

Mitigating new AIDS cases through poverty elimination by 2030: a Latin American perspective

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Introduction

The UNAIDS Report 2022 has shown that, in 2021, Latin American (LA) countries have made significant progress in reducing AIDS-related deaths, with a 32% decrease in rates compared to 2010. However, this report also highlights a regrettable trend of increasing new HIV infections that have occurred since 2000. This trend is particularly evident in countries such as Costa Rica, Peru, Chile, and Brazil, while other countries such as Mexico, Colombia, Argentina, and Ecuador have shown a slight decrease in new HIV/AIDS cases. Such data undermines progress towards achieving the Sustainable Development Goals (SDG) indicator 3.3.1 to end the epidemic of HIV/AIDS by 2030.

Some evidence has shown a positive association between unfavorable SDHs and AIDS incidence and poor AIDS-related outcomes. Poverty is one of the most noted SDHs in the context of the transmission of infectious disease, particularly in low-, and middle-income countries (LMICs). In contrast, the implementation conditional cash transfer programs have been associated with reduced AIDS incidence, hospitalizations, and mortality. To effectively achieve SDG 3.3.1 and other health-related indicators within SDG 3, it is essential to prioritize the attainment of SDGs interconnected with social determinants of health (SDHs) and social vulnerabilities.

In this study, we forecast the potential impact of a hypothetical intervention aimed at eliminating poverty by 2030 on the annual incidence of new AIDS cases in seven LA countries.

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Methods

Utilizing a compartmental model (Fig. 1), we projected trends in new AIDS cases from 2020 to 2030, leveraging country-specific data spanning 2000 to 2019. This comprehensive analysis factored in population demographics, while integrating poverty data across three scenarios: baseline (reflecting a steady-state trend), decreasing, and increasing poverty levels. Our study includes seven of the most populous countries in LA: Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, and Peru.

The HIV/AIDS model is composed of five dynamic variables: susceptible to HIV infection via sexual contact (S), HIV-positive individuals who are infectious (I), individuals with full-blown AIDS (A), individuals being treated with undetectable viral load (T), and individuals who are not yet sexually active or have changed their sexual habits so they are no longer part of the susceptible population (R).

We included the annual poverty rate in select model parameters (as a linear form – see Fig. 1) to consider socioeconomic influence since social determinants of health significantly impact the incidence and mortality rates of these diseases.

We integrate the risk linked to poverty by including the Population Attributable Fraction (PAF). PAF means the additional risk of acquiring HIV infection or progression to AIDS that could be attributable to poverty. Also, the associated estimates (relative risk, RR) among poverty and AIDS incidence were derived from a recent Brazilian AIDS retrospective cohort study that used multivariable Poisson regression analysis to investigate SDH associated with AIDS incidence.

The model was calibrated using the report of new AIDS cases for each country by using the Python PyMC v5.7.2 package that implements the Markov chain Monte Carlo (MCMC) sampling of the posterior estimates. This Bayesian approach allows us to fit the model, calibrate the parameters, and estimate the median, 95th, and 5th credible intervals (CI) for the calibration period (from 2000 to 2019) as well as for the forecasting prediction period (from 2020 to 2030).

Results

We fitted the model to AIDS new cases in the period 2000-2019 for each country analyzed.

Figure 2 shows the AIDS incidence rate in the seven Latin America countries for 2030, under different poverty scenarios.

Our model showed that, considering the hypothetical scenario of achieving the 2030 poverty elimination goal, the percentage of reduction on AIDS incidence ranges from 3.75% (95% CI:3.65-3.74 (for Chile) to 14.15% (for Colombia), when compared to the counterfactual baseline scenario for each country (Fig. 2). Brazil and Mexico achieved a reduction on AIDS incidence of 9.61% and 9.55%, respectively, showing a similar reduction despite of the size country. On the other hand, Peru achieved a great reduction on AIDS incidence of 13.86%.

Under a scenario of a gradual increase in poverty, by 2030, the estimates showed an increase on AIDS incidence of 6.13% (95% CI:5.96-6.21) for Argentina and 13.87% (95% CI:13.53-14.12) for Ecuador.

Conclusion

Eliminating poverty by 2030 holds the potential to initiate a favorable trend, resulting in a decline in new AIDS cases. This, in turn, can play a crucial role in advancing the objectives outlined in the UNAIDS Global plan, Ending the HIV/AIDS epidemic by 2030.

Poverty elimination can positively impact healthcare access, raise awareness, and enhance overall health conditions, thereby further reducing HIV transmission and improving AIDS care.

The elimination of poverty in Latin America by 2030 has significant potential to reduce the number of new cases of AIDS, which would represent a crucial step towards achieving the SDG 3.3.1 indicator of the Agenda 2030.

Poverty reduction can result in better access to healthcare, increased awareness of the risks of infection, and healthier living conditions ultimately leading to better outcomes for patients living with HIV, and preventing progression to the AIDS stage.

This study underscores the substantial contribution of poverty alleviation efforts and other social protection policies in the fight against the HIV/AIDS pandemic.

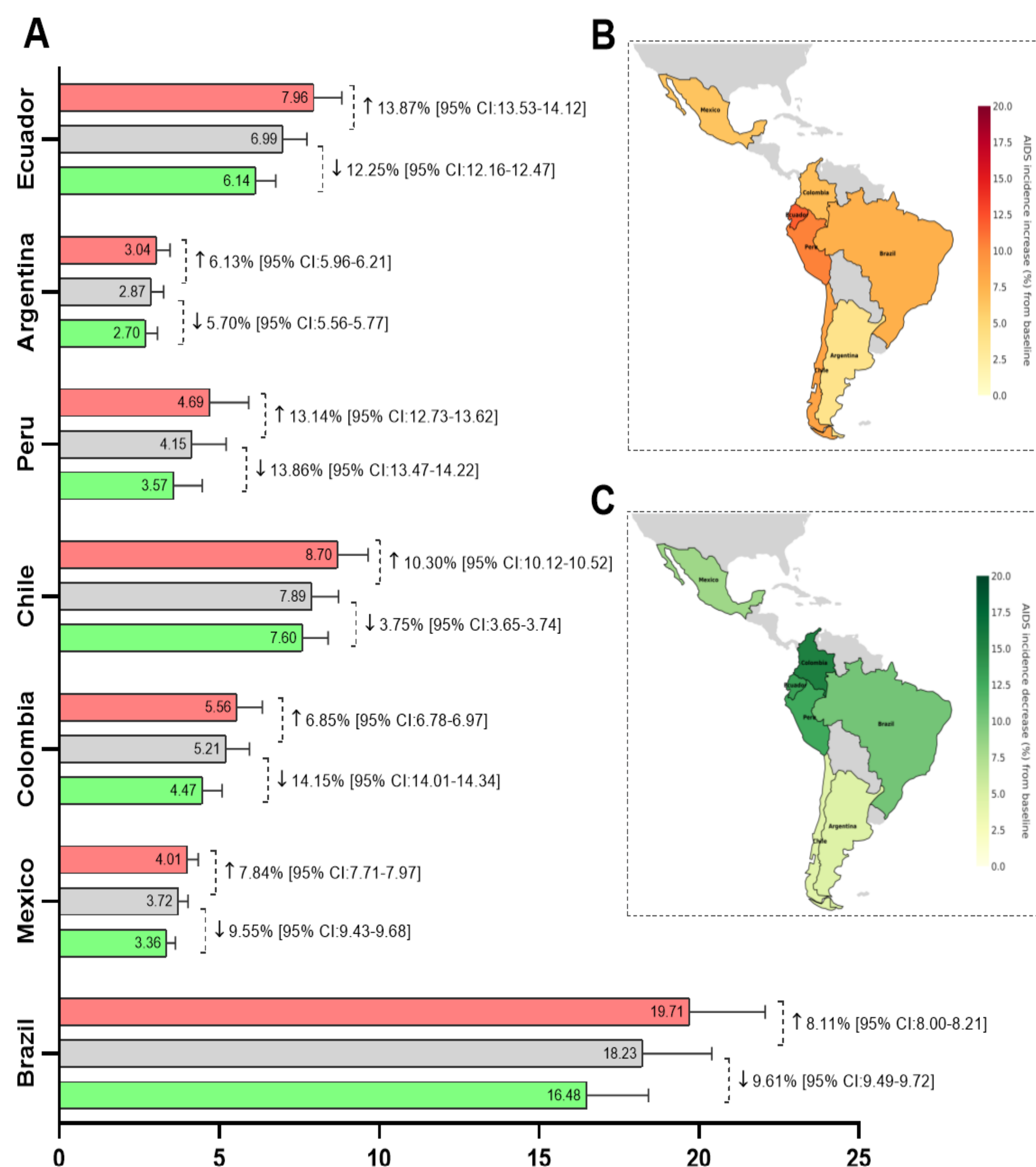


Figure 2 - (A) Modelled AIDS incidence (per 100,000 population) with 95% credible intervals (CI) in seven Latin America countries for 2030, under different poverty scenarios as increasing (red), mitigating poverty (green), and the baseline scenario (gray). Images on the right depict the geographical location of each country, illustrating the percentage change in poverty levels under both increase (B) and decrease (C) scenarios, respectively.

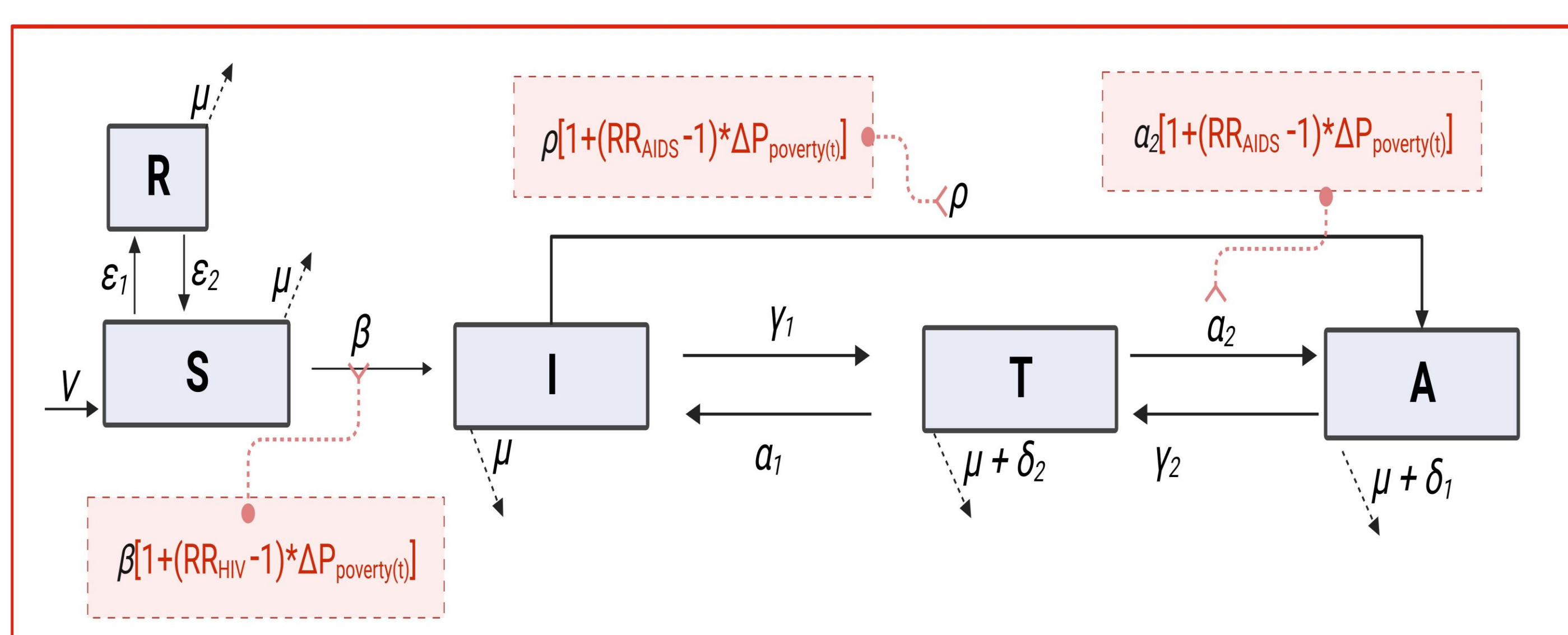


Figure 1 - Model structure of the compartments used to analyze the dynamics of HIV transmission and AIDS progression.