

# FORECAST OF SOCIAL AND ECONOMIC BURDEN OF HIV-INFECTION IN RUSSIA IN DIFFERENT SCENARIOS OF ANTI-HIV POLICY UP TO 2035

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## BACKGROUND

- Russia remains among the world leaders in HIV infection incidence, prevalence, and death rates, despite significant progress has been made in past years. As of 2019 Russia has the highest incidence rate of HIV among Eastern European and Central Asia (EECA) countries. Russia is also the leader in HIV prevalence among them<sup>1</sup>.
- Several anti-HIV programs are implemented by the government in Russia. The current Strategy to fight HIV until 2030 was adopted in 2020. It implies achieving the first two UNAIDS "95-95-95" targets<sup>2</sup> (proportion of people living with HIV (PLHIV) who know their HIV status / receiving antiretroviral therapy / achieved viral suppression)
- However, implementation of anti-HIV programs is significantly limited by low funding allocated to screening and treatment of this disease: as of 2020 only 74.5% of infected people knew their status and only 67.4% of them received antiretroviral therapy and 77.3% had viral suppression.

## OBJECTIVES

- The aim of this study was to forecast future social and economic burden of HIV-infection in Russia in various scenarios of centralized financing of anti-HIV activities

## METHODS

- We assessed impact of the national HIV policy on demographic and social indicators by 2030 in following scenarios:
  - "no change" scenario of maintaining costs for HIV control in nominal values at the level of 2020;
  - «+25%» scenario, which assumed 25% increase in expenditures without any change in current structure of costs;
  - «+50%» scenario, which assumed 50% increase in expenditures without any change in current structure of costs;
  - «full coverage» scenario, which assumed full coverage of people living with HIV (PLHIV) without any change in current structure of costs;
  - «intensive» scenario, which assumed full coverage of PLHIV with newer third-generation antiretroviral therapy regimens
- We proposed the following model of ART coverage and HIV testing impact on the main components of socioeconomic burden of HIV infection (Fig. 1).

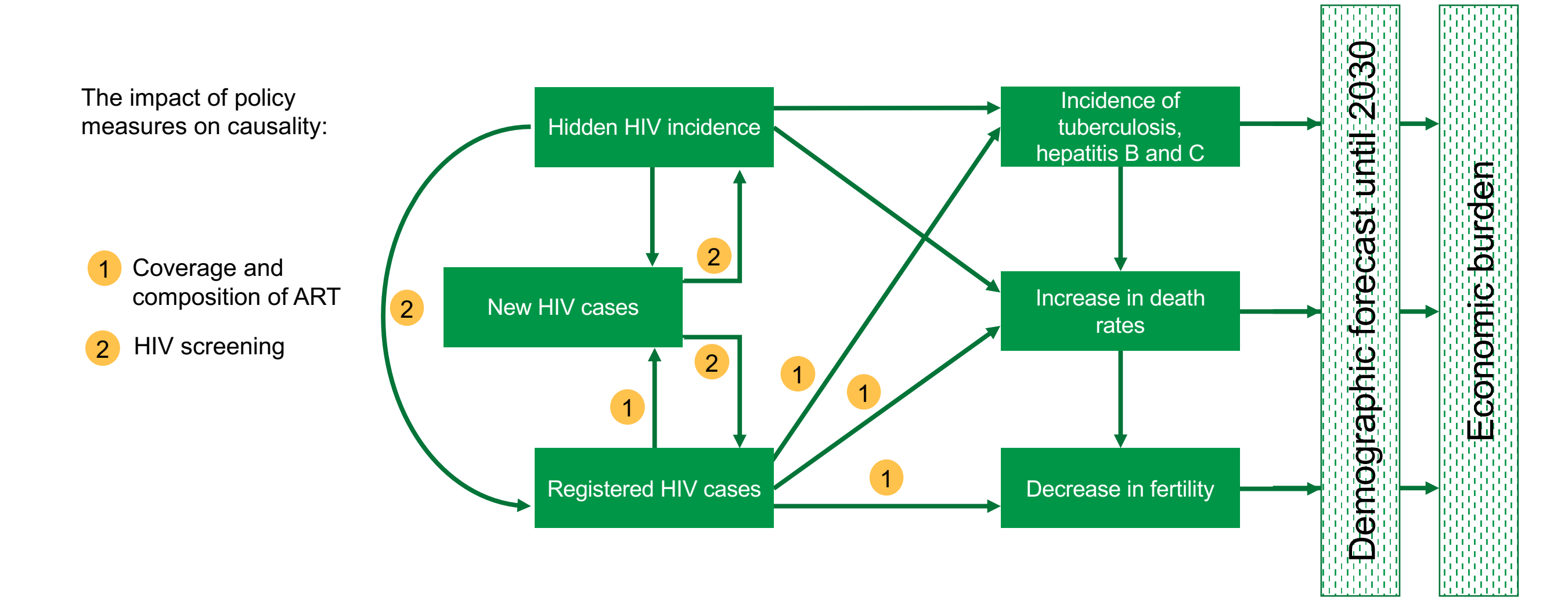


Figure 1. ART and HIV screening coverage impact on demographic parameters

- We developed a Markov model to forecast epidemiology, as well as social and economic burden of HIV in different funding strategies (Figure 2). Transition probabilities between model states were determined based on literature data (Walmsley, 2013<sup>3</sup>; Kanters, 2018<sup>4</sup>; Kyaw, 2017<sup>5</sup>) as well as published statistics in Russia.

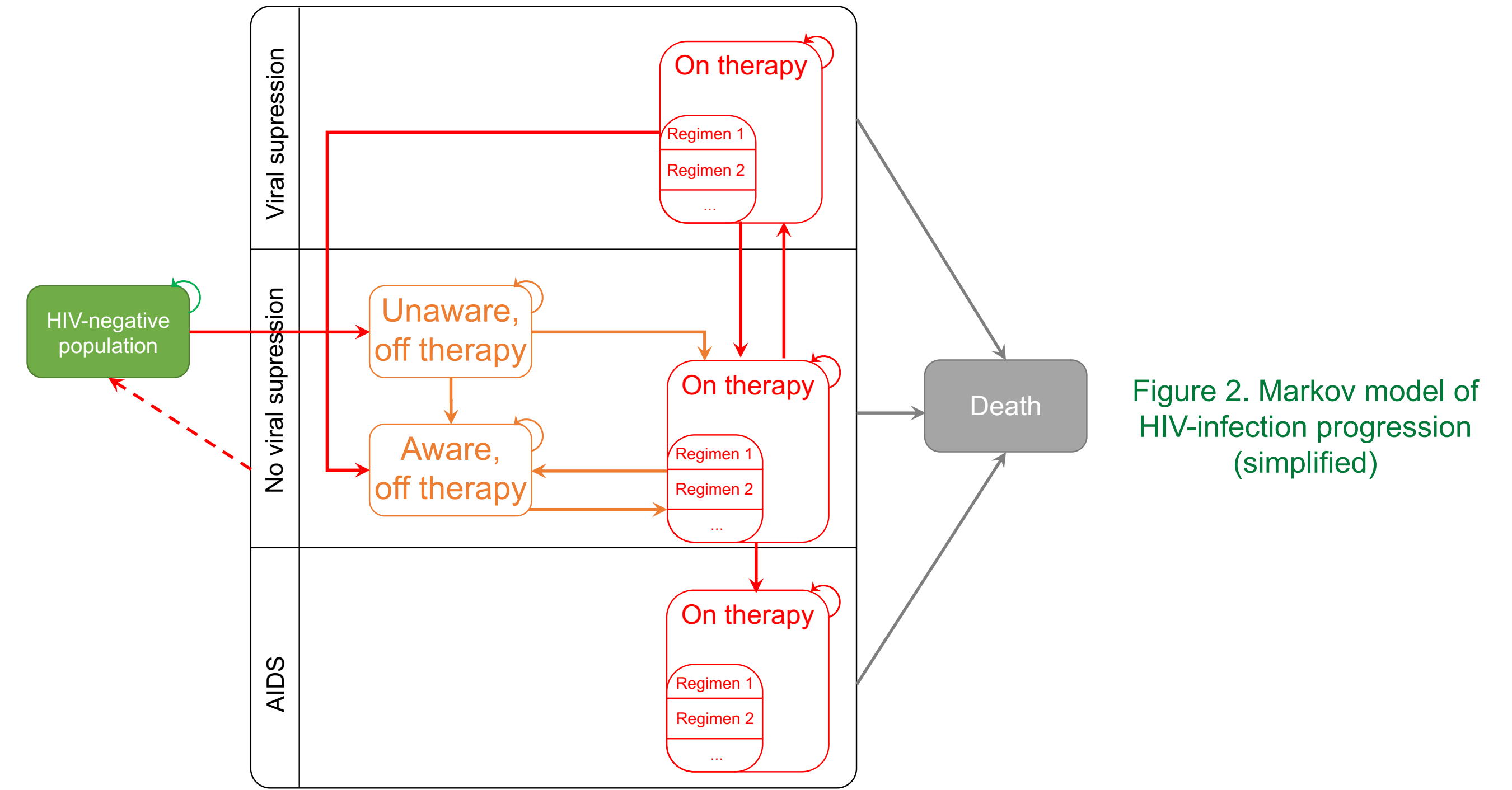


Figure 2. Markov model of HIV-infection progression (simplified)

- Social burden was defined as excess mortality and decrease in life expectancy at birth, fertility, natural population growth and population size.
- Economic burden included medical costs of screening, diagnosis and treatment of HIV; direct non-medical costs of disability benefits, and indirect costs in form of GDP loss due to premature HIV-related mortality and disability.

## RESULTS

### HIV epidemiology forecast:

- By 2030 all considered scenarios (except the "no change" scenario) predict a decrease in number of new registered cases of HIV. Since the number of diagnosed cases may differ from total number of actual new cases due to undiagnosed morbidity, we also calculated the number of new (undiagnosed) HIV cases, which by 2030 is estimated to range from 5 to 75 thousand people. In the "no change" scenario the number of new cases fluctuates between 50 and 75 thousand cases over the entire modeling period, while in the full coverage and intensive scenarios there is a sharp decline in the indicator due to reduction of undiagnosed morbidity and high ART coverage, which allows to significantly reduce the probability of HIV transmission.
- Higher expenditure and shift to 3<sup>rd</sup> generation ART led to decrease in HIV incidence rate. In the "full coverage" and "intensive" scenarios, number of new HIV cases per 100,000 population in the Russian Federation by 2030 will be comparable to OECD countries (Spain, Italy, Switzerland) as of 2019, while in "no change" and "+25%" scenarios, Russia will remain the leader in the incidence of HIV infection per 100,000 population compared to EECA countries as of 2019.

Scenario	PLHIV, thsd. people		Prevalence (per 100 thsd. Population)	
	2019	2030	2019	2030
No change	850.6	1 173.4	579.5	814.1
+25%	850.6	1 112.6	579.5	771.7
+50%	850.6	1 042.3	579.5	722.7
Full coverage	850.6	975.0	579.5	675.9
Intensive	850.6	964.2	579.5	668.4

Table 1. HIV prevalence in different scenarios of centralized financing

- Proportion of PLHIV, who know their HIV status, by 2024 can reach at least 90% in all considered scenarios, except the "no change" scenario. The 95% goal can be achieved by 2030 in all scenarios, except "no change" and "+25%"
- ART coverage is estimated to be in range of 51 - 96% by 2024 and in range 59-98% by 2030 (in both cases targets can be achieved only in the "full coverage" and intensive scenarios). In the "no change", "+25%" and "+50%" scenarios, we forecast a downward trend in ART coverage.
- Proportion of people with viral suppression will reach the target of 90% or higher by 2024 only in the intensive scenario, since the current mix of procured ART is characterized by insufficient effectiveness and safety profile.

### Social burden forecast:

- Social burden in terms of population mortality is estimated to decrease considerably in all scenarios, compared to the "no change" scenario (table 2).
- "Intensive" scenario would result in lowest number of deaths due to smaller population of PLHIV, who do not achieve viral suppression.

Scenario	Years				Total 2020–2030
	2020–2021	2022–2024	2025–2027	2028–2030	
No change	5 373 900	5 353 475	5 316 223	5 218 909	21 262 508
Difference with "no change" scenario:					
+25%	-	-6 671	-13 658	-17 179	-37 508
+50%	-	-13 541	-28 135	-35 384	-77 059
Full coverage	-	-16 667	-42 106	-53 097	-111 869
Intensive	-	-18 055	-47 111	-57 593	-122 759

Table 2. HIV-related mortality in various financing scenarios, people.

- Birth rate decreases due to premature mortality in women of reproductive age and reducing propensity of PLHIV to have children. The "no change" scenario is characterized by the highest burden: 4-6 thousand births annually, which could be decreased to 2 thousand in other scenarios.
- All scenarios with increased funding are projected to improve life expectancy at birth relative to "no change" by 2024 and 2030 (table 3).

Scenario	Year		
	2019	2024	2030
No change	73.33	75.74	77.61
Difference with "no change" scenario:			
+25%	-	+0.06	+0.10
+50%	-	+0.12	+0.22
Full coverage	-	+0.16	+0.32
Intensive	-	+0.19	+0.35

Table 3. Forecast of life expectancy under different scenarios, years

### Economic burden:

- We estimate additional cost of ART procurement (until 2030) in "full coverage" scenario up to 3.6 billion US\$ and 14.9 billion US\$ in intensive scenario
- Economic burden of HIV over 2020 - 2030 is estimated to be 34.3-57.3 billion US\$.
- The main component of the economic burden of HIV is indirect economic losses due to premature disability and mortality of the population. Additional ART procurement funding decreases total economic burden of HIV since it is fully offset by increase in GDP production.
- The lowest economic burden is forecasted in the "Full coverage" scenario, which is most economically effective.

Cost	No change	+25%	+50%	Full coverage	Intensive
Direct medical	6.2	7.2	8.1	9.0	21.5
Procurement of ART	4.7	5.6	6.5	7.3	19.6
HIV screening	0.2	0.3	0.3	0.4	0.6
Purchases of therapy for HIV-associated deceases	0.5	0.5	0.5	0.5	0.5
Outpatient treatment	0.5	0.5	0.5	0.5	0.4
Inpatient treatment	0.3	0.3	0.3	0.3	0.3
Direct non medical	2.9	2.3	1.7	1.2	1.0
Disability benefits	2.9	2.3	1.7	1.2	1.0
Indirect economical	48.3	40.2	31.6	24.1	21.8
Loss of GDP	48.3	40.2	31.6	24.1	21.8
Incl. wages	22.1	18.4	14.4	11.0	10.0
Total	57.3	49.6	41.4	34.3	44.3

Table 4. Economic burden of HIV during 2020 – 2030 period, billion US\$

## CONCLUSION

- Based on the modeling results, we can conclude that the current level of spending on HIV diagnostics may be insufficient. Current level of expenditures on anti-HIV activities will not allow to reach 90-90-90 goal.
- Considered social and demographic indicators can be improved with the growth of anti-HIV centralized financing

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### References:

- Roser, M. and Ritchie, H. 'HIV / AIDS', Our World in Data [Preprint]. Available at: <https://ourworldindata.org/hiv-aids> (Accessed: 15 July 2021).
- UNAIDS . Understanding fast-track. Accelerating action to end the AIDS epidemic by 2030. Available at: [https://www.unaids.org/sites/default/files/media\\_asset/201506\\_JC2743\\_Understanding\\_FastTrack\\_en.pdf](https://www.unaids.org/sites/default/files/media_asset/201506_JC2743_Understanding_FastTrack_en.pdf) (Accessed: 12 July 2021).
- Kanters S., Jansen J., Zoratti M., Forrest J., Humphries B., Campbell J. Web Annex B. Systematic literature review and network meta-analysis assessing first-line antiretroviral treatments In: Updated recommendations on first-line and second-line antiretroviral regimens and post-exposure prophylaxis and recommendations on early infant diagnosis of HIV: interim guidelines. – World Health Organization, 2018. – №. WHO/CDS/HIV/18.51.
- Walmsley S. L. et al. Dolutegravir plus abacavir–lamivudine for the treatment of HIV-1 infection //New England Journal of Medicine. – 2013. – T. 369. – №. 19. – C. 1807-1818.
- Kyaw N. T. T. et al. High rate of virological failure and low rate of switching to second-line treatment among adolescents and adults living with HIV on first-line ART in Myanmar, 2005-2015 //PLoS One. – 2017. – T. 12. – №. 2. – C. e0171780.