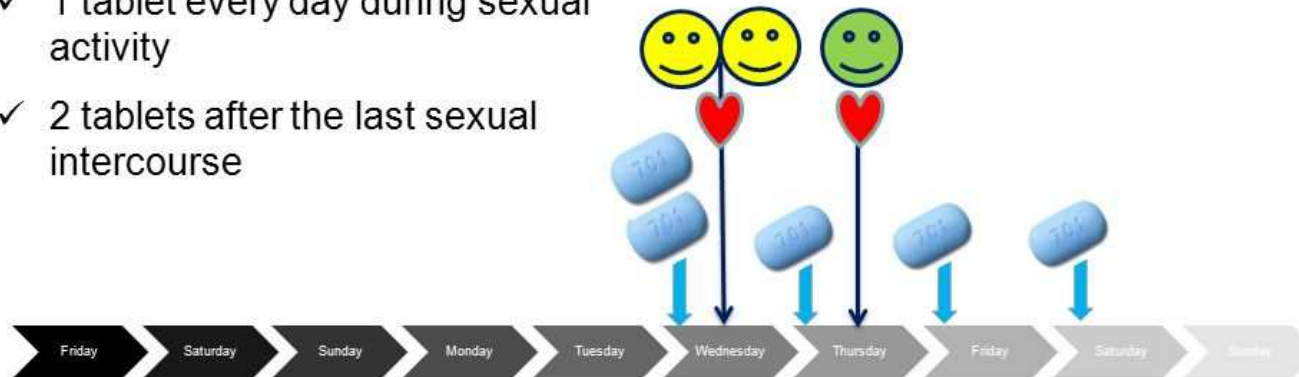


On-demand PrEP



IPIERGAY : Sex-Driven iPrEP

- ✓ 2 tablets 2-24 hours before sex
- ✓ 1 tablet every day during sexual activity
- ✓ 2 tablets after the last sexual intercourse

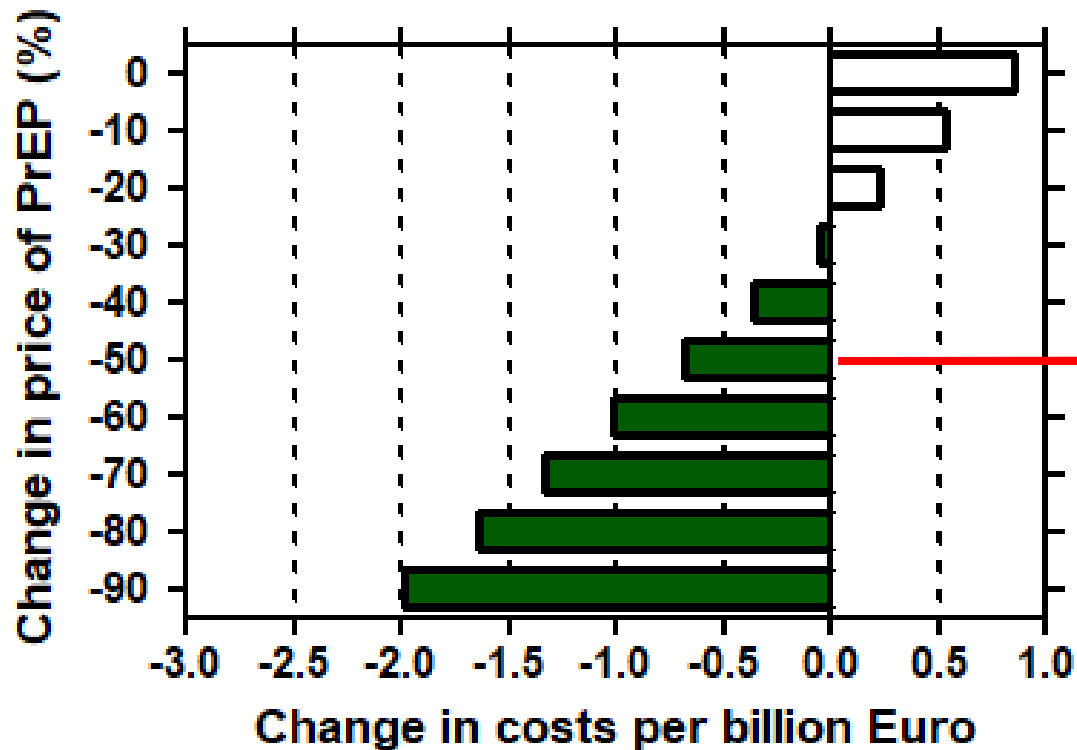


On demand PrEP tells you **How to Start and How to Stop PrEP**

50% reduction in dosages (and therefore costs of PrEP)

Change in price of PrEP

Budget impact of PrEP over forty years



On-demand PrEP is cost saving!

Generic PrEP

- Tenofovir DF/Emtricitabine (Truvada®) lost patent in summer of 2017
 - Generic PrEP
 - € 823.91 (including care)

Economic outcomes, life-time

	Current	Generic PrEP
Costs HIV Care	35.7	35.7
Change costs w/ PrEP	+ 0.8	-3.8
% change in costs	+2.3%	-10.3%
Cost effectiveness	10,800	Saving!

Costs in billion Euro's

Generic drugs

- Generic versions of antiretroviral drugs used for treatment?
 - Newer drugs with patent
 - TAF
 - Dolutegravir
- Price of treatment reduced by 50%
 - € 8500 per year (including care)

Economic outcomes, life-time

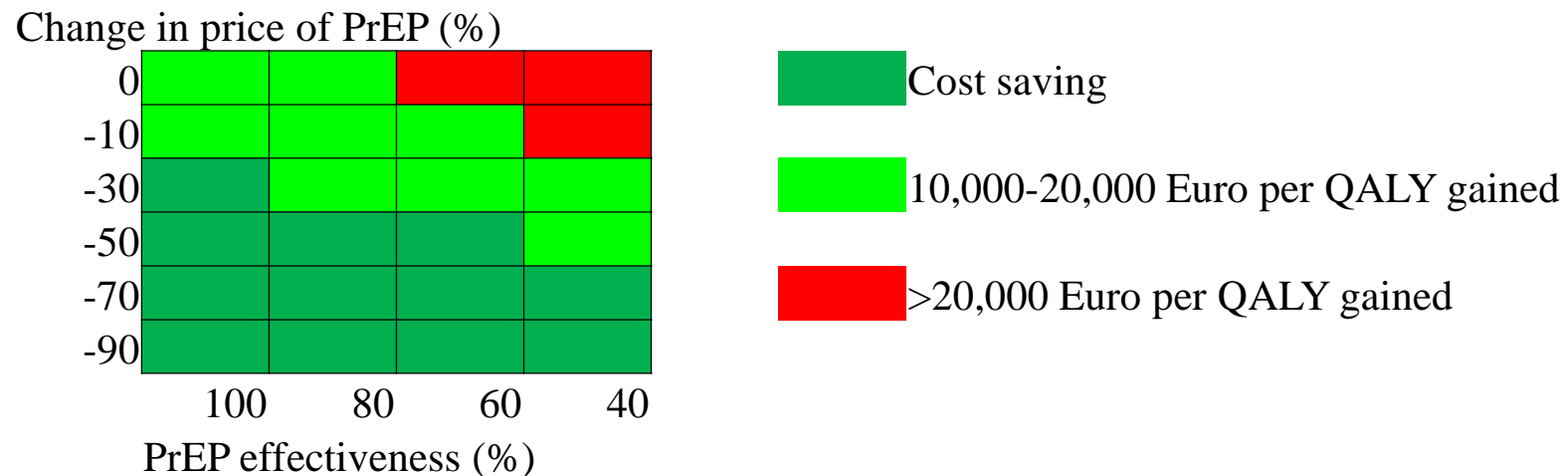
	Current	Generic PrEP	Generic PrEP + ART
Costs HIV Care	35.7	35.7	18.1
Change costs w/ PrEP	+ 0.8	-3.8	-1.6
% change in costs	+2.3%	-10.3%	-8.9%
Cost effectiveness	10,800	Saving!	Saving!

Costs in billion Euro's

Informal use

- PrEP is not reimbursed
 - Order PrEP on-line
 - Go to Thailand, South Africa to buy PrEP
 - Pill-sharing
- Netherlands
 - PrEP users get testing from e.g. GP
 - €139

Different effectiveness of PrEP?

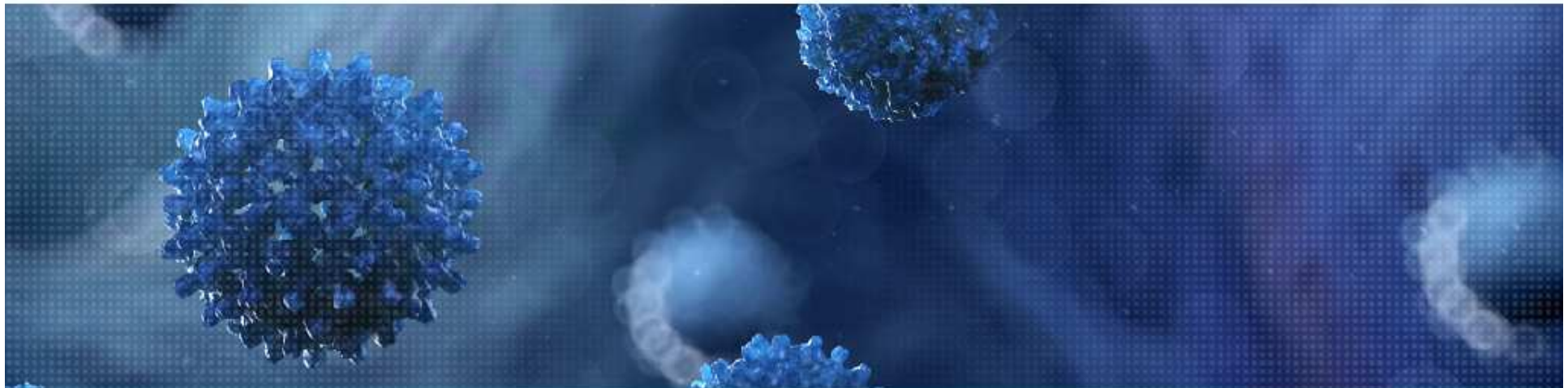


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Discussion

Discussion

- PrEP is cost-effective in Germany
 - Use limited to high-risk MSM
 - Will remain cost-effective if more MSM use PrEP
 - Cost-effectiveness ratio will be higher

Discussion

- Generic PrEP is cost-saving
 - Even if price of antiretroviral drugs is also reduced
 - Co-payment

Discussion

- Investments in providing PrEP are required
- Invest now and save money in the future!
 - Prevention starts from the first day PrEP is implemented

Conclusion

- PrEP is a cost-effective intervention in Germany
 - But substantial investments required in the short term

Acknowledgements

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■

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**Vielen Dank für Ihre
Aufmerksamkeit !**

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