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Research Report

Cost of HIV in Switzerland - A cost-of-illness analysis to quantify the economic and social impact of the HIV epidemic in Switzerland and its progress towards ending the epidemic

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Research Report

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University of St.Gallen
School of Medicine

Cost of HIV in Switzerland

A cost-of-illness analysis to quantify the economic and social impact of the HIV epidemic in Switzerland and its progress towards ending the epidemic

Dr. Irene Salvi, Enqi Fu, Prof. Alexander Geissler

St. Gallen, September 2026



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Data security

The Chair of Health Economics, Policy and Management at the University of St. Gallen commits itself to complying with applicable data protection law and institutional data-security requirements in the handling of anonymised and aggregated data used for this project, including after completion of the study. No individual-level identifiable patient data are reported in this document.

Conflict of interest

The authors declare no personal financial conflicts of interest or material involvement with the products, services, or interventions evaluated in this report. The scientific content of the study was developed independently by the authors, and academic freedom in research and interpretation was maintained at all times. The study was financed by Gilead Sciences Switzerland Sàrl, and the third-party funds made available were used for the intended research purpose. Representatives of Gilead Sciences Switzerland Sàrl provided input on project scope, data interpretation, and contextual assumptions through project discussions, but the modelling approach, interpretation of results, and conclusions remained the responsibility of the authors.

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Abstract

Background

Switzerland has achieved considerable progress in HIV care, with high treatment coverage and viral suppression among diagnosed people living with HIV. However, new infections continue to occur, and the remaining gap in the HIV care cascade is primarily related to diagnosis. In view of upcoming funding cuts, updated estimates of the lifetime economic burden of new HIV infections are needed to inform prevention policy, resource allocation, and progress towards UNAIDS and Swiss National Programme (NAPS) elimination targets. This cost-of-illness study estimated the lifetime direct medical and broader societal costs associated with one new HIV infection in Switzerland.

Methods

We developed an incidence-based state-transition Markov model to simulate the lifetime progress through CD4 categories-defined health states of a newly infected person living with HIV in Switzerland. The model followed individuals in annual cycles across CD4 >500 cells/μL, CD4 200–500 cells/μL, CD4 <200 cells/μL, and death. Direct medical costs included antiretroviral therapy, outpatient visits, diagnostics and monitoring, and inpatient care. Indirect and broader societal costs included morbidity-related productivity losses, productivity losses due to premature mortality, depression-related costs, and monetised quality-adjusted life-year (QALY) losses. Costs were estimated using a bottom-up approach based on Swiss prices, tariffs, inpatient data, Swiss HIV Cohort Study inputs, Swiss mortality data, and published evidence. Future costs and outcomes were discounted at 3% annually. Sensitivity analyses examined the impact of discounting, age at infection, productivity assumptions, HIV utility ratios, and willingness-to-pay thresholds. A scenario analysis estimated the potential economic implications of reaching the UNAIDS diagnosis target of 95% in Switzerland.

Results

In the base case, the total lifetime cost of one new HIV infection in Switzerland was estimated at CHF 731,130. Direct medical costs accounted for CHF 289,584, while indirect and broader societal costs accounted for CHF 441,546. ART was the dominant direct cost component, amounting to CHF 258,224 and representing approximately 89% of direct medical costs. Other direct cost components were smaller: outpatient visits accounted for CHF 8,034, diagnostics for CHF 16,384, and inpatient care for CHF 6,942. Among indirect costs, productivity losses amounted to CHF

198,348, consisting of CHF 124,878 from morbidity-related paid work losses and CHF 73,469 from productivity losses due to premature mortality. Depression-related costs contributed CHF 3,198, while monetised QALY losses accounted for CHF 240,000. Sensitivity analyses showed that total lifetime costs ranged from CHF 611,130 under a lower willingness-to-pay threshold to CHF 1,192,145 in the undiscounted scenario. In the UNAIDS diagnosis scenario, increasing the diagnosed proportion from 93% to 95% was estimated to reduce the undiagnosed population by approximately 352 individuals. Depending on the transmission assumption applied, this corresponded to 24-70 avoided infections and potential lifetime cost savings of CHF 17.8-51.2 million.

Conclusion

The lifetime economic burden of a new HIV infection in Switzerland is substantial and extends beyond direct medical costs. While ART is the main driver of direct medical costs, indirect and broader societal costs, particularly productivity losses and quality-of-life losses, account for a larger share of the total burden. These findings support sustained investment in HIV prevention, targeted testing, early diagnosis, and linkage to care. In the Swiss context, further progress towards UNAIDS and NAPS targets may generate meaningful long-term value by preventing new infections and avoiding lifetime medical and societal costs.

List of Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral therapy
cART	combined ART, combined antiretroviral therapy
CD4	CD4 T lymphocytes
CD8	CD8 T lymphocytes
CD4 <200	CD4 <200 cells/μL
CD4 >500	CD4 >500 cells/μL
CD4 200-500	CD4 200-500 cells/μL
CD4 categories	CD4 cell count
COI	Cost-of-illness
FOPH	Swiss Federal Office of Public Health
FSO	Swiss Federal Statistical Office
HIV	Human Immunodeficiency Virus infection
ICD-10	International Classification of Diseases Tenth Revision
NAPS	Swiss National Programme
PLWH	People living with HIV
PrEP	Pre-Exposure Prophylaxis
QALY	Quality-adjusted life-year
SHCS	Swiss HIV Cohort Study
STI	Sexually transmitted infections
SwissDRG	Swiss Diagnosis-Related Groups
U=U	Undetectable = Untransmittable
UNAIDS	The Joint United Nations Programme on HIV/AIDS

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1 Introduction

1.1 HIV in Switzerland: Therapy success and funding challenges

Over the past three decades, advances in antiretroviral therapy (ART) have fundamentally changed the course of the Human Immunodeficiency Virus (HIV) infection [1]. This can now be managed as a chronic health condition rather than progressing to Acquired Immune Deficiency Syndrome (AIDS) and premature death, provided that individuals are diagnosed early, linked to care, and adhere to treatment [1]. With contemporary ART and early diagnosis, many people living with HIV (PLWH) can achieve a near-normal life expectancy and maintain a high quality of life [1]. This happens because sustained viral suppression reduces HIV to undetectable levels in blood, and evidence shows that people who are undetectable for a long time do not transmit HIV sexually ("Undetectable = Untransmittable", U=U) [2, 3].

The Joint United Nations Programme on HIV/AIDS (UNAIDS) framework has set ambitious goals to end AIDS as a public health threat by 2030 [4, 5]. In recent years, the global benchmark has been the "95–95–95" cascade (high diagnosis coverage - high treatment coverage among those diagnosed - and high viral suppression among those treated) [5]. Switzerland has made substantial progress along this cascade: Publicly reported Swiss estimates suggest that roughly 93% of PLWH know their status, 98% of those diagnosed are on treatment, and 99% of those treated are virally suppressed [6, 7]. This shows good progress that, however, leaves important gaps for elimination goals. According to the Swiss Federal Office of Public Health (FOPH) [8], 318 new HIV infections were reported in Switzerland and Liechtenstein in 2024, with an incidence of about 3.5 per 100,000 people. This suggests that prevention, testing, and rapid linkage to care remain essential even in a setting with strong ART outcomes [8, 9].

As life expectancy increases, HIV care increasingly becomes a chronic manageable condition that involves long-term ART treatment, regular clinical and laboratory monitoring, and the management of comorbidities [10]. Contemporary cohort evidence across Europe and North America shows that among people aged 40 who started ART after 2015, remaining life expectancy is estimated at 37 years for men and 39 years for women, compared with 40.7 and 45.8 years in the general population, with outcomes varying strongly by baseline clinical status and treatment [11]. Swiss cohort evidence similarly shows large survival gains across treatment eras, with life expectancy at age 20 rising to 54.9 years in the most recent combined ART (cART) era [12].

Despite these successes, at the beginning of 2025, Swiss public reporting described planned reductions in federal funding for prevention of sexually transmitted infections (STI), including HIV, aimed at saving approximately CHF 11 million per year starting in 2026, with concerns that cuts may occur despite rising STI case numbers [13]. In this context, the challenge is to continue progressing on the achievements in HIV management (including U=U and strong cascade performance) [14]. To inform policy and resource allocation in chronic conditions, cost-of-illness (COI) studies are a valuable tool to help quantify the burden imposed on the health system and society and identify the main cost components [15].

1.2 Research gap and aim of this study

Swiss evidence on the COI of HIV is limited. An early study was based on 65 ambulatory patients in Zürich and excluded patient costs [16]. An older Swiss report was produced in 2001, before the current c-ART era [17]. Later studies linked insurance claims and the Swiss HIV Cohort Study but focused on annual healthcare expenditures in linked treated cohorts rather than on a comprehensive lifetime burden estimate [18, 19]. As comprehensive and representative data on HIV-related costs remain scarce in Switzerland, an up-to-date national COI assessment to support evidence-based planning and resource allocation is still lacking [15]. This gap is particularly relevant in a setting where prevention and testing budgets are under financial pressure and HIV care increasingly reflects the long-term management of a chronic condition [10, 13].

To fill this research gap, the aim of this study is to provide a comprehensive assessment of the economic and social burden of HIV in Switzerland and to relate this burden to the country's progress towards ending the epidemic. Specifically, this study aims to answer five research questions:

1) What are the direct medical costs of a new HIV infection in Switzerland?
2) What indirect costs arise from morbidity, disability, and premature mortality?
3) What is the broader societal burden, including quality-of-life losses?
4) What is the lifetime health system and societal cost of each new HIV infection?
5) How progress towards the UNAIDS goals can translate into economic value?

2 Methods

2.1 State-transition model

To estimate the COI associated with HIV infection, we developed a Markov state-transition model. This model was considered appropriate as HIV infection is a chronic condition characterised by progression over time between clinically defined health states, with costs and outcomes depending on both infection severity and survival [20–22]. Markov models are well suited to chronic diseases and decision problems involving time-dependent risks, recurring events, and long-term accumulation of costs and outcomes [20, 21] and have been widely used in HIV economic evaluations [23–26]. Our model simulated the lifetime course of a newly infected person living with HIV in Switzerland across mutually exclusive CD4-defined health states and death. In each annual cycle, individuals could remain in the same CD4 category, transition to another CD4 category, or die. This structure allowed the model to capture long-term disease progression, immune recovery under ART, HIV-related excess mortality, and the accumulation of direct and indirect costs over time. Consistent with the broader COI framework, the model adopted an incidence-based perspective for lifetime estimation, so that costs were projected over the remaining lifetime rather than restricted to a single calendar year [15, 27]. TreeAge Pro software has been used to manage data and model specifications.

The model comprised four mutually exclusive health states: CD4 >500 cells/μL (CD4 >500), CD4 200-500 cells/μL (CD4 200-500), CD4 <200 cells/μL (CD4 <200), and death. CD4 refers to cluster of differentiation 4-positive T lymphocytes, also known as CD4 T cells or T helper cells, which are a key marker of immune function in HIV infection [28]. CD4 cell count was used to define the living health states because it is a clinically established marker of immune status in HIV infection and remains associated with prognosis and mortality in contemporary ART cohorts [11]. CD4-defined or CD4-informed health states are also commonly used to represent disease severity and long-term progression also in contemporary HIV economic modelling, often alone or in combination with viral load or virological response [23–26]. This structure is also consistent with the available Swiss data sources used in the analysis. The Swiss HIV Cohort Study (SHCS) reports CD4 categories including <200, 200–500, and >500 cells/μL in its summary statistics [29], while Swiss inpatient coding uses U61 codes to classify HIV-related hospitalisations according to CD4 cell-count categories [30].

These health states aim to capture clinically meaningful variation in severity, resource use, and productivity losses. Death was treated as an absorbing state. At model entry, the cohort was distributed across the CD4 categories according to SHCS descriptive statistics on the distribution of infection stage at recruitment [31]. The model then followed the cohort in annual cycles until all simulated individuals had transitioned to death or had reached the end of the analytic time horizon of 99 years, according to the Swiss Federal Statistical Office (FSO) [32]. Transition probabilities between health states were parameterised using published cohort evidence, with particular emphasis on Swiss and European HIV studies [33–37]. The model allowed movement both to more advanced (CD4>200, CD4200-500) and to less advanced (CD4>500) CD4 categories, reflecting the fact that, under contemporary antiretroviral treatment, both immunological recovery and deterioration can occur [11, 34, 37, 38]. Annual mortality in each CD4 state was implemented by combining age-specific Swiss general-population mortality with CD4-specific HIV-related excess mortality [33–35, 39–41]. CD4-specific base mortality risks were first converted to hazards and compared with the reference general-population hazard at model entry. The resulting excess hazard was added to age-specific background mortality in each cycle. Transition probabilities between living CD4 states were then scaled by the probability of remaining alive in that cycle, ensuring that the total probability across living states and death summed to one. For more details on the model assumptions, please refer to Table A1 in the Appendix.

Lifetime direct medical costs were assigned to each health state on an annual basis. These state-specific costs were calculated within the Markov model and comprised antiretroviral therapy, outpatient visits, diagnostics and monitoring, and inpatient care. Lifetime indirect costs were also calculated within the Markov model and included productivity losses (due to morbidity and to premature mortality), depression-related costs, and monetised quality-of-life losses.

To estimate cumulative lifetime costs, in the base-case scenario the model summed the expected direct and indirect costs accrued across all cycles. Future costs were discounted annually to reflect time preference, consistent with standard health-economic practice [22, 42]. Separate model outputs were generated for total direct costs and their subcomponents, as well as for total indirect costs and their subcomponents. The model was validated through three stakeholder meetings.

2.2 Direct costs estimation

2.2.1 ART costs

Antiretroviral regimen distribution and patient counts were informed by descriptive statistics from the SHCS, using the 2024 SHCS report as the main source [31]. After consultation with market experts and project stakeholders, the distribution of the most frequently used initial ART regimens in 2023 was used to approximate regimen use during the first four years after treatment initiation. This assumption was based on the SHCS table on regimen switching, indicating that ART regimens are commonly modified over follow-up and that the average duration of first-line therapy is approximately four years [31]. The use of initial regimens for the early treatment phase was therefore intended to reflect prescribing at treatment start, while allowing for subsequent regimen evolution in long-term care. ART switching in contemporary Swiss HIV care may occur for several reasons. In the SHCS, regimen changes and treatment discontinuations are routinely captured, and published SHCS analyses show that switches are frequently driven by treatment simplification, convenience, patient or physician preference, and toxicity or intolerance, whereas virological failure is relatively uncommon in modern ART cohorts [43, 44]. Specific reasons may include reducing pill burden, moving to single-tablet or better tolerated regimens, addressing central nervous system adverse events, managing renal, metabolic, gastrointestinal, hepatic, or lipid-related toxicity, avoiding drug–drug interactions in an ageing population with increasing comorbidity and comedication, and adapting treatment to changes in clinical guidelines or drug availability [43, 44]. For subsequent years, ART distribution was based on the most frequently used regimens observed among patients in the follow-up cohort [31].

Unit costs of antiretroviral drugs were obtained from the list of specialties by the FOPH [45]. For each regimen, annual drug costs were calculated from the official public price of a standard 30-day pack and multiplied by 12. For details on the calculation, please refer to Table A2 in the Appendix.

The resulting annual ART costs were reviewed considering stakeholder expectations and available Swiss evidence on ART cost trends [18, 19].

2.2.2 Outpatient visit costs

Outpatient costs were estimated by identifying the frequency of ambulatory HIV-related follow-up visits and multiplying this by the corresponding Swiss unit costs for outpatient consultations. Following consultation with an infectiology specialist, visit frequency was not assumed to depend on CD4 cell count, but rather on being in the first two years (early phase) or in the subsequent

years (stable phase) of ART treatment. Therefore, in the initial phase, more frequent follow-up visits (four visits per year) were assumed to reflect treatment initiation, adherence support, and early clinical monitoring. In the stable phase, lower visit frequency (two visits per year) was assumed to reflect sustained viral control and routine follow-up. Each outpatient HIV follow-up visit was modelled as a 45-minute specialist outpatient consultation including the initial consultation time, additional consultation time, a basic physical assessment, the closing consultation time, and brief formalised documentation/reporting. We consulted physicians to identify billing codes in TARMED (00.0010, 00.0020, 00.0030, 00.0415, 00.2206) and then transcoded them to TARDOC codes (AA.00.0010, AA.00.0020, AA.25.0030) using the official grouper [46] (See Table A3 in the Appendix. We followed the TARDOC tariff system and applied a tax point value of 0.89 to estimate the single bill [47]. Additionally, we included six visits per year for patients on injectable ART [48], weighting the resulting costs by the percentage of patients receiving injectable ART. Outpatient visit costs were then aggregated to annual per-patient outpatient costs. For details on the calculation, please refer to Table A4 and A5 in the Appendix.

2.2.3 Diagnostics costs

Diagnostic costs were estimated as the cost of routine laboratory and other monitoring procedures required for the follow-up of HIV infection in Switzerland. Consultation with an infectiology specialist allowed to define a standard set of diagnostic and monitoring procedures consistent with Swiss HIV care practice and clinical guidance. This set was subsequently validated through a stakeholder meeting.

Routine diagnostics after the initial diagnosis included virological monitoring, immunological monitoring, haematology, renal and liver function tests, metabolic monitoring, urine testing, selected STI- and hepatitis-related testing, and additional less frequent investigations such as anal cancer screening and bone density assessment [49, 50].

Resource use assumptions for follow-up diagnostics were linked to the same logic used for outpatient visits, with a higher intensity of monitoring in the earlier treatment period and a lower but ongoing monitoring intensity in clinically stable patients. Diagnostic tests were not assumed to be performed uniformly at every follow-up visit. For each diagnostic item, the expected annual per-patient cost was calculated by multiplying the relevant Swiss unit cost by the assumed annual testing frequency through a weighting factor reflecting the expected clinical frequency of use. Tests routinely performed during HIV follow-up, such as HIV-RNA, CD4, and CD8 (CD8 T lymphocytes [51]) monitoring, were assigned a weight of 1, whereas less systematically performed investigations were assigned lower weights. The weighted diagnostic costs were then summed to

estimate total follow-up diagnostics expenditure per patient-year. See Table A6 in the Appendix for more details on the diagnostics costing assumptions and weighting.

2.2.4 Inpatient costs

Inpatient resource use was estimated using the FSO Medical Statistics of Hospitals, which can be obtained upon request. This dataset contains inpatient admission records, including patient characteristics such as age and sex, as well as admission-level information including length of stay, the International Classification of Diseases Tenth Revision (ICD-10) diagnosis codes, and SwissDRG codes. HIV-related inpatient cases and CD4-related severity categories were identified using relevant ICD-10 and DRG coding information. We used records from 2022–2023 to estimate inpatient costs among people living with HIV. Costs were calculated from the health insurer perspective and included hospitalisations among people living with HIV, irrespective of whether HIV was recorded as the primary reason for admission. Estimated case-level costs were aggregated by CD4 category and used to derive annual inpatient cost inputs for the model. We identified HIV-related inpatient episodes using ICD-10 codes B20–B24, excluding the main diagnosis B23.0 Among these episodes, we looked at U61 codes to classify hospitalisations by CD4 category: CD4 >500, CD4 200–500, and CD4 <200 [30]. For each inpatient episode, costs were estimated by multiplying the effective Swiss Diagnosis-Related Groups (SwissDRG) cost weight by the assumed base rate [52]. Under SwissDRG, each inpatient case is assigned to a cost weight, which is multiplied with a hospital-specific negotiated base rate to determine reimbursement [53]. Because base rates vary across cantons and hospitals and have generally ranged around CHF 8,000-12,000 in recent years [54, 55], we applied an average base-rate assumption of CHF 10,000 (see Table A7 in the Appendix for details). To reduce the influence of extreme values in inpatient expenditure, raw case-level costs were winsorised at the 5th and 95th percentiles before calculating mean costs by CD4 category. Annual inpatient cost inputs for the model were then derived by multiplying the winsorised mean cost per hospitalisation by the estimated annual probability of hospitalisation in each CD4 category. This probability was calculated by annualising the number of observed inpatient cases over the study period and dividing it by the extrapolated number of people living with HIV in the corresponding CD4 category. For a detailed break-down of the calculations involved for the estimation of annual inpatient costs, please refer to Table A8 in the Appendix.

2.3 Indirect and societal cost estimation

2.3.1 Productivity costs

To estimate indirect productivity losses associated with HIV, we used the human capital approach [56, 57]. Productivity costs in our study include losses from both market productivity (paid work) and non-market productivity (volunteer work), as common practice in COI studies [58, 59]. Productivity losses from paid work reflect financial losses due to HIV-related morbidity and mortality. The retirement age in Switzerland is 65 [60]. We assume that productivity loss before age 65 is due to morbidity (reduced work ability) and mortality. Annual salary from paid work represents the main source of productivity loss. The annual mean salary was adjusted by age and gender using the most recent 2024 Swiss wage statistics [61, 62], then weighted according to the SHCS gender distribution of 70% men and 30% women [63].

International research indicates that, although the types of voluntary work undertaken by PLWH are limited, PLWH possess both the ability and the willingness to participate in such activities [64]. Volunteers of PLWH who are motivated by personal intrinsic drive tend to persevere for longer than those who are motivated solely by a sense of "social duty to help others" [65]. We therefore assume the unpaid volunteer work among PLWH aged 65 and older is comparable to that of the general population [66].

Productivity loss due to morbidity

Productivity loss due to morbidity was based on reduced work ability in paid work among PLWH in Switzerland. Information on the work ability for each CD4 level was derived from two Swiss studies: recent HIV work ability data [67] and the distribution of PLWH across CD4 categories [58]. In both studies, work ability was measured by treating physicians on a scale from 0% to 100% (0% = total disability; 100% = no disability).

We used 70.52% work ability for CD4 <200 as an anchor [67] and applied the odds ratio of 1.68 for CD4 200-500 and 2.01 for CD4 >500 [58]. We then adjusted work ability for employment barriers (due to stigma or institutional barriers) [68]. For comparison, work ability for the general population uses the Swiss employment rate of 80.70% in 2023 [69]. For more details on the calculations, see Table A9 in the Appendix.

As we assume no decrement for volunteer work in PLWH, productivity loss due to morbidity was only accumulated by the model up to retirement age (65 in Switzerland [60]).

Productivity loss due to mortality

Productivity loss due to mortality was estimated for both paid work and unpaid volunteer work. Productivity from paid work for PLWH was calculated by multiplying the weighted average annual salary by the estimated participation rate of PLWH, then multiplying by the ratio of new infections in 2023 in each CD4 category [70]. See Table A10 in the Appendix for more details. Unpaid productivity losses due to premature mortality were estimated by valuing forgone volunteer work. Volunteer activity was differentiated between institutional and informal volunteering and parameterised using age-specific participation rates and average weekly hours for Switzerland [71]. For individuals aged 40–64 years, institutional volunteering was based on a participation rate of 17.2% and an average of 2.9 hours per week, while informal volunteering was based on a participation rate of 36.4% and an average of 3.7 hours per week [71]. For individuals aged 65 years and older, the corresponding participation rates were 13.2% and 28.9% [71]. Annual volunteer hours were calculated over a 52-week year and weighted by the respective participation rates, resulting in estimated annual volunteer contributions of 96 hours for individuals aged 40–64 years and 76 hours for individuals aged 65 years and older. These hours were valued using an hourly rate of CHF 22, corresponding to the minimum wage assumption applied in the analysis [72]. The resulting annual value of volunteer work was CHF 2,111 before age 65 and CHF 1,661 from age 65 onward. See Table A11and A12 in the Appendix for details.

Productivity costs due to premature mortality were calculated as the difference in lifetime productivity between the model with HIV-related excess mortality included and the model with excess mortality switched off. The model accumulated forgone productivity over the lifetime, including paid work and unpaid volunteer work before age 65, and unpaid volunteer work only after age 65.

2.3.2 Mental health costs: Depression

PLWH have a higher risk of developing depression than the general population. We interpret this as the excess depression cost attributable to HIV [73]. The expected annual cost of this excess incidence is calculated as the excess incidence multiplied by the average annual cost per depression case. Excess annual incidence is defined as the difference between the incidence in the HIV cohort [73] and the general population baseline [74]. Existing evidence shows that the direct cost of depression is distributed across severity categories (mild, moderate, severe) using gender-specific clinical distributions. Historical direct cost data (originally in euros) were converted to Swiss francs [75] and adjusted for general inflation [76]. See Table A13 in the Appendix for details on the calculations. We applied the annual excess incidence of depression attributable to HIV to the severity-weighted annual direct cost per new depression case and accumulated these costs over the modelled lifetime among individuals in the Markov model.

2.3.3 Quality-of-life costs

Quality-of-life losses associated with HIV infection were estimated within the Markov model by applying an HIV-specific utility decrement to each year lived with HIV. We used the Swiss general-population EQ-5D utility value as the reference utility [77] and adjusted this value by a relative utility ratio for people living with HIV compared with the general population [78]. In the base case, the Swiss general-population utility was based on a Swiss utility valuation study, and the HIV utility ratio on the average estimate from Popping et al. [78]. This resulted in an annual utility decrement of approximately 0.033 QALYs per year lived with HIV. The resulting QALY loss was accrued directly within the model for individuals alive in the CD4-defined health states and was accumulated over the simulated lifetime. QALY losses were then estimated as the difference between the general-population utility reference and the utility assigned to people living with HIV. To express the quality-of-life burden in monetary terms, accumulated QALY losses were multiplied by a willingness-to-pay threshold of CHF 100,000 per QALY. This value was selected as a pragmatic reference threshold for the Swiss context. Although Switzerland does not apply a single formally binding cost-effectiveness threshold, CHF 100,000 per QALY is commonly used in Swiss health-economic analyses and is consistent with threshold values discussed in health economic assessments and reports from the BAG [79].

2.4 Sensitivity analyses

Deterministic sensitivity analyses were conducted to assess the robustness of the estimated lifetime cost of a new HIV infection to structural and parameter assumptions.

First, we assessed the impact of discounting. In the base case, future costs and outcomes were discounted at 3% per year. In the sensitivity analysis, the model was run without discounting by setting the discount rate to 0%. This scenario was included because lifetime cost-of-illness estimates are sensitive to the time at which costs and outcomes accrue, especially for chronic infections such as HIV, where treatment costs, productivity losses, and quality-of-life losses extend over several decades [80].

Second, we varied the assumed age at infection. The base case used an average starting age of 39 years, reflecting the estimated average age at diagnosis in Switzerland [81]. In sensitivity analysis, the starting age was reduced to 30 years. This scenario reflects uncertainty around the timing of infection relative to diagnosis, particularly because HIV may remain undiagnosed for several years and late presentation remains relevant in Switzerland [82]. A younger starting age increases

the remaining lifetime over which costs and outcomes can accrue and therefore provides a conservative assessment of the lifetime burden among younger adults acquiring HIV.

Third, we explored an alternative assumption for morbidity-related productivity loss among individuals with preserved immune function. In the base case, morbidity-related paid work loss was assigned to all CD4 categories, including individuals with CD4 >500 cells/μL. In sensitivity analysis, we assumed no HIV-related decrement in work ability for individuals with CD4 >500 cells/μL, setting their morbidity-related productivity loss equal to zero. This scenario was included because the base-case work ability estimates are based on older evidence, while contemporary ART, earlier treatment initiation, and sustained immune recovery may reduce or eliminate work-ability differences among clinically stable people living with HIV [83, 84].

Fourth, we varied the HIV-specific utility ratio used to estimate QALY losses. In the base case, the HIV utility ratio relative to the general population was set to 0.96, corresponding to the average of estimates from two high-income European countries [78]. Sensitivity analyses used the reported lower and upper values, namely 0.94 and 0.98. Given the absence of a single Swiss HIV-specific EQ-5D utility norm, this allowed us to assess the effect of uncertainty in the assumed quality-of-life decrement associated with HIV.

Finally, we explored uncertainty around the monetary valuation of QALY losses. In the base case, discounted QALYs lost were monetised using a willingness-to-pay threshold of CHF 100,000 per QALY. As Switzerland does not have a formally binding cost-effectiveness threshold, and Swiss health-economic assessments commonly present results across a range of hypothetical willingness-to-pay thresholds, sensitivity analyses were conducted using thresholds of CHF 50,000 and CHF 150,000 per QALY [85, 86]. See Table 1 for a summary of the sensitivity analyses.

Table 1. Sensitivity analyses

Parameter	Base-case assumption	Alternative assumption
Discounting	3% annual discount rate	0% discount rate
Age at infection	39 years	30 years
Work ability CD4 >500	CD4-specific productivity loss applied	No productivity decrement for CD4 >500
HIV utility ratio	0.96	0.94 and 0.98
WTP threshold for a QALY	CHF 100,000/QALY	CHF 50,000 and 150,000/ QALY

2.5 Progress towards UNAIDS 95-95-95 targets

Based on our COI of HIV estimation, we estimated the potential economic value of further progress towards the UNAIDS 95-95-95 targets [5]. The scenario focused on the first step of the

HIV care cascade, i.e. the proportion of people living with HIV who are diagnosed, since this is the step in which Switzerland is still lagging behind with respect to the UNIADS targets [6]. The current Swiss cascade was compared with a scenario in which the proportion of diagnosed increases to 95%, while treatment coverage among diagnosed individuals and viral suppression among treated individuals remain unchanged.

For each scenario, the number of undiagnosed people living with HIV was estimated as:

$$N_{undiagnosed,j} = N_{PLWH} \times \left(1 - p_{diagnosed,j}\right)$$

where N_{PLWH} is the estimated number of PLWH in Switzerland, $p_{diagnosed,j}$ is the proportion diagnosed, and j denotes either the current situation or the UNAIDS-target scenario. The relative reduction in the undiagnosed population was calculated as:

$$r_{undiagnosed} = \frac{N_{undiagnosed,current} - N_{undiagnosed,scenario}}{N_{undiagnosed,current}}$$

To approximate the number of averted HIV infections, we assumed that the reduction in the undiagnosed population translates proportionally into a reduction in infections attributable to undiagnosed HIV. This was to a factor obtained from a Swiss study on the dynamic of the HIV epidemic in men who have sex with men in Switzerland [87]. Due to the uncertainty around this estimation, this value was varied in a sensitivity analysis, where input from an older study from the US was used [88]. The annual number of infections attributable to undiagnosed infection was calculated as:

$$I_{undiagnosed} = I_{new} \times s_{undiagnosed}$$

where I_{new} is the annual number of new HIV diagnoses in Switzerland and $s_{undiagnosed}$ is the assumed share of transmissions attributable to undiagnosed infection. Averted infections were then estimated as:

$$I_{averted} = I_{new} \times s_{undiagnosed} \times r_{undiagnosed}$$

Avoided costs were calculated by multiplying the estimated number of averted infections by the lifetime cost per new HIV infection estimated in the cost-of-illness model:

$$C_{averted} = I_{averted} \times C_{lifetime\ HIV}$$

where $C_{lifetime\ HIV}$ denotes the estimated lifetime cost per HIV infection.

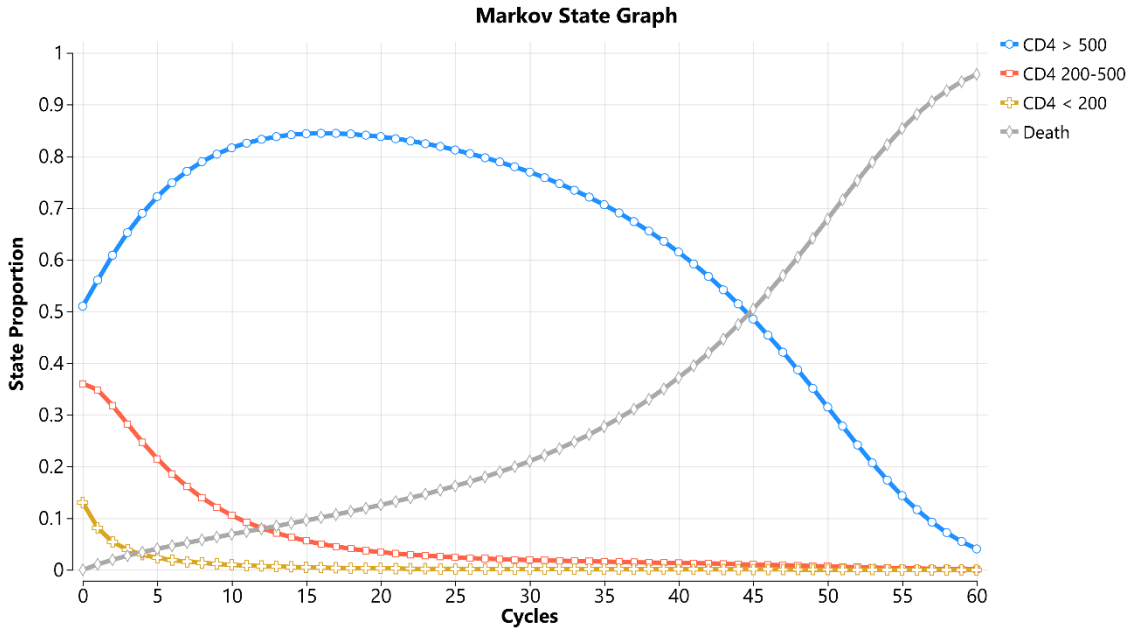
3 Results

3.1 State-transition model

The state-transition graph in Figure 1 illustrates the expected evolution of the simulated cohort across the CD4-defined health states over the lifetime horizon. At model entry, the cohort was distributed across the three living health states, with the largest proportion starting in CD4 >500 state, followed by CD4 200-500 and CD4 <200. Over the first model cycles, the proportion of individuals in the CD4 >500 state increased, while the proportions in the CD4 200-500 and CD4 <200 states decreased over time. The CD4 200-500 state declined progressively during the early cycles, while the CD4 <200 state rapidly became a small share of the living cohort. Consequently, most person-time among surviving individuals was accumulated in the CD4 >500 state. The death state increased gradually over the model horizon, reflecting the accumulation of age-specific background mortality and HIV-related excess mortality. By the end of the simulated time horizon, nearly all individuals had transitioned to death and most survivors were in the CD4 >500 state (approximately 90% of individuals still alive).

Overall, the state-transition graph confirms that the model behaves consistently with its intended structure: early movement towards higher CD4 states among survivors, limited long-term residence in advanced immunosuppression, and progressive absorption into the death state over the lifetime horizon.

Figure 1. Simulated lifetime cohort distribution across CD4-defined health states



The graph shows the proportion of the cohort in each health state over annual model cycles. At model entry, individuals are distributed across the three living CD4 states. During the early cycles, the proportion in the CD4 >500 state increases, reflecting immune recovery and stabilisation under ART, while the proportions in the CD4 200-500 and CD4 <200 states decline. Over time, the death state progressively increases as age-specific background mortality and HIV-related excess mortality accumulate. The trajectory illustrates that most surviving person-time is spent in the CD4 >500 state, whereas relatively little long-term person-time is spent in the CD4 <200 state. Among individuals still alive at the end of the model horizon, approximately 90% are in the CD4 >500 state.

3.2 Direct costs estimation

Annual direct HIV-related costs varied by time since treatment initiation and by CD4 category. Across all CD4 categories, they were highest among individuals with <200, while costs among individuals with CD4 >500 and CD4 200-500 were relatively similar.

Table 2 shows the annual direct medical costs by CD4 category and cost category, for the different treatment phases. During the first four years, annual ART costs were estimated at CHF 13,351 per patient and were applied equally across all CD4 categories. Outpatient visits and diagnostics were also applied equally across CD4 categories during this period, at CHF 667 and CHF 1,433 per patient-year, respectively. Inpatient costs varied instead depending on the CD4 category, ranging from CHF 47 per year among individuals with CD4 >500 to CHF 446.00 among those with CD4 200-500 and CHF 15,773 among those with CD4 <200. Among inpatient costs, PLWH with CD4 <200 represented the highest cost subgroup, with a longer mean length of stay of 15 days and higher mean inpatient costs (CHF 24,518) than the other CD4 categories. Hospitalized cases from the CD4 200-500 category and the CD4 >500 category showed significantly lower mean costs (CHF 19,348 and CHF 18,058, respectively).

Lower outpatient and diagnostic costs after two years (reflecting decreased outpatient visit frequency in stable, long-term HIV care), and lower assumed ART costs after four years (due to treatment switching) leads to lower direct medical costs overall in the later phases. Annual direct costs from year 5 onward were CHF 12,677 for CD4 >500, CHF 13,076 for CD4 200-500, and CHF CHF 28,403 for CD4 <200.

Table 2. Annual direct medical costs by CD4 category, cost category, and treatment phase

Year 1 to 4					
CD4 category	**ART costs**	**Outpatient visits**	**Diagnostics**	**Inpatient costs**	**Total annual direct costs**
CD4 >500	CHF 13,351	CHF 667	CHF 1,433	CHF 47	CHF 15,498
CD4 200-500	CHF 13,351	CHF 667	CHF 1,433	CHF 446	CHF 15,897
CD4 <200	CHF 13,351	CHF 667	CHF 1,433	CHF 15,773	CHF 31,224
Year 3 to 4					
CD4 category	**ART costs**	**Outpatient visits**	**Diagnostics**	**Inpatient costs**	**Total annual direct costs**
CD4 >500	CHF 13,351	CHF 353	CHF 716	CHF 47	CHF 14,467
CD4 200-500	CHF 13,351	CHF 353	CHF 716	CHF 446	CHF 14,866
CD4 <200	CHF 13,351	CHF 353	CHF 716	CHF 15,773	CHF 30,193
Year 5 onward					
CD4 category	**ART costs**	**Outpatient visits**	**Diagnostics**	**Inpatient costs**	**Total annual direct costs**
CD4 >500	CHF 11,561	CHF 353	CHF 716	CHF 47	CHF 12,677
CD4 200-500	CHF 11,561	CHF 353	CHF 716	CHF 446	CHF 13,076
CD4 <200	CHF 11,561	CHF 353	CHF 716	CHF 15,773	CHF 28,403

When looking at differences by CD4 category, ART costs accounted for the majority of annual direct medical costs in patients with higher CD4 categories. Among patients with CD4 >500, ART costs represented CHF 13,351 of the CHF 15,498 total annual direct cost in years 1 to 2, corresponding to approximately 86% of annual direct costs. In years 3 to 4, ART costs represented CHF 13,351 of CHF 14,467, corresponding to approximately 92% of annual direct costs. From year 5 onward, ART costs represented CHF 11,561 of CHF 12,677, corresponding to approximately 91% of annual direct costs. A similar pattern was observed among patients with CD4 200-500, where ART costs represented approximately 84% of annual direct costs in years 1 to 2, 90% in years 3 to 4, and 88% from year 5 onward. By contrast, the relative contribution of ART costs was lower among patients with CD4 <200, because inpatient costs were substantially higher in this group. In this health state, ART costs represented CHF 13,351 of CHF 31,224 total annual direct costs in years 1 to 2, corresponding to approximately 43% of annual direct costs. In years 3 to 4, ART costs represented CHF 13,351 of CHF 30,193, corresponding to approximately 44% of annual direct costs. From year 5 onward, ART costs represented CHF 11,561 of CHF 28,403, corresponding to approximately 41% of annual direct costs.

Table 3 shows the total lifetime direct medical costs per new HIV infection. Over the modelled lifetime of a new HIV infection, discounted total direct HIV costs amounted to CHF 289,584 per person. ART represented the largest cost component, with discounted lifetime ART costs of CHF 258,224, corresponding to approximately 89% of total direct costs. Other direct cost components were smaller: outpatient visits accounted for CHF 8,034, diagnostics for CHF 16,384, and inpatient care for CHF 6,942 per new HIV infection.

Table 3. Lifetime direct medical costs per new HIV infection

Cost component	Lifetime cost per new HIV infection	Percentage of total direct HIV costs
ART costs	CHF 258,224	89%
Outpatient visits	CHF 8,034	3%
Diagnostics	CHF 16,384	6%
Inpatient costs	CHF 6,942	2%
Total direct HIV costs	**CHF 289,584**	**100.00%**

3.3 Indirect costs estimation

3.3.1 Productivity-related cost

Table 4 shows that over the modelled lifetime, discounted morbidity-related productivity losses amounted to CHF 124,878 per new HIV infection.

Mortality-related productivity losses captured the value of future productive activity forgone due to premature HIV-related mortality. Before age 65, productivity was valued as the sum of paid employment and unpaid volunteer work. The weighted annual paid productivity value was CHF 66,177.19, to which unpaid volunteer work was added before age 65, giving a combined annual productivity value of approximately CHF 68,288. After age 65, only unpaid volunteer work was included, valued at approximately CHF 1,661 per year. Comparing lifetime productivity with and without excess HIV-related mortality yielded a mortality-related productivity loss of CHF 73,469 per new HIV infection.

Overall, total lifetime productivity losses amounted to CHF 198,348 per new HIV infection.

Table 4. Lifetime productivity costs per new HIV infection

Productivity cost component	Description	Annual cost input	Lifetime cost per new HIV infection
Morbidity-related	CD4-specific loss of work ability (until 65)	CD4 <200: CHF 17,162 CD4 200-500: CHF 9,453 CD4 >500: CHF 7,266	CHF 124,878
Mortality-related	Future paid and unpaid productivity forgone due to premature death	<65: CHF 68,288/year ≥65: CHF 1,661/year	CHF 73,469
Total productivity losses			**CHF 198,348**

3.3.2 Mental health burden: Depression

Table 5 shows that over the modelled lifetime of a new HIV infection, discounted costs related to excess incidence of depression attributable to HIV amounted to CHF 3,198 per person. Since only the excess incidence of depression was attributed to HIV, the resulting lifetime cost contribution is relatively small compared with the other indirect cost components.

Table 5. Lifetime excess depression-related costs per new HIV infection

Parameter	Value
Excess depression incidence attributable to HIV	0.92 pp in men; 1.13 pp in women
Weighted average lifetime direct costs per new depression case	CHF 14,851
Discounted lifetime depression-related cost	**CHF 3,198**

Notes: pp = Percentage points

3.3.3 QALYS

Table 6 presents the quality-of-life-related costs per new HIV infection. We estimated 5.2 undiscounted QALYs lost per new HIV infection. After discounting at 3% per year, this corresponded to 2.4 discounted QALYs lost. Applying the willingness-to-pay threshold of CHF 100,000 per QALY, we obtained the monetised lifetime quality-of-life costs of CHF 240,000 per new HIV infection. Alternative thresholds are explored in sensitivity analyses to reflect uncertainty around the willingness to pay for a QALY in Switzerland.

Table 6. Lifetime quality-of-life-related costs per new HIV infection

Parameter	Value
HIV-specific utility used in the model	0.797
Annual utility decrement relative to Swiss general population	0.033 QALYs
Lifetime QALYs lost, undiscounted	5.2 QALYs
Lifetime QALYs lost, discounted at 3%	2.4 QALYs
Base-case willingness-to-pay threshold	CHF 100,000 per QALY
Monetised QALY loss per new HIV infection	**240,000**

3.4 Total lifetime costs

Table 7 shows that the estimated total lifetime cost of one new HIV infection in Switzerland was CHF 731,130. This included both direct HIV-related medical costs and indirect costs, including productivity losses, depression-related costs, and monetised quality-of-life losses.

Direct medical costs amounted to CHF 289,584 per new HIV infection, representing approximately 40% of the total lifetime burden. ART was the dominant direct cost component, with lifetime costs of CHF 258,224, corresponding to approximately 89% of total direct medical costs. Other direct cost components were substantially smaller: outpatient visits (CHF 8,034), diagnostics (CHF 16,384), and inpatient care (CHF 6,942).

Indirect costs accounted for the larger share of the total lifetime burden, amounting to CHF 441,546, 60% of the total. Within indirect costs, monetised QALY loss was the largest component, at CHF 240,000 per new HIV infection. Productivity losses were also substantial, with a total of CHF 198,348, comprising CHF 124,878 due to morbidity-related reductions in paid work and CHF 73,469 due to premature mortality. Excess depression-related costs contributed a smaller amount, at CHF 3,198.

Table 7. Lifetime direct and indirect costs of a new HIV infection

Cost component	Lifetime cost per new HIV infection	Percentage of total lifetime costs
Direct costs		
ART costs	CHF 258,224	35%
Outpatient visits	CHF 8,034	1%
Diagnostics	CHF 16,384	2%
Inpatient costs	CHF 6,942	1%
Total direct HIV costs	**CHF 289,584**	**40%**
Indirect costs		
Productivity loss due to morbidity	CHF 124,878	17%
Productivity loss due to premature mortality	CHF 73,469	10%
Subtotal productivity losses	**CHF 198,348**	**27%**
Depression-related costs	CHF 3,198	0%
Monetised QALY loss	CHF 240,000	33%
Total indirect costs	**CHF 441,546**	**60%**
Total direct + total indirect costs	**CHF 731,130**	**100%**

3.5 Sensitivity analyses

Sensitivity analyses reported in Table 8 show that the estimated lifetime cost of a new HIV infection was most sensitive to assumptions affecting the duration over which costs and outcomes accrued, the valuation of QALY losses, and the application of discounting. In the base case, the total lifetime cost per new HIV infection was estimated at CHF 731,130.

Removing discounting had the largest impact on the estimated lifetime burden. In the undiscounted scenario, total lifetime costs increased to CHF 1,192,145 per new HIV infection. The detailed component-level results for the undiscounted scenario are reported in Appendix Table A14.

The starting age of the cohort also had a substantial effect on the lifetime cost estimate. When the assumed age at infection was reduced from 39 to 30 years, total lifetime costs increased to CHF 847,373 per new HIV infection. This increase was driven by the longer remaining lifetime over which costs and outcomes could accrue. Detailed results for the younger age-at-infection scenario are shown in Appendix Table A15.

When no HIV-related work-ability decrement was assumed for individuals with CD4 >500, total lifetime costs decreased to CHF 640,160 per new infection. This scenario only affected morbidity-related productivity losses, while direct medical costs were unchanged. Component-level results for this scenario are presented in Appendix Table A16.

Varying the HIV utility ratio affected the monetised quality-of-life component, while leaving direct costs, productivity losses, and depression-related costs unchanged. Using a lower HIV utility ratio of 0.94 increased the total lifetime cost to CHF 768,130 per new infection, whereas using an upper ratio of 0.98 reduced the total to CHF 695,130. Detailed calculations for the two utility-ratio scenarios are reported in Appendix Table A17.

At a threshold of CHF 50,000 per QALY, total lifetime costs decreased to CHF 611,130 per new infection. At CHF 150,000 per QALY, total lifetime costs increased to CHF 851,130, and at CHF 200,000 per QALY they increased further to CHF 971’130. These changes were entirely driven by the monetised QALY-loss component. The full threshold analysis is provided in Appendix Table A18.

Overall, the sensitivity analyses showed that total lifetime costs ranged from CHF 611,130 in the low willingness-to-pay threshold scenario to CHF 1,192,145 in the undiscounted scenario.

Table 8. Sensitivity analyses of total lifetime cost per new HIV infection

Analysis	Assumption varied	Total lifetime cost per new HIV infection
Base case	Discounted; Start age = 39; HIV utility ratio = 0.96; WTP = CHF 100,000/QALY	CHF 731,130
Undiscounted	Discount rate = 0%	CHF 1,192,145
Younger age at infection	StartAge = 30	CHF 847,373
No productivity decrement in CD4 >500	Productivity loss in CD4 >500 set to 0	CHF 640,160
Lower HIV utility ratio	HIV utility ratio = 0.94	CHF 768,130
Upper HIV utility ratio	HIV utility ratio = 0.98	CHF 695,130
Lower WTP threshold	CHF 50,000/QALY	CHF 611'130
Higher WTP threshold	CHF 150,000/QALY	CHF 851'130
Very high WTP threshold	CHF 200,000/QALY	CHF 971'130

3.6 Progression towards UNAIDS goals

We estimated the potential economic implications of further progress towards the UNAIDS 95-95-95 targets in Switzerland [5]. The analysis focused on the first target, since Switzerland is already assumed to perform strongly on treatment and viral suppression among diagnosed individuals, while the main remaining gap concerns the proportion of people living with HIV who are aware of their status [6].

Table 9 shows that 93% of people living with HIV in Switzerland were assumed to be diagnosed, leaving 7% undiagnosed. Achieving the UNAIDS diagnosis target of 95% would reduce the undiagnosed proportion to 5%. Applied to the estimated Swiss population living with HIV, this corresponded to a decrease from approximately 1,233 to 881 undiagnosed individuals, equivalent to 352 fewer people living with undiagnosed HIV and a 28.6% relative reduction in the undiagnosed population.

Using the assumption that 69% of new HIV infections are attributable to undiagnosed individuals [87], this reduction was estimated to avert 70 new HIV infections. This estimate represents a simplified scenario analysis as it assumes that reductions in the undiagnosed population translate proportionally into reductions in infections attributable to undiagnosed HIV.

Based on the estimated lifetime cost of CHF 731,130 per new HIV infection, preventing 70 infections would correspond to potential lifetime cost savings of CHF 51.2 million.

In sensitivity analysis, an alternative transmission-rate approach was applied using an annual transmission rate of 6.9% among individuals unaware of their HIV infection [88]. Under this assumption, 352 fewer undiagnosed individuals would correspond to approximately 24 avoided

infections. Based on the estimated lifetime cost of CHF 731,130 per new HIV infection, this would correspond to potential lifetime cost savings of CHF 17.8 million.

Table 9. Calculation of potential cost savings with progress towards UNAIDS targets

Calculation step	Base-case attribution approach	Sensitivity transmission-rate approach
Current diagnosed proportion	0.93	0.93
Target diagnosed proportion	0.95	0.95
Current undiagnosed PLWH	1,233	1,233
Target undiagnosed PLWH	881	881
Reduction in undiagnosed PLWH	352	352
Transmission assumption	69% of infections attributable to undiagnosed PLWH	6.9% annual transmission rate among undiagnosed PLWH
Estimated avoided infections	70	24
Lifetime cost per new HIV infection	CHF 731,130	CHF 731,130
Potential lifetime cost savings	**CHF 51.2 million**	**CHF 17.8 million**

4 Discussion

4.1 Interpretation of main findings

This study provides an updated incidence-based modelled estimate of the lifetime direct and societal burden of a new HIV infection in Switzerland and quantifies the potential economic value of progress towards diagnosis and prevention targets.

Using a state-transition Markov model and bottom-up direct, indirect and societal costs collection, we estimated a total lifetime cost of CHF 731,130 per new infection in the base case. Direct medical costs accounted for CHF 289,584, while indirect and broader societal costs accounted for CHF 441,546.

The results include the economic consequences of HIV that extend beyond direct medical expenditure and show that preventing new infections can generate long-term value through avoided treatment costs, reduced productivity losses, and preservation of quality of life.

Indirect and broader societal costs represented the larger share of the total lifetime burden. Monetised QALY losses and productivity losses were the main drivers of this component, amounting to CHF 240,000 and CHF 198,348 per new infection, respectively. This finding show that analyses restricted to healthcare costs alone would underestimate the full economic value of preventing new HIV infections, and that prevention and earlier diagnosis can generate value not only by avoiding future treatment expenditure, but also by preserving productivity and quality of life.

Within direct medical costs, ART remained the dominant component. Lifetime ART costs accounted for approximately 89% of total direct costs, reflecting the long duration of treatment under contemporary HIV care. This is consistent with Swiss and international evidence showing that pharmaceutical expenditure remains the principal driver of direct HIV care costs in the modern treatment era [18, 19].

The modelled state-transition trajectory helps explain the distribution of direct costs. Although the CD4 <200 state was associated with the highest annual inpatient costs, relatively little lifetime person-time was spent in this state. In contrast, most surviving person-time accumulated in the CD4 >500 state. The plausibility of this trajectory was assessed through stakeholder consultation: approximately 90% of individuals still alive at the end of the simulated horizon were in the CD4 >500 state, which stakeholders considered consistent with contemporary Swiss HIV care. This

assessment is also supported by recent clinical evidence showing that, in the modern ART era, life expectancy among adults with HIV in Europe and North America has improved substantially, particularly among individuals with better immune status, and that persistent CD4 <200 immunological non-response is now uncommon among virally suppressed patients [11, 38].

As a result, lifetime direct costs were driven less by prolonged advanced immunosuppression and more by long-term survival with ongoing ART and routine follow-up. This pattern reflects the clinical success of contemporary HIV treatment and the long-term economic commitment associated with lifelong care, as demonstrated by recent evidence from Europe and North America [11, 38]

4.2 Comparison with the existing literature

The present analysis updates an area where Swiss evidence has been limited. An earlier Swiss report on the social cost of HIV infection, conducted using data from 1998, estimated annual social costs of approximately CHF 443 million in total, with drug costs accounting for the largest share [5,6]. That report was produced in a different epidemiological and treatment context, shortly after the introduction of combination ART, and therefore is not directly comparable with the present lifetime per-infection estimate. Nevertheless, it is important historically because it showed early that HIV imposed costs beyond the healthcare sector and that drug costs were already a major component of the economic burden.

More recent Swiss studies have focused primarily on annual direct medical costs rather than the lifetime cost of incident infections. Lowy et al. reported that ART accounted for approximately 80% of total treatment costs among Swiss PLWH [88]. Leon-Reyes et al. estimated mean individual annual total costs of approximately USD 30,000 in 2012-2013 using linked SHCS and claims data, with costs largely attributable to ART [18]. Aghlmandi et al. extended this claims-linkage evidence to 2012-2017 and reported mean adjusted annual overall costs of approximately CHF 24,700-24,900 per patient, with ART contributing most to total costs but decreasing over time [19]. Our annual direct medical costs are lower than the all-cause annual cost estimates in these claims-based studies because our model focused on HIV-attributable direct cost components and excluded broader non-HIV healthcare costs captured in claims data. The finding that ART make up the largest share of direct medical costs is nevertheless consistent with both studies.

The present study adds to this literature by translating annual cost inputs into an incidence-based lifetime estimate. This is a complementary perspective to prevalence-based annual cost studies.

International studies similarly show that the economic burden of HIV is substantial and that direct medical costs capture only part of the total burden. In the United States, discounted lifetime medical costs of HIV infection were estimated as USD 326,500 for individuals infected at age 35, with antiretroviral medications accounting for 60% of cost [89]. A Canadian report from The Institute of Health Economics reported even higher lifetime economic costs when productivity and quality-of-life losses are included, with an estimated the average lifetime cost of a new HIV infection in Canada of CAD 1.44 million, including direct healthcare costs, productivity losses, and quality-of-life losses [90]. An earlier Canadian study also showed that adding productivity and quality-of-life losses substantially increases the estimated burden compared with direct healthcare costs alone [91]. The most recent Canadian model shares a similar approach to ours [90]. Our total estimate of approximately CHF 731,130 per new infection is lower than the most recent Canadian estimate [90], corresponding to approximately CHF 821,671 [92], but it shows a similar pattern where direct medical costs are substantial, while broader societal costs account for a large share of the total burden. The difference between the two estimates is driven primarily by the productivity component: while in our study productivity losses were estimated conservatively as small HIV-attributable losses under contemporary Swiss HIV care, the Canadian study applies broad assumptions on reduced labour-force among people with HIV [90]. The approach used in this study likely produces a lower but more specific estimate of productivity loss attributable to HIV in a modern treated population.

4.3 Policy relevance: UNAIDS targets and NAPS

The findings are directly relevant to Switzerland's progress towards HIV elimination goals. Switzerland has strong performance on treatment and viral suppression among diagnosed individuals [6]. The remaining gap is primarily in diagnosis: approximately 93% of people living with HIV in Switzerland were estimated to know their status in 2023, compared with the UNAIDS target of 95% [5, 6, 14]. Because undiagnosed HIV is a key driver of onward transmission, further progress in diagnosis has both clinical and economic significance.

This aligns closely with the Swiss National Programme NAPS, which aims to eliminate transmission of HIV and hepatitis B and C viruses by 2030 and to reduce other sexually transmitted infections [14]. NAPS builds on Switzerland's long-standing prevention strategy but shifts the policy objective from control towards elimination. Importantly, NAPS also explicitly recognises that access barriers remain, particularly for people at increased risk of infection, and that the full prevention cycle includes information, counselling, vaccination, testing and treatment [14]. The present study provides an economic complement to this policy agenda: by estimating

the lifetime cost of a new HIV infection, it allows reductions in incidence to be translated into long-term economic value.

Our scenario analysis suggested that moving from 93% to 95% diagnosed could reduce the number of undiagnosed people living with HIV by approximately 352 individuals. Using the base-case attribution approach, this was estimated to avert 70 new infections, corresponding to potential lifetime cost savings of CHF 51.2 million. This estimate should be interpreted as a simplified scenario rather than as the output of a dynamic transmission model.

The relationship between diagnosis and avoided infections is complex. Earlier diagnosis can reduce onward transmission by enabling linkage to care, ART initiation, and viral suppression [93, 94]. The Swiss HIV cascade indicates that once diagnosed and treated, viral suppression is very high, supporting the prevention value of diagnosis and linkage to care [1, 6, 9]. However, the magnitude of avoided infections depends on transmission dynamics, timing of diagnosis, sexual networks, risk behaviour, Pre-Exposure Prophylaxis (PrEP) uptake, testing frequency, and the distribution of infections across key populations [93, 94].

Recent Swiss modelling assessed expanded access to HIV and STI testing in Switzerland and concluded that targeted expansion of screening among key populations at risk can reduce the incidence of HIV and syphilis, with regular screening offering potential cost savings to insurers under specific coverage and treatment scenario [95]. Our analysis extends this logic by estimating the lifetime direct and societal cost of each avoided HIV infection. Together, these findings suggest that targeted testing and earlier diagnosis can generate economic short- and long-term value.

From a policy perspective, these findings support concentrating prevention resources where the remaining undiagnosed burden and transmission risk are greatest. In the Swiss context, this does not imply broad undifferentiated population screening, but rather a differentiated prevention strategy focused on key populations and other people with increased HIV exposure risk. This is consistent with NAPS, which defines key groups as population groups with an increased risk of infection with sexually transmitted pathogens or people already living with such infections, including gay, bisexual, queer and other men who have sex with men, people from countries with increased prevalence, people in prison, people living with HIV or other STIs and their sexual contacts, people who inject, inhale or sniff drugs, sex workers, clients of sex workers, and trans people [14]. It is also consistent with WHO guidance, which recommends prioritising HIV testing services for populations most affected by, or at high ongoing risk of, HIV infection and adapting services to local epidemiology and population needs [96].

Targeted testing should therefore be part of a broader prevention pathway rather than as a stand-alone intervention. Testing identifies undiagnosed HIV infection and enables rapid linkage to ART, which benefits the individual and reduces onward transmission through viral suppression [96]. A negative test among people with ongoing exposure risk still provides an opportunity to deliver prevention counselling, PrEP assessment, condom promotion, vaccination where relevant, and regular STI screening. WHO recommends PrEP as an additional prevention choice for people at substantial risk of HIV infection as part of combination prevention, and emphasises that PrEP should be linked to regular HIV testing and broader sexual health services [97]. Repeated testing can increase health literacy by improving knowledge of transmission risks, symptoms of acute infection, prevention options, PrEP, and the meaning of U=U [96].

The relevance of this approach is supported by Swiss evidence on missed opportunities for diagnosis. Prior Swiss analyses found that a substantial proportion of individuals newly presenting for HIV care had prior healthcare contacts or clinical indicators that could have prompted earlier testing, suggesting that elimination efforts should not rely only on individuals self-identifying as being at risk [98, 99]. Improving health literacy among people with increased exposure risk is therefore only one part of the strategy; health-system literacy among providers is also important, including awareness of testing indications, indicator conditions, symptoms of acute HIV infection, and sensitive communication.

Importantly, prevention should remain responsive to heterogeneity across populations. Key populations and other people with increased exposure risk may face different barriers to prevention and testing, including stigma, cost, confidentiality concerns, low perceived risk, language barriers, legal or social vulnerability, and limited access to sexual health services [96, 100]. Targeted prevention should therefore combine biomedical tools, such as PrEP and ART-mediated viral suppression, with interventions that improve access and acceptability, including community outreach, self-testing, walk-in testing, culturally and linguistically adapted information, and integration of HIV testing with STI and hepatitis services [14, 96].

The results of this study provide a rationale for sustaining and strengthening targeted prevention investments. Each additional infection prevented avoids not only future ART and other direct and indirect medical costs, but also productivity losses and quality-of-life losses over the lifetime. Prevention and testing programmes should therefore not be evaluated only against their short-term budget impact. Even in a low-incidence, high-treatment-performance setting such as Switzerland, the lifetime value of each avoided infection remains substantial, and evidence shows that in this setting, the greatest value is likely to come from targeted testing strategies, reducing missed opportunities for diagnosis, improving access for underserved populations, and ensuring

rapid linkage to care [9, 95]. This is particularly relevant for Switzerland, where the policy objective is elimination rather than control [9].

4.4 Strenghts and limitations

This study has several strengths. First, it uses an incidence-based lifetime framework combined with a bottom-up costing approach, which allowed to estimate the full downstream burden of a new HIV infection while retaining transparency and precision in the valuation of individual cost components.

Second, it separates direct costs into ART, outpatient visits, diagnostics, and inpatient care, allowing the main drivers of direct medical expenditure to be identified.

Third, it incorporates indirect and broader societal costs, including productivity losses, depression-related costs, and monetised quality-of-life losses.

Fourth, the model is grounded in Swiss data where possible, including SHCS descriptive statistics, Swiss tariff and price data, Swiss mortality tables, and Swiss epidemiological estimates.

Finally, scenario and sensitivity analyses were conducted for major sources of uncertainty, including discounting, age at infection, productivity among individuals with CD4 >500, HIV utility ratios, and willingness-to-pay thresholds.

Several limitations should be considered. First, ART costs were estimated using the best available SHCS regimen distributions to approximate early and longer-term ART use and Swiss list prices from the Spezialitätenliste to estimate unit costs. However, official list prices may not fully reflect real-world net prices paid by insurers or purchasers, as confidential rebates, discounts, or managed-entry agreements may apply. The ART cost estimates should therefore be interpreted as list-price-based estimates rather than definitive estimates of actual net ART expenditure. In addition, future ART expenditure remains uncertain because treatment patterns and prices may change over time as a result of innovation, shifts in prescribing practice, patent expiries, generic entry, price revisions, and uptake of long-acting or simplified regimens. Overall, this approach was intended to reflect current Swiss treatment patterns transparently, rather than to forecast future ART market dynamics or future market shares.

Second, the base-case morbidity-related productivity estimates were derived from available evidence on work ability and employment barriers among people living with HIV in Switzerland, but these estimates may not fully represent the contemporary situation of clinically stable individuals on effective ART. Sensitivity analysis showed that assuming no work-ability

decrement among individuals with CD4 >500 substantially reduced the total lifetime cost, reflecting uncertainty and the need for updated Swiss data on employment, work ability, and productivity among people living with HIV. International evidence supports the possibility that modern treatment and immune recovery may allow many people living with HIV to have work ability similar to that of the general population [11, 101].

Third, quality-of-life inputs were based on international evidence rather than Swiss HIV-specific EQ-5D utility decrements, and their monetary value depend on the specific cost-effectiveness threshold applied. In Switzerland, there is no formally binding cost-effectiveness threshold, although CHF 100,000 per QALY is often used as a pragmatic reference value in Swiss health-economic evaluations. The sensitivity analyses therefore varied the threshold between CHF 50,000 and CHF 150,000 per QALY.

Fifth, in our model, only the excess incidence of depression among people living with HIV compared with the general population was attributed to HIV. This conservative approach avoided assigning all depression-related costs in people living with HIV to HIV itself and reduced the risk of double counting costs that would also occur in the general population. However, the estimate likely understates the broader mental health burden.

Finally, the model used CD4-defined health states to represent HIV infection progression. This structure is transparent and clinically interpretable, and it allowed costs and mortality to vary by infection severity; however, it necessarily simplifies the heterogeneity of contemporary HIV care, and relied on transition probabilities that were derived and calibrated from published cohort evidence rather than estimated directly from patient-level longitudinal SHCS data. Although the resulting cohort trajectory was considered plausible in light of stakeholder feedback and contemporary ART outcomes, future work could strengthen the model by estimating transition probabilities directly from longitudinal Swiss cohort data and by incorporating additional clinical markers beyond CD4 cell count.

4.5 Conclusion

The lifetime economic burden of a new HIV infection in Switzerland is substantial. Direct medical costs are driven mainly by long-term ART, while indirect and broader societal costs, particularly productivity losses and monetised QALY losses, account for a large share of the total burden. In the Swiss policy context, the results reinforce the economic rationale for sustained investment in prevention, earlier diagnosis, linkage to care, and targeted testing strategies. Achieving further

progress towards UNAIDS and NAPS targets may generate meaningful long-term value by preventing new infections and avoiding lifetime medical and societal costs.

References

1. Swiss AIDS Federation (2026) Therapy. https://aids.ch/en/knowledge/hiv/therapy/. Accessed 2 Mar 2026
2. Rodger AJ, Cambiano V, Phillips AN, et al (2019) Risk of HIV transmission through condomless sex in serodifferent gay couples with the HIV-positive partner taking suppressive antiretroviral therapy (PARTNER): final results of a multicentre, prospective, observational study. The Lancet 393:2428–2438. https://doi.org/10.1016/S0140-6736(19)30418-0
3. U.S. Centers for Disease Control and Presention CDC (2024) Undetectable = Untransmittable. https://www.cdc.gov/global-hiv-tb/php/our-approach/undetectable-untransmittable.html
4. Radu P, Hayes H, Tunnicliffe E, et al (2025) Altering the trajectory of HIV in Europe - OHE. https://www.ohe.org/publications/altering-the-trajectory-of-hiv-in-europe/. Accessed 2 Mar 2026
5. UNAIDS (2026) Global AIDS Strategy 2021-2026. https://www.unaids.org/en/Global-AIDS-Strategy-2021-2026. Accessed 25 Jun 2026
6. Swiss AIDS Federation (2026) Data on HIV and AIDS. https://aids.ch/en/knowledge/topics/data/. Accessed 2 Mar 2026
7. Bundesamt für Gesundheit (2024) BAG-Bulletin 48/2024
8. Bundesamt für Gesundheit (2025) BAG-Bulletin 44/2025
9. Federal Office of Public Health (2026) National programme (NAPS): Stop HIV, hepatitis B and C viruses and sexually transmitted infections. https://www.bag.admin.ch/en/national-programme-naps-stop-hiv-hepatitis-b-and-c-viruses-and-sexually-transmitted-infections. Accessed 5 Jun 2026
10. European Centre for Disease Prevention and Control (2025) European standards of HIV prevention and care: module on HIV and co-morbidities. https://doi.org/10.2900/6459922
11. Trickey A, Sabin CA, Burkholder G, et al (2023) Life expectancy after 2015 of adults with HIV on long-term antiretroviral therapy in Europe and North America: a collaborative analysis of cohort studies. Lancet HIV 10:e295. https://doi.org/10.1016/S2352-3018(23)00028-0
12. Gueler A, Moser A, Calmy A, et al (2017) Life expectancy in HIV-positive persons in Switzerland: matched comparison with general population. AIDS 31:427–436. https://doi.org/10.1097/QAD.0000000000001335
13. Bundesamt für Gesundheit BAG muss auf verschiedene Aufgaben verzichten. https://www.news.admin.ch/de/nsb?id=104317. Accessed 31 Mar 2026
14. National programme (NAPS): Stop HIV, hepatitis B and C viruses and sexually transmitted infections. https://www.bag.admin.ch/en/national-programme-naps-stop-hiv-hepatitis-b-and-c-viruses-and-sexually-transmitted-infections. Accessed 31 Mar 2026
15. Tarricone R (2006) Cost-of-illness analysis: What room in health economics? Health Policy (New York) 77:51–63. https://doi.org/10.1016/J.healthpol.2005.07.016

16. Lowy A, Page J, Jaccard R, et al (2005) Costs of treatment of Swiss patients with HIV on antiretroviral therapy in hospital-based and general practice-based care: a prospective cohort study. AIDS Care 17:698–710. https://doi.org/10.1080/09540120412331336689
17. Zurn P, Taffé P, Rickenbach M, Danthine J-P (2001) Social Cost of HIV Infection in Switzerland
18. Leon-Reyes S, Schafer J, Früh M, et al (2019) Cost estimates for HIV care and patient characteristics for health resource utilisation from linkage of claims data with the Swiss HIV Cohort Study. Clin Infect Dis. https://doi.org/10.1093/cid/ciy564.PMID:30020416.
19. Aghlmandi S, Schmidlin K, Huber C, et al (2025) Trends in Costs for HIV Care During a Hepatitis C Virus Early Treatment and Elimination Program: A Data Linkage Study of Claims and Swiss HIV Cohort Study Data. Open Forum Infect Dis 12:. https://doi.org/10.1093/OFID/OFAF410
20. Sonnenberg FA, Beck JR (1993) Markov models in medical decision making: a practical guide. Med Decis Making 13:322–338. https://doi.org/10.1177/0272989X9301300409
21. Briggs A, Sculpher M (1998) An introduction to Markov modelling for economic evaluation. Pharmacoeconomics 13:397–409. https://doi.org/10.2165/00019053-199813040-00003
22. Drummond M, Sculpher M, Claxton K, Stoddart G (2015) Methods for the economic evaluation of health care programmes
23. Uthman RT, Sutton AJ, Jackson LJ, Uthman OA (2018) Does directly administered antiretroviral therapy represent good value for money in sub-Saharan Africa? A cost-utility and value of information analysis. PLoS One 13:e0191465. https://doi.org/10.1371/JOURNAL.PONE.0191465
24. Freedberg EAF, Osina LL, Ilton M, et al (2001) The cost effectiveness of combination antiretroviral therapy for HIV disease. J Med 344:
25. Farnham PG, Gopalappa C, Sansom SL, et al (2013) Updates of lifetime costs of care and quality-of-life estimates for HIV-infected persons in the United States: late versus early diagnosis and entry into care. J Acquir Immune Defic Syndr 64:183–189. https://doi.org/10.1097/QAI.0B013E3182973966
26. Li M, Cao Y, Huang H, et al (2023) Cost-effectiveness analysis of antiretroviral drugs for treatment-naive HIV infection in China. BMC Public Health 2023 23:1 23:2228-. https://doi.org/10.1186/S12889-023-17052-1
27. Segel JE (2006) Cost-of-Illness Studies-A Primer. RTI-UNC center of excellence in health promotion economics
28. NIH (2026) CD4 T Lymphocyte. https://clinicalinfo.hiv.gov/en/glossary/cd4-t-lymphocyte. Accessed 25 Jun 2026
29. Swiss HIV Cohort Study (SHCS) (2024) The Swiss HIV Cohort Study (SHCS). https://www.shcs.ch/. Accessed 21 May 2026
30. Federal Statistical Office (2026) Medizinisches Kodierungshandbuch. Der offizielle Leitfaden der Kodierrichtlinien in der Schweiz. https://www.bfs.admin.ch/bfs/en/home/statistics/catalogues-databases.assetdetail.36144081.html. Accessed 25 Jun 2026

31. Swiss HIV Cohort Study SHCS (2024) Key Data. In: Swiss HIV Cohort Study. https://www.shcs.ch/about-shcs/shcs-key-data-tables/. Accessed 4 Jun 2026
32. Federal Statistical Office FSO Life expectancy. In: Federal Statistical Office FSO. https://www.bfs.admin.ch/bfs/en/home/statistics/population/births-deaths/life-expectancy.html. Accessed 25 Jun 2026
33. Trickey A, Sabin CA, Burkholder G, et al (2023) Life expectancy after 2015 of adults with HIV on long-term antiretroviral therapy in Europe and North America: a collaborative analysis of cohort studies. Lancet HIV 10:e295–e307. https://doi.org/10.1016/S2352-3018(23)00028-0
34. Engsig FN, Zangerle R, Katsarou O, et al (2014) Long-term Mortality in HIV-Positive Individuals Virally Suppressed for >3 Years With Incomplete CD4 Recovery. Clinical Infectious Diseases 58:1312–1321. https://doi.org/10.1093/CID/CIU038
35. May MT, Gompels M, Delpech V, et al (2014) Impact on life expectancy of HIV-1 positive individuals of CD4+ cell count and viral load response to antiretroviral therapy. AIDS 28:1193–1202. https://doi.org/10.1097/QAD.0000000000000243
36. Ledergerber B, Cavassini M, Battegay M, et al (2011) Trends over time of virological and immunological characteristics in the Swiss HIV Cohort Study. HIV Med 12:279–288. https://doi.org/10.1111/j.1468-1293.2010.00880.x.
37. Kaufmann GR, Perrin L, Pantaleo G, et al (2003) CD4 T-Lymphocyte Recovery in Individuals With Advanced HIV-1 Infection Receiving Potent Antiretroviral Therapy for 4 Years: The Swiss HIV Cohort Study. Arch Intern Med 163:2187–2195. https://doi.org/10.1001/ARCHINTE.163.18.2187
38. Taramasso L, Labate L, Briano F, et al (2022) CD4+ T lymphocyte recovery in the modern antiretroviral therapy era: Toward a new threshold for defining immunological non-responders. Frontiers in Virology 2:822153. https://doi.org/10.3389/FVIRO.2022.822153
39. Weber R, Ruppik M, Rickenbach M, et al (2013) Decreasing mortality and changing patterns of causes of death in the Swiss HIV Cohort Study. HIV Med 14:195–207. https://doi.org/10.1111/J.1468-1293.2012.01051.X
40. Lewden C, Bouteloup V, De Wit S, et al (2012) All-cause mortality in treated HIV-infected adults with CD4 ≥500/mm3 compared with the general population: evidence from a large European observational cohort collaboration. Int J Epidemiol 41:433–445. https://doi.org/10.1093/IJE/DYR164
41. Life expectancy | Federal Statistical Office - FSO. https://www.bfs.admin.ch/bfs/en/home/statistics/population/births-deaths/life-expectancy.html. Accessed 5 Jun 2026
42. Husereau D, Drummond M, Augustovski F, et al (2022) Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) statement: updated reporting guidance for health economic evaluations. BMC Med 20:1–8. https://doi.org/10.1177/23814683211061097
43. Elzi L, Erb S, Furrer H, et al (2017) Adverse events of raltegravir and dolutegravir. AIDS 31:1853–1858. https://doi.org/10.1097/QAD.0000000000001590

44. Sculier D, Gayet-Ageron A, Battegay M, et al (2017) Rilpivirine use in the Swiss HIV cohort study: a prospective cohort study. BMC Infectious Diseases 2017 17:1 17:476-. https://doi.org/10.1186/S12879-017-2579-2
45. Bundesamt für Gesundheit Spezialitätenliste. https://sl.bag.admin.ch/sl. Accessed 5 Jun 2026
46. Webgrouper. https://tarifmatcher.oaat-otma.ch/transcode
47. Meier S (2026) Taxpunktwert TARDOC 2026: Alle 26 Kantone im Überblick. In: Doc report AI. https://docreport.eu/blog/taxpunktwert-tardoc-kanton-schweiz-2026
48. AIPS - Einzelabfrage. https://www.swissmedicinfo-pro.ch/
49. Ambrosioni J, Levi LI, Alagaratnam J, et al (2026) Major revision version 13.0 of the European AIDS Clinical Society guidelines 2025. HIV Med 27:18–32. https://doi.org/10.1111/HIV.70120
50. Swiss HIV Cohort Study SHCS (2026) Protocol. https://www.shcs.ch/about-shcs/study-design/protocol/
51. NIH (2026) CD8 T Lymphocyte. https://clinicalinfo.hiv.gov/en/glossary/cd8-t-lymphocyte. Accessed 25 Jun 2026
52. Federal Statistical Office (2025) Medizinisches Kodierungshandbuch. Der offizielle Leitfaden der Kodierrichtlinien in der Schweiz, Version 2026
53. Inpatient tariff structures. https://www.bag.admin.ch/en/inpatient-tariff-structures
54. Spitalfinanzierung Reference tariffs 2012 to 2025. httpss://zg.ch/de/gesundheit/spitaeler-und-kliniken/spitalfinanzierung
55. Bukanova-Berend D, Campbell-James T, Vogel J (2025) Hospitalizations and inpatient resource consumption of patients suffering from chronic disease – Past trend and forecast for Switzerland. BMC Health Serv Res 25:1514. https://doi.org/10.1186/s12913-025-13687-5
56. Kattan MW (2009) Human Capital Approach. In: Encyclopedia of Medical Decision Making. SAGE Publications, Inc., California
57. Pearce A (2016) Productivity Losses and How they are Calculated. Cancer Research Economics Support Team (CREST)
58. Sendi P, Schellenberg F, Ungsedhapand C, et al (2004) Productivity costs and determinants of productivity in HIV-infected patients. Clin Ther 26:791–800. https://doi.org/10.1016/S0149-2918(04)90080-X
59. Warkentin L, Adibnia E, Chojecki D, et al (2024) Current and future investments for reaching the UNAIDS 95-95-95 HIV targets in Canada: Evidence review and cost analysis: : Evidence Review & Cost Analysis. Edmonton (AB): Institute of Health Economics
60. Central Compensation Office CCO (2025) Old-age pensions. In: Central Compensation Office CCO. https://www.zas.admin.ch/en/old-age-pensions
61. Federal Statistical Office (2025) Gross monthly wage by age and gender, 2024. In: Federal Statistical Office. https://www.bfs.admin.ch/asset/en/36195912
62. Federal Statistical Office (2025) Permanent resident population by sex and age, 1860-2024. In: Federal Statistical Office. https://www.bfs.admin.ch/asset/de/36021708

63. Swiss HIV Cohort Study SHCS (2019) Some Figures on the Cohort 2019
64. Samson A, Lavigne RM, MacPherson P (2009) Self-fulfillment despite barriers: volunteer work of people living with HIV. AIDS Care 21:1425–1431. https://doi.org/10.1080/09540120902814403
65. Omoto AM, Snyder M (1995) Sustained helping without obligation: Motivation, longevity of service, and perceived attitude change among AIDS volunteers. J Pers Soc Psychol 68:671–686. https://doi.org/10.1037/0022-3514.68.4.671
66. Gueler A, Moser A, Calmy A, et al (2017) Life expectancy in HIV-positive persons in Switzerland. AIDS 31:427–436. https://doi.org/10.1097/QAD.0000000000001335
67. Elzi L, Conen A, Patzen A, et al (2016) Ability to Work and Employment Rates in Human Immunodeficiency Virus (HIV)-1-Infected Individuals Receiving Combination Antiretroviral Therapy: The Swiss HIV Cohort Study. Open Forum Infect Dis 3:. https://doi.org/10.1093/ofid/ofw022
68. Perri M, Craig-Neil A, Gaspar M, et al (2021) A qualitative study of barriers to employment experienced by people living with HIV in Toronto and Ottawa. Int J Equity Health 20:36. https://doi.org/10.1186/s12939-020-01356-4
69. EURopean Employment Services EURES (2025) Labour Market Information: Switzerland. https://eures.europa.eu/living-and-working/labour-market-information/labour-market-information-switzerland_en
70. Swiss HIV Cohort Study (SHCS). In: Table 3.1. https://www.shcs.ch/about-shcs/shcs-key-data-tables/. Accessed 4 Jun 2026
71. Federal Statistical Office (2021) Freiwilliges Engagement in der Schweiz 2020. In: Freiwilliges Engagement in der Schweiz 2020. https://www.bfs.admin.ch/asset/de/19504083
72. Swiss Confederation (2022) Minimum wage and average salary. In: Easy answers about life in Switzerland CH.CH. https://www.ch.ch/en/work/salary/minimum-wage-and-average-salary/
73. Anagnostopoulos A, Ledergerber B, Jaccard R, et al (2015) Frequency of and Risk Factors for Depression among Participants in the Swiss HIV Cohort Study (SHCS). PLoS One 10:e0140943. https://doi.org/10.1371/journal.pone.0140943
74. Ferrari AJ, Somerville AJ, Baxter AJ, et al (2013) Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature. Psychol Med 43:471–481. https://doi.org/10.1017/S0033291712001511
75. Tomonaga Y, Haettenschwiler J, Hatzinger M, et al (2013) The Economic Burden of Depression in Switzerland. Pharmacoeconomics 31:237–250. https://doi.org/10.1007/s40273-013-0026-9
76. Federal Statistical Office (2023) Inflation Calculatior 2009-2023. In: Consumer Price Index. https://lik-app.bfs.admin.ch/. Accessed 5 Jun 2026
77. Perneger T V, Combescure C, Courvoisier DS (2010) General Population Reference Values for the French Version of the EuroQol EQ-5D Health Utility Instrumentv he_727 631..635. 1098. https://doi.org/10.1111/j.1524-4733.2010.00727.x
78. Popping S, Kall M, Nichols BE, et al (2021) Quality of life among people living with HIV in England and the Netherlands: a population-based study. The Lancet Regional Health - Europe 8:100177. https://doi.org/10.1016/J.LANEPE.2021.100177

79. Eichler K, Tzogiou C, Knöfler F, et al (2019) Health Technology Assessment (HTA) HTA Report v3.0 Self-measurement of blood glucose in patients with non-insulin treated diabetes mellitus type 2 Technology Self-measurement of blood glucose
80. ISPOR Model Parameter Estimation and Uncertainty Analysis: Report 6. https://www.ispor.org/heor-resources/good-practices/article/model-parameter-estimation-and-uncertainty-analysis. Accessed 4 Jun 2026
81. Bundesamt für Gesundheit Infoportal übertragbare Krankheiten. https://www.idd.bag.admin.ch/de/diseases/hiv/statistic. Accessed 5 Jun 2026
82. Hachfeld A, Ledergerber B, Darling K, et al (2015) Reasons for late presentation to HIV care in Switzerland. J Int AIDS Soc 18:20317. https://doi.org/10.7448/IAS.18.1.20317
83. Verbooy K, Wagener M, Kaddouri M, et al (2018) Are people living with HIV less productive at work? AIDS Care 30:1265–1272. https://doi.org/10.1080/09540121.2018.1447076
84. Trickey A, Sabin CA, Burkholder G, et al (2023) Life expectancy after 2015 of adults with HIV on long-term antiretroviral therapy in Europe and North America: a collaborative analysis of cohort studies. Lancet HIV 10:e295–e307. https://doi.org/10.1016/S2352-3018(23)00028-0
85. Eichler K., Tzogiou C., Knöfler F., et al Self-measurement of blood glucose in patients with non-insulin treated diabetes mellitus type 2
86. Strohmaier C, Zechmeister-Koss I (2024) Threshold Values in Health Economic Evaluations and Decision-Making. Vienna: HTA Austria – Austrian Institute for Health Technology Assessment GmbH AIHTA Project Report:
87. Sighem A van, Vidondo B, Glass TR, et al (2012) Resurgence of HIV Infection among Men Who Have Sex with Men in Switzerland: Mathematical Modelling Study. PLoS One 7:e44819. https://doi.org/10.1371/JOURNAL.PONE.0044819
88. Branson BM (2006) To Screen or Not to Screen: Is That Really the Question? Ann Intern Med 145:857–859. https://doi.org/10.7326/0003-4819-145-11-200612050-00011
89. Schackman BR, Fleishman JA, Su AE, et al (2015) The lifetime medical cost savings from preventing HIV in the United States. Med Care 53:293–301. https://doi.org/10.1097/MLR.0000000000000308
90. Warkentin L, Adibnia E, Chojecki D, et al (2024) Current and Future Investments for Reaching the UNAIDS 95-95-95 HIV Targets in Canada Evidence Review & Cost Analysis. Institute of Health Economics Alberta
91. Dodds C, Colman R, Atlantic C, et al The cost of HIV/AIDS in Canada. GPI Atlantic
92. Bank of Canada (2026) Daily exchange rates. https://www.bankofcanada.ca/rates/exchange/daily-exchange-rates. Accessed 25 Jun 2026
93. Swiss AIDS Federation Testing for HIV. In: Swiss AIDS Federation. https://aids.ch/en/knowledge/hiv/test/. Accessed 25 Jun 2026
94. World Health Organization (2015) Consolidated guidelines on HIV testing services: 5Cs: consent, confidentiality, counselling, correct results and connection 2015. World Health Organization

95. Harkare HV, Antillon M, Schmidt AJ, Tediosi F (2026) Modelling the health and cost implications of expanded access to HIV, HCV and sexually transmitted infection testing in Switzerland. Swiss Med Wkly 155:1–12. https://doi.org/10.57187/S.4581
96. WHO (2024) Consolidated guidelines on differentiated HIV testing services. 164
97. WHO (2016) Consolidated Guidelines on the Use of Antiretroviral Drugs for Treating and Preventing HIV Infection. Consolidated Guidelines on the Use of Antiretroviral Drugs for Treating and Preventing HIV Infection: Recommendations for a Public Health Approach XXXii
98. Lazzarino T, Martenet S, Mamin R, et al (2018) Effect of national HIV testing recommendations and local interventions on HIV testing practices in a Swiss university hospital: a retrospective analysis between 2012 and 2015. BMJ Open 8:e021203. https://doi.org/10.1136/BMJOPEN-2017-021203
99. Lhopitallier L, Moulin E, Hugli O, et al (2018) Missed opportunities for HIV testing among patients newly presenting for HIV care at a Swiss university hospital: a retrospective analysis. BMJ Open 8:e019806. https://doi.org/10.1136/BMJOPEN-2017-019806
100. European Centre for Disease Prevention and Control (2023) HIV and migrants - Monitoring the implementation of the Dublin Declaration on partnership to fight HIV/AIDS in Europe and Central Asia: 2022 progress report
101. Verbooy K, Wagener M, Kaddouri M, et al (2018) Are people living with HIV less productive at work? AIDS Care 30:1265–1272. https://doi.org/10.1080/09540121.2018.1447076

Appendix

Table A1. Model parameters assumptions

Variable	Value	Sources
Initial proportion in CD4 >500	0.51	Swiss HIV Cohort Study
Initial proportion in CD4 200-500	0.36	Swiss HIV Cohort Study
Initial proportion in CD4 <200	0.13	Swiss HIV Cohort Study
Initial proportion in Death	0	Model assumption
Unadjusted annual mortality, CD4 >500	0.0037	Lewden et al. 2012; Trickey et al. 2023
Unadjusted annual mortality, CD4 200–500	0.01	Weber et al. 2013; May et al. 2014; Trickey et al. 2023
Unadjusted annual mortality, CD4 <200	0.04	Engsig et al. 2014; Kaufmann et al. 2003; Trickey et al. 2023
CD4 >500 to CD4 200–500	0.0033	Ledergerber et al. 2010/2013; model calibration
CD4 >500 to CD4 >500	0.993	Ledergerber et al. 2010/2013; model calibration
CD4 >500 to CD4 <200	0	Model assumption
CD4 200–500 to CD4 >500	0.15	Kaufmann et al. 2003; May et al. 2014; Engsig et al. 2014; model calibration
CD4 200–500 to CD4 200–500	0.81	Model calibration based on SHCS CD4 distributions
CD4 200–500 to CD4 <200	0.03	SHCS descriptive distributions; model calibration
CD4 <200 to CD4 >500	0.42	Kaufmann et al. 2003; Engsig et al. 2014; model calibration
CD4 <200 to CD4 200–500	0.54	Kaufmann et al. 2003; Engsig et al. 2014; model calibration
CD4 <200 to CD4 <200	0.04	Engsig et al. 2014; model calibration

Table A2. ART costs for the first 4 years and afterwards (Cost unit: CHF)

First 4 years					
Name of preparation	**Most frequent combinations**	**Number of patients**	**% of total (n=124)**	**Cost per unit**	**Annual cost per patient**
Biktarvy (Gilead)	Bictegravir-Emtricitabine-Tenofovir alafenamide	96	78%	1,110	13,321
Descovy (Gilead)+ Tivicay (VIIV)	Dolutegravir-Emtricitabine-Tenofovir alafenamide	8	7%	1,326	15,911
Delstrigo (Merck)	Lamivudine-Doravirine-Tenofovir	3	2%	700	8,399
Symtuza (Janssen)+ Tivicay (VIIV)	Cobicistat-Emtricitabine-Tenofovir alafenamide-Darunavir-Dolutegravir	3	2%	1,656	19,877
Emtricitabin-Tenofovir-Mepha+ Tivicay (VIIV)	Dolutegravir-Emtricitabine-Tenofovir	3	2%	715	8,581
Dovato (VIIV)	Lamivudine-Dolutegravir	2	2%	778	9.338
Weighted average per person					**13,351**
From 4th year					
Name of preparation	**Most frequent combinations**	**Number of patients**	**% of total (n=9482)**	**Cost per unit**	**Annual cost per patient**
Biktarvy (Gilead)	Bictegravir-Emtricitabine-Tenofovir alafenamide	2,655	28%	1,110	13,321
Dovato (VIIV)	Lamivudine-Dolutegravir	1,783	19%	778	9,338
Eviplera (Gilead)	Emtricitabine-Rilpivirine-Tenofovir alafenamide	780	8%	843	10,120
Triumeq (VIIV)	Lamivudine-Abacavir-Dolutegravir	524	6%	992,70	11,912
Stribild (Gilead)	Cobicistat-Emtricitabine- Elvitegravir-Tenofovir alafenamide	453	5%	1,055	12,664
Descovy (Gilead)+ Tivicay (VIIV)	Dolutegravir-Emtricitabine-Tenofovir alafenamide	450	5%	1,326	15,911
Vocabria(VIIV)+ Rekambys(Janssen)	Cabotegravir-Rilpivirine	379	4%	902	10,820
Delstrigo (Merck)	Lamivudine-Doravirine-Tenofovir	235	3%	700	8,399
Descovy (Gilead)+ Nevirapin (Sandoz)	Emtricitabine-Nevirapine-Tenofovir alafenamide	188	2%	876	10,514
3TC (VIIV)+ Nevirapin (Sandoz)	Lamivudine-Nevirapine	145	2%	385	4,623
Weighted average per person					**11,561**

Note: Number of patients are as of 2024; Cost per unit is for 30 days, and the last price update was access by January 22, 2026

Table A3. Transcoding outpatient costs: TARMED to TARDOC (cost unit: CHF)

TARMED							
Service	**code**	**Description**	**Volume**	**AL**	**TL**	**TPW**	**Cost**
Beginn Arzttermin	0,001	Gespräch / Konsultation (erste 5 min)	1	10,42	8,19	0,89	17
Gespräch	0,002	Konsultation, jede weitere 5 min	7	10,42	8,19	0,89	116
Ende Arztgespräch	0,003	Gespräch / Konsultation (letzte 5 min)	1	5,21	4,1	0,89	8
Blutdruck, Puls, Gewicht, Bauchumfang; kleine körperliche Untersuchung	0,0415	Kleine Untersuchung	0,5	10,42	9,34	0,89	9
Brief an Hausarzt	0,2206	Formalisierter Arztbericht, pro 5	1	10,42	8,19	0,89	17
TARDOC							
Service	**code**	**Description**	**Volume**	**AL**	**TL**	**TPW**	**Cost**
Beginn Arzttermin	AA.00.0010	Ärztliche Konsultation, erste 5 Min.	1	10,56	8,64	0,89	17
Gespräch	AA.00.0020	+ Ärztliche Konsultation, jede weitere 1 Min.	35	73,85	60,55	0,89	120
Ende Arztgespräch	AA.00.0020	+ Ärztliche Konsultation, jede weitere 1 Min.	2,5	5,28	4,33	0,89	9
Blutdruck, Puls, Gewicht, Bauchumfang; kleine körperliche Untersuchung	AA.05.0010	Untersuchung: Kreislauf	0.06	0,73	0,74	0,89	1
Beginn Arzttermin	AA.00.0010	Ärztliche Konsultation, erste 5 Min.	1	10,56	8,64	0,89	17

Table A4. Outpatient costs by CD4 category

CD4 category	TARDOC code	Cost/visit	Visits/year	Annual OP costs
CD4 >500	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	2	CHF 325
CD4 200-500	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	2	CHF 325
CD4 <200	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	2	CHF 325
Injection	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	6	CHF 974

Table A5. Outpatient costs by phase

Year	TARDOC code	Cost/visit	Visits/year	Annual OP costs
First two years	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	4	CHF 649
After 2 years	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	2	CHF 325
Injection	AA.00.0010, AA.00.0020, AA.05.0010, AA.25.0030	CHF 162	6	CHF 974

Table A6. Diagnostic codes and costs (Cost unit: CHF)

Test/procedure	Code(s)	Unit cost	Weight	Weighted cost per assessment	Annual cost, 2 assessments	Annual cost, 4 assessments
HIV RNA	3101	120	1.00	120	239	479
CD4/CD8 count	1525	51	1.00	51	103	205
Complete blood count II	1371	8	1.00	8	16	32
Complete blood count III	1372	9	1.00	9	18	36
Creatinine	1509.01	8	1.00	8	16	32
Liver enzymes/panel: ALT, AST, GLDH	1020.01; 1093.01; 1341.01; 1027.01	32	1.00	32	63	126
HbA1c	1363.01	19	0.50	10	19	38
Lipid profile: total cholesterol, HDL, LDL, triglycerides	1410.01; 1521.00; 1230.01	19	1.00	19	39	78
Urinary protein	1023.01	16	1.00	16	32	65
Syphilis and hepatitis testing	3478.00; 3050.00; 3054.00; 3069.00	99	0.30	30	59	119
Gonorrhoea/chlamydia testing	3460; 3396	95	0.30	29	57	114
Anal cancer screening	3136	162	0.15	24	49	97
Bone densitometry	39.195	56	0.05	3	6	11
Total				**358**	**716**	**1,433**

Table A7. Inpatient tariffs 2012 to 2022 across 26 cantons (Base rate unit: CHF)

Year	Median base rate	Min base rate	Max base rate	Canton Count
2012	10,365	8,327	11,400	26
2013	10,118	8,407	11,400	26
2014	10,220	8,414	11,500	26
2015	9,934	8,357	11,500	26
2016	9,820	8,454	11,500	26
2017	9,843	8,484	11,400	26
2018	9,843	8,930	11,400	26
2019	9,846	8,930	10,866	26
2020	9,828	8,930	10,855	26
2021	9,828	8,930	10,855	26
2022	9,828	8,930	10,855	26

Table A8. New HIV infection inpatient cost base on the inpatient admissions of 2022-2023

CD4 category	Cases	Mean age	Median age	Mean LOS	Mean cost	Winsorized cost	Number of PLHIV extrapolated	Weight	Weighted average
CD4 >500	70	52	52	9	CHF 18,692	CHF 18,058	13470	0,003	CHF 47
CD4 200-500	177	52	52	12	CHF 23,370	CHF 19,348	3840	0,023	CHF 446
CD4 <200	386	51	52	15	CHF 28,321	CHF 24,518	300	0,643	CHF 15,773

Table A9. Productivity due to morbidity costs (only paid work from age 39-65)

CD4 category	Work ability	Employment barrier factor	Actual participation rate PLWH	Swiss employment rate	Work ability loss	Annual salary	Annual paid loss
CD4 >500	82,8%	87,9%	72,8%	80,7%	7,9%	CHF 91,805	CHF 7,266
CD4 200-500	80,1%	87,9%	70,4%	80,7%	10,3%	CHF 91,805	CHF 9,453
CD4 <200	70,5%	87,9%	62,0%	80,7%	18,7%	CHF 91,805	CHF 17,162

Table A10. Average productivity from paid work (< 65 y/o)

CD4 category	Ratio	HIV employment rate	Annual Salary	Productivity by CD4 level	Weighted average
CD4 >500	76.5%	72,8%	CHF 91,805	CHF 66,822	CHF 51,119
CD4 200-500	21.8%	70,4%	CHF 91,805	CHF 64,635	CHF 14,090
CD4 <200	1.7%	62,0%	CHF 91,805	CHF 56,926	CHF 968
Weighted average					**CHF 66,177**

Table A11. Productivity costs due to premature mortality from volunteer work (40-65 y/o)

CD4 category	Institutional volunteer participation rate	Informal volunteer participation rate	Annual hours	Min. Wage	Annual volunteer value
CD4 >500	17,2%	36,4%	96	CHF 22	CHF 2,111
CD4 200–500	17,2%	36,4%	96	CHF 22	CHF 2,111
CD4 <200	17,2%	36,4%	96	CHF 22	CHF 2,111

Table A12. Productivity costs due to premature mortality from volunteer work (65-85 y/o)

CD4 category	Institutional volunteer participation rate	Informal volunteer participation rate	Annual hours	Min. Wage	Annual volunteer value
CD4 >500	13,2%	28,9%	76	CHF 22	CHF 1,661
CD4 200–500	13,2%	28,9%	76	CHF 22	CHF 1,661
CD4 <200	13,2%	28,9%	76	CHF 22	CHF 1,661

Table A13. Calculation of the annual direct medical costs of depression

Severity level	Number of new patient due to HIV	Direct cost of one new depression patient due to HIV	Inflation rate 5.1% (baseline)
Mild	38	CHF 4,849	CHF 5,097
Moderate	82	CHF 13,269	CHF 13,946
Severe	53	CHF 22,116	CHF 23,244
Weighted average		**CHF 14,130**	**CHF 14,851**

Table A14. Sensitivity analysis of lifetime costs per new HIV infection: Undiscounted

Cost component	Lifetime cost per new HIV infection, undiscounted
Direct costs	
ART costs	CHF 469,456
Outpatient visits	CHF 14,484
Diagnostics	CHF 29,477
Inpatient costs	CHF 9,197
Total direct HIV costs	**CHF 522,613**
Indirect costs	
Productivity loss due to morbidity	CHF 175,781
Productivity loss due to premature mortality	CHF 117,888
Subtotal productivity losses	CHF 293,669
Depression-related costs	CHF 5,861
Monetised QALY loss	CHF 370,000
Total indirect costs	**CHF 669,531**
Total direct + total indirect costs	***CHF 1,192,145***

Table A15. Sensitivity analysis of lifetime costs per new HIV infection: Starting age = 30

Cost component	Lifetime cost per new HIV infection, Starting age = 30
Direct costs	
ART costs	CHF 274,710
Outpatient visits	CHF 8,538
Diagnostics	CHF 17,405
Inpatient costs	CHF 7,058
Total direct HIV costs	**CHF 307,711**
Indirect costs	
Productivity loss due to morbidity	CHF 148,313
Productivity loss due to premature mortality	CHF 108,943
Subtotal productivity losses	CHF 257,256
Depression-related costs	CHF 3,406
Monetised QALY loss	CHF 279,000
Total indirect costs	**CHF 539,662**
Total direct + total indirect costs	***CHF 847,373***

Table A16. Sensitivity analysis of lifetime costs per new HIV infection: No productivity decrement for CD4>500

Cost component	Lifetime cost per new HIV infection, no productivity decrement for CD4 >500
Direct costs	
ART costs	CHF 258,224
Outpatient visits	CHF 8,034
Diagnostics	CHF 16,384
Inpatient costs	CHF 6,942
Total direct HIV costs	**CHF 289,584**
Indirect costs	
Productivity loss due to morbidity	CHF 27,060
Productivity loss due to premature mortality	CHF 79,318
Subtotal productivity losses	CHF 106,378
Depression-related costs	CHF 3,198
Monetised QALY loss	CHF 241,000
Total indirect costs	**CHF 350,576**
Total direct + total indirect costs	***CHF 640,160***

Table A17. Sensitivity analysis of lifetime costs per new HIV infection: HIV utility ratios

Cost component	Lifetime cost per new HIV infection, HIV utility ratio = 0.94	Lifetime cost per new HIV infection, HIV utility ratio = 0.98
Direct costs		
ART costs	CHF 258,224	CHF 258,224
Outpatient visits	CHF 8,034	CHF 8,034
Diagnostics	CHF 16,384	CHF 16,384
Inpatient costs	CHF 6,942	CHF 6,942
Total direct HIV costs	**CHF 289,584**	**CHF 289,584**
Indirect costs		
Productivity loss due to morbidity	CHF 124,878	CHF 124,878
Productivity loss due to premature mortality	CHF 73,469	CHF 73,469
Subtotal productivity losses	CHF 198,348	CHF 198,348
Depression-related costs	CHF 3,198	CHF 3,198
Monetised QALY loss	CHF 277,000	CHF 204,000
Total indirect costs	**CHF 478,546**	**CHF 405,546**
Total direct + total indirect costs	***CHF 768,130***	***CHF 695,130***

Table A18. Sensitivity analysis of lifetime costs per new HIV infection: WTP thresholds

Cost component	WTP CHF 50,000/QALY	WTP CHF 100,000/QALY	WTP CHF 150,000/QALY	WTP CHF 200,000/QALY
Direct costs				
ART costs	CHF 258'224	CHF 258'224	CHF 258'224	CHF 258'224
Outpatient visits	CHF 8'034	CHF 8'034	CHF 8'034	CHF 8'034
Diagnostics	CHF 16'384	CHF 16'384	CHF 16'384	CHF 16'384
Inpatient costs	CHF 6'942	CHF 6'942	CHF 6'942	CHF 6'942
Total direct HIV costs	**CHF 289,584**	**CHF 289,584**	**CHF 289,584**	**CHF 289,584**
Indirect costs				
Productivity loss due to morbidity	CHF 124,878	CHF 124,878	CHF 124,878	CHF 124,878
Productivity loss due to premature mortality	CHF 73,469	CHF 73,469	CHF 73,469	CHF 73,469
Subtotal productivity losses	CHF 198,348	CHF 198,348	CHF 198,347	CHF 198,347
Depression-related costs	CHF 3,198	CHF 3,198	CHF 3,198	CHF 3,198
Monetised QALY loss	CHF 120,000	CHF 240,000	CHF 360,000	CHF 480'000
Total indirect costs	**CHF 321,546**	**CHF 441,546**	**CHF 561,546**	**CHF 681,546**
Total direct + total indirect costs	***CHF 611,130***	***CHF 731,130***	***CHF 851,130***	***CHF 971,130***

Notes: WTP = Willingness to pay threshold; QALY = Quality-adjusted life-year