

Modelling of PrEP implementation among PWID in the Russian Federation and ARV cost savings

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Background:

Transmission computational models allow to foresee the results of aggressive intervention aimed on incidence reduction. We used Kermack - McKendrik model without immunity with parameters characterizing people who inject drugs (PWID) as a key risk population for HIV infection in the Russian Federation.

Methods:

The equations

$$dY/dt = R\alpha XY - \mu Y;$$

$$dX/dt = -R\alpha XY + \mu - \mu X$$

where Y - prevalence of HIV infected, X - ratio of susceptible (noninfected).

Parameters for the PWID risk group in Russian Federation

- Contact rate: (basic reproduction number) $R=3.81$,
- Renewal rate: $\mu = 1/(3*365)$.
- Reverse duration of infectivity: $\alpha = 1/(2.5*365)$.
- Population number: $N=500\ 000$

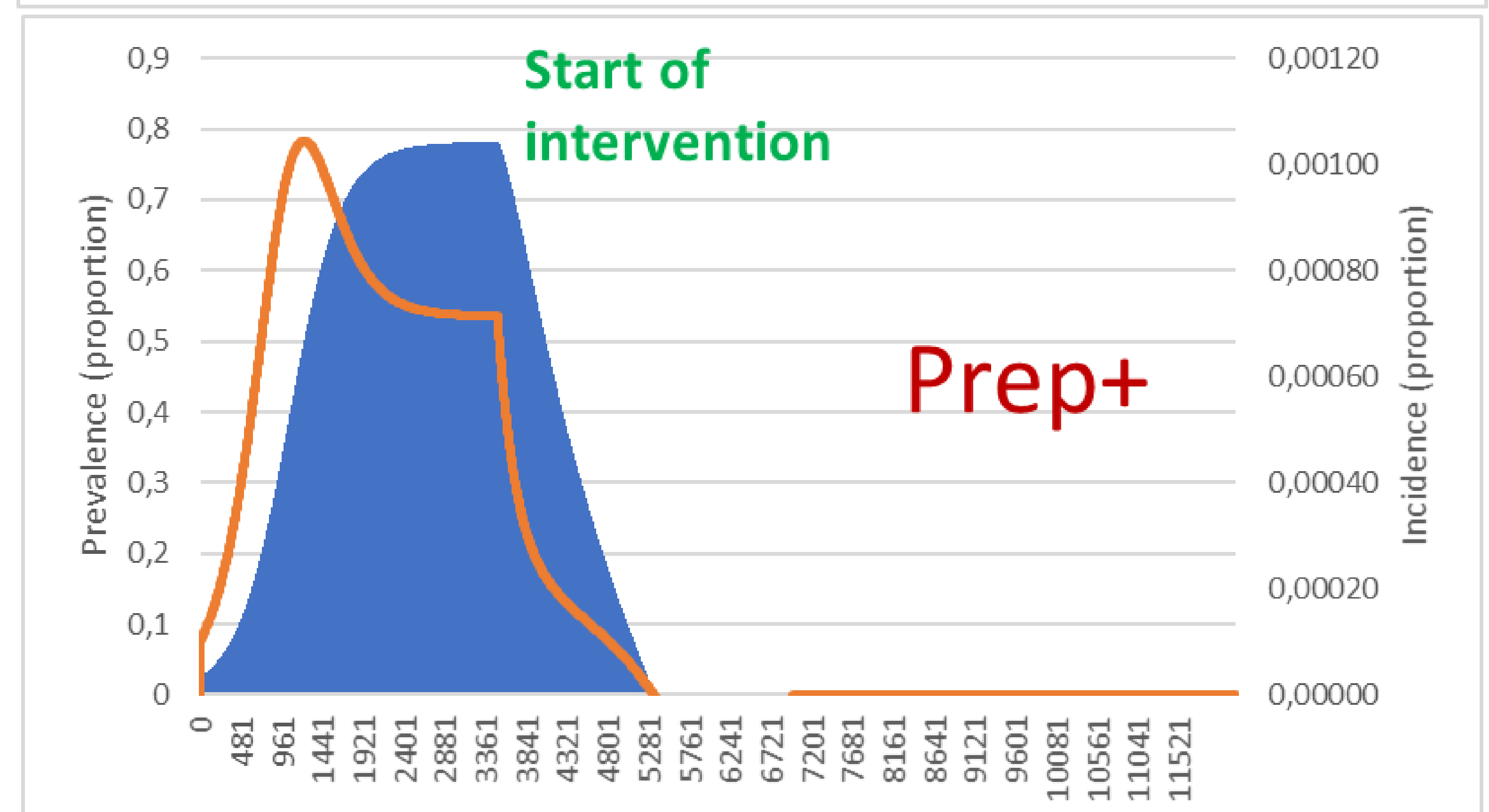
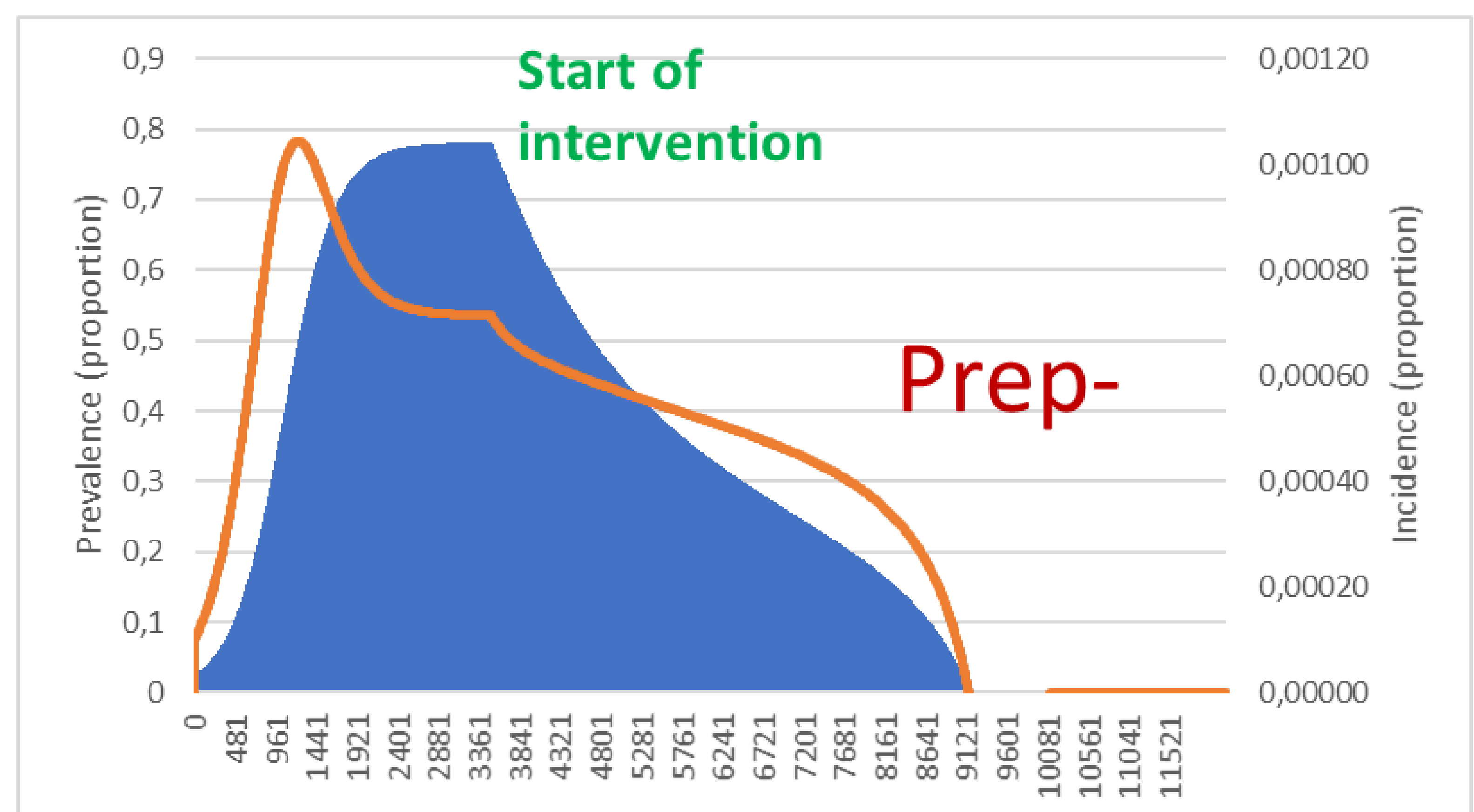
With these parameters the model predicts high and stable incidence rate - 359 new cases per day (131 thousands new cases per year). The biggest part of HIV epidemic in PWID is hidden.

Revealing rate which is a rate of detection + linking + retaining in care is a controlling parameter.

Results:

Aggressive intervention program in Russian Federation is aimed to reveal and arrest the hidden HIV epidemic. It includes NGO assisted HIV testing campaign with noninvasive rapid tests, on spot HIV diagnosis and immediate treatment. Number of found and managed cases per day must be at least 150 for the risk population size of 500 000 with the revealing rate 0.0003 per day. This stable rate of intervention leads to zero incidence in 55989 days or 16.4 years.

With aggressive intervention campaign HIV positive people from the risk group receive immediate treatment, and HIV-negative -should receive PrEP [1]. We considered PrEP rate to be twice higher than revealing rate, that means that at least 2 people in the surroundings of 1 infected will receive PrEP. Prescribing PrEP with the rate of 300 per day (0.0006 as respect to population) lessens the time to zero HIV incidence to 1845 days or 5.1 years.



Prep shortens the time of HIV spread elimination by 10 years.

We compared ARV drugs costs for both programs (with and without PrEP) in the middle point of implementing programs when one half of the necessary number of HIV-positive patients were already revealed and treated.

The annual cost of treatment of each program was:

- with PrEP - 14.9 billion RUB (212.0 million Euro)
- without PrEP - 27.0 billion RUB (382.3 million Euro).

The middle-point ratio of programs' costs is 1.8 times, and cost difference increases with each subsequent day.

Conclusions:

PrEP enhances intervention and is cost-effective because it lessens time of the intervention program and saves money on treatment of prevented cases at least twice.

Reference:

1. Cairns, Gusa; McCormack, Sheena; Molina, Jean-Michel. The European preexposure prophylaxis revolution. Current Opinion in HIV and AIDS: January 2016 - Vol.11 - Issue 1 - p 74–79