SOCIAL COST OF HIV INFECTION IN SWITZERLAND

FINAL REPORT

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EXECUTIVE SUMMARY

It is estimated that between 11'000 and 21'000 individuals are living with HIV infection in Switzerland[1]. Compared to the early years of the epidemic, the number of new cases has decreased and more potent drugs are available. In such a changing context, disposing of pertinent information is important to target the fight against HIV infection as effectively as possible. Social cost is one example of such information. Indeed, assessing the social cost of HIV, its different components and their relative importance is a central element in designing public health policies and identifying priorities. Assessing the social cost enables various comparisons, for instance, between prevention and treatment costs, or an assessment of the cost impact of Highly Active Antiretroviral Therapy (HAART). Comparisons with the social cost of other illnesses or the assessment of HIV infection in the total Swiss health care costs are also relevant elements for decision makers.

- **Objectives:**

The objective of the present study is to assess the social cost of HIV infection in Switzerland. For that purpose, we consider, in the first part of the report, a “Bottom-Up” model. Under this approach, the various components of the social cost are first estimated separately and compared, and then reassembled.

As anticipation of future costs is an issue of importance to health decision makers in terms of long term strategy, we consider, in the second part, future HIV social cost. The ongoing changes and progresses over the last ten years demonstrate that long term projections would be hazardous, so we focus on a short time span and assess social cost for the years 2001 and 2005.

- **Methodology:**

The assessment of HIV social cost in 1998 relies on a “Bottom-Up” model that aggregates the different components of the social cost. Our assessment of social cost focuses on two main components, i.e., HIV **direct** and **indirect costs**. **Direct costs** are divided into **outpatient** and **inpatient care** costs. **Outpatient care** comprises **drug treatments**, **ambulatory medical visits, psychotherapy**, and **home care**. **Inpatient care** relates to **hospital and institutional psycho-social care**. **Indirect costs** are associated with HIV **morbidity and mortality**. Since methodologies for estimating intangible costs are quite complex to implement and the results often difficult to interpret, particularly in a context of ongoing changes as is the case for HIV, such costs have not been included in our study. The issue of whether **prevention** costs should be included or not in the social cost is still the object of a debate among health economists. Although we do not consider prevention costs as a component of the social cost, we do compare these costs in our study with social cost components.

To perform projections of future HIV social cost, we develop a multistate Markov model describing HIV patients’ transition between different health states over time. A cost (direct and indirect) per unit time is defined for each health state. To determine future social cost, the expected time spent by individuals in each health state is multiplied by the costs associated with the corresponding health state.

[1] Office Fédéral de la Santé Publique (1999),SIDA et VIH en Suisse : Situation épidémiologique à la fin 1998, Berne

- **Results:**

We initially undertake an assessment of prevention costs. Our estimate of HIV prevention costs at the Swiss level for the year 1998 ranges from **41** to **62 million Sfr**. Despite the fact that we concentrate only on the main prevention programmes, the above figures demonstrate that HIV prevention expenses are quite substantial.

We then concentrate on HIV direct costs, evaluated at **168 million Sfr**. and displayed in Table A. One central result is the importance of **antiretroviral costs**, estimated at **91 million Sfr.**, and accounting for more than **50 %** of total direct costs. Prior to the introduction of Highly Active Antiretroviral Therapy (HAART), hospital care costs represented the main share of direct costs. Since then, hospitalisation cost share has declined and represented in 1998 19 % of total direct costs, i.e., **32 million Sfr**.

Table A : Social Cost components

Cost components	Costs (Sfr.)	Percentage
OUTPATIENT CARE		
HIV related drug treatments		
Anti-retroviral drugs	91’400’000	54 %
Co-morbidity drugs	9'140’000	6 %
Co-medication	2’920’000	2 %
Medical and Para-Medial Care		
Ambulatory medical visits	24’000’000	14 %
Psychotherapy	2’350’000	1 %
Home care	1’780’000	1 %
TOTAL OUTPATIENT CARE	**131’590’000**	**78 %**
INPATIENT CARE		
Hospital care	32'290’000	19 %
Institutional psycho-social care	4’300’000	3 %
TOTAL INPATIENT CARE	**36’590’000**	**22 %**
TOTAL DIRECT COSTS	**168’180’000**	**100 %**
MORBIDITY COSTS	**115’100’000**	**41.8 %**
MORTALITY COSTS	**160’040’000**	**58.2 %**
TOTAL INDIRECT COSTS	**275’140’000**	**100 %**
SOCIAL COST	**443’310’000**	

We furthermore examine indirect costs, i.e., morbidity and mortality costs associated with HIV infection, and adopt the “human capital” approach to evaluate them. Productivity losses associated with HIV morbidity are estimated at **115 million Sfr**. in 1998, whereas mortality costs are evaluated at **160 million Sfr.**

HIV social cost (direct + indirect costs) is estimated at **443 million Sfr**. in Switzerland for the year 1998. Alternative assumptions, reflecting either more or less conservative views, are also considered, and result in a social cost of **367** and **586 million Sfr.,** respectively.

The annual cost per patient is high, **21’000 Sfr** and **14’400 Sfr** for direct and morbidity costs, respectively. Furthermore, since HIV infection affects relatively young people, average cost per death due to AIDS is one of the highest among all causes of death. HIV infection cannot, therefore, be neglected within the frame of public health policy. This is particularly true within the current context suggesting a certain disregard of HIV prevention messages.

In the second part of the report, we project social cost for the years 2001 and 2005. On the one hand, the annual direct and indirect cost per patient is expected to slightly decrease in the forthcoming years. On the other hand, the rise in the number of individuals living with HIV infection will favour an increase of the social cost. On the basis of our assumptions, the cost reduction per patient will not outweigh the cost increase resulting from the greater number of HIV patients. Therefore, total HIV social cost is expected to rise in forthcoming years, from **443 million Sfr.** in 1998 **to 542 million Sfr**. in 2005, corresponding to an annual growth rate of approximately **3 %**. Different elements, however, could modify these conclusions. First, a change in the price of antiretroviral drugs would have a significant effect on social cost, since they represent the main direct cost component. Second, new therapeutic options could be developed in a near future, namely intermittent antiretroviral drug treatments, which would reduce antiretroviral drug consumption. Third, one could anticipate an increase in the number of hospitalisations due to treatment side-effects, in relation to longer-lasting antiretroviral treatments. Finally, our projections assume a constant number of new HIV cases in the forthcoming years, however, a substantial change in their number would also affect our projections.

Our projections suggest that HIV prevention should remain a key element in the battle against HIV as it constitutes an essential means to limit or reduce the HIV social cost over the next years.

PART I: HIV SOCIAL COST IN 1998

INTRODUCTION

Since 1981, when scientists in the United States reported the first clinical evidence of a disease that would become known as AIDS, the HIV[2] epidemic has spread to every corner of the world, and over 36 million people today are infected with HIV[3]. The rapid development of the HIV epidemic, the severity of the disease, and the initial lack of effective medicine all explain that HIV infection became a high priority for decision makers.

It is estimated that between 11'000 and 21'000 individuals are living with HIV infection in Switzerland[4]. Compared to the early years of the epidemic, the number of new cases has decreased and more potent drugs are available. In such a changing context, disposing of pertinent information is important to target the fight against HIV infection as effectively as possible. Social cost is one example of such information. Indeed, assessing the social cost of HIV, its different components and their relative importance is a central element in designing public health policies and identifying priorities. Assessing the social cost enables various comparisons, for instance, between prevention and treatment costs, or an assessment of the cost impact of Highly Active Antiretroviral Therapy (HAART). Comparisons with the social cost of other illnesses or the assessment of HIV infection in the total Swiss health care costs are also relevant elements for decision makers.

The objective of this first part of the report is to assess the social cost of HIV infection in Switzerland during the year 1998. For that purpose, we consider a “Bottom-Up” model. Under this approach, the various components of the social cost are first estimated separately and compared, and then reassembled.

Since HIV epidemiological elements are central to the assessment of the social cost, we present, in the first chapter, a general overview of HIV epidemiology in Switzerland, and focus in particular on HIV and AIDS prevalence, HIV and AIDS incidence, and AIDS mortality.

A general description of the “bottom-up model” is presented in the second chapter. The various cost components of the social cost are detailed. Two main cost categories are differentiated, i.e., direct and indirect costs. Direct costs relate to inpatient and outpatient care associated with HIV infection. Indirect costs are associated with HIV morbidity and mortality. In addition, we also include prevention in our cost assessment. Our different sources of information are also presented in this chapter. Intangible costs are not included.

An assessment of prevention costs is proposed in the third chapter. The issue of whether prevention costs should be included or not in the social cost is still the object of a debate among health economists. Although we do not consider prevention costs as a component of the social cost, we include these costs in our study so that they can be compared with social

[2] HIV is the virus that causes AIDS

[3] UNAIDS (2001), Twenty years of HIV/AIDS, Fact-Sheets, Geneva

[4] Office Fédéral de la Santé Publique (1999), SIDA et VIH en Suisse: Situation épidémiologique à la fin 1998, Berne

cost components. We concentrate on the main programmes related to HIV prevention and differentiate between primary and secondary prevention.
Direct costs are assessed in the fourth chapter. Direct costs are divided into outpatient and inpatient care costs. Outpatient care comprises drug treatments, ambulatory medical visits, psychotherapy, and home care. Inpatient care relates to hospital and institutional psycho-social care. The methodology adopted to assess direct costs attributable to HIV infection is detailed.

In chapter five, indirect costs are measured. Assessing indirect costs requires the evaluation of morbidity and mortality costs. Morbidity and mortality costs represent the value of goods and services that HIV positive individuals would have produced had they not contracted the disease. We adopted the human capital approach to assess indirect costs. Under the human capital approach, assessing morbidity costs involve estimating lost workdays attributable to HIV infection, and then applying an economic value to these workdays. Mortality cost measurement combines the number of deaths caused by AIDS and an economic value for each potential year of life lost.

1 HIV EPIDEMIOLOGY IN SWITZERLAND

A general overview of HIV epidemiology in Switzerland is presented in this chapter. We define the HIV infection as encompassing all disease stages, i.e., AIDS and non-AIDS stages. The AIDS stage is defined by specific clinical events that are detailed in Appendix 1.

We consider the following epidemiological elements:

- HIV and AIDS incidence
- HIV and AIDS prevalence
- AIDS mortality

The major source of information about new HIV infections and AIDS cases is provided by anonymous reporting to the Swiss Federal Office of Public Health (SFOPH). This reporting system is mandatory since December 1987. Additional sources of information reported by the SFOPH are:

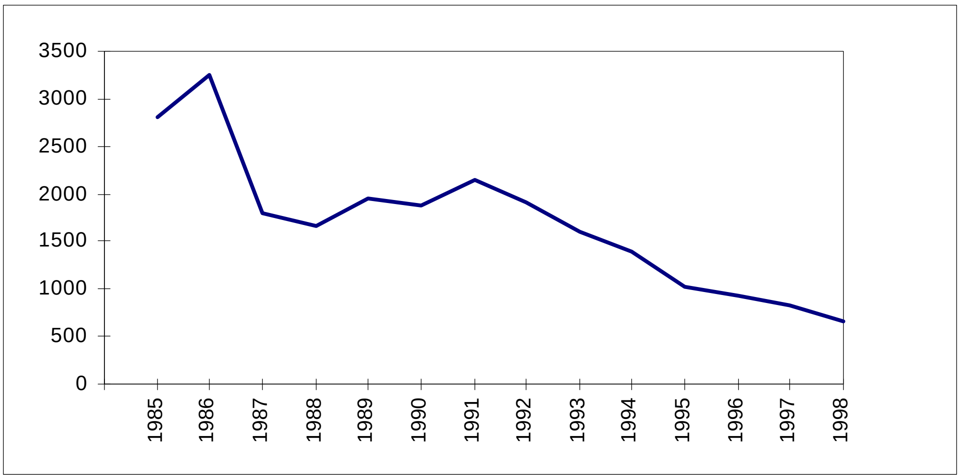
(i) The national death registry
(ii) Anonymous HIV testing centres
(iii) Blood transfusion centres
(iv) Follow up of patients with sexually transmitted diseases

As we shall see below, HIV epidemiology has significantly changed over the last years, with a significant decrease in the number of new HIV infections and AIDS deaths.

1.1 HIV & AIDS INCIDENCE

The number of yearly **diagnosed HIV positive cases** provides a good picture of the epidemiological evolution of HIV infection. Figure 1 indicates the yearly number of new positive HIV tests declared by confirmation laboratories. Since 1991, there has been an ongoing decrease, attributable to a large extent to prevention. The number of new cases has decreased from **2’144** in 1991 to **657** in 1998, i.e., a decrease of **69 %.**

Figure 1: Yearly number of new positive HIV tests



Source: Office Fédéral de la Santé Publique (1999), SIDA et VIH en Suisse: Situation épidémiologique à la fin 1998, Berne

One should however point out that the number of yearly **new positive HIV tests** does not exactly correspond to the actual number of **new HIV infections**. The reasons are the following:

(i) In general, testing is not done immediately after contracting the disease. Thus, positive HIV tests communicated to the SFOPH mainly reflect past infections. In a context of ongoing decrease in the number of new positive tests, the number of HIV infections might therefore be overestimated.

(ii) Another element contributing to overestimate the actual number of HIV infections is the double reporting of new HIV cases, resulting from the anonymous report system, and accounting for around 10 to 15 % of reported HIV confirmation tests[5].

(iii) By opposition, the actual number of HIV infections is underestimated by the fact that a certain proportion of individuals are unaware of being infected. In France, it was estimated in 1996[6] that HIV infection had not been detected prior to AIDS diagnosis in approximately 25% of AIDS cases. Such a phenomenon is also observed in the Swiss HIV Cohort Study (SHCS). Indeed, on the average, since 1993, 16 % of individuals who have developed AIDS had their first positive HIV test within a period of one month prior to the first AIDS defining disease.

All in all, taking into account these various factors, the SFOPH estimates that the likely number of HIV infections for 1998 lies between **600** and **700 cases.** This corresponds to an incidence rate of 13/100'000 for the 13-65 year-old population.

The yearly number of **declared AIDS cases** is depicted in Figure 2. Up to 1995, the number of AIDS declarations continuously increased. Thereafter, the number of AIDS notifications fell regularly, and actually decreased by more than **40 %** between 1995 and 1998. This change in evolution is generally attributed to the introduction of the **highly active antiretroviral therapy (HAART),** which has now become the standard of care for persons infected with HIV in developed countries.

During this last decade, two new classes of drugs - protease inhibitors (PI) and the non-nucleoside reverse transcriptase inhibitors (NNRTI) – have been developed, in addition to nucleoside reverse transcriptase inhibitors (NRTI), already prescribed since 1987. HAART combines three or more different drugs such as two nucleoside reverse transcriptase inhibitors (NRTI) and a protease inhibitor (PI), or two NRTIs and a non-nucleoside reverse transcriptase inhibitor (NNRTI).

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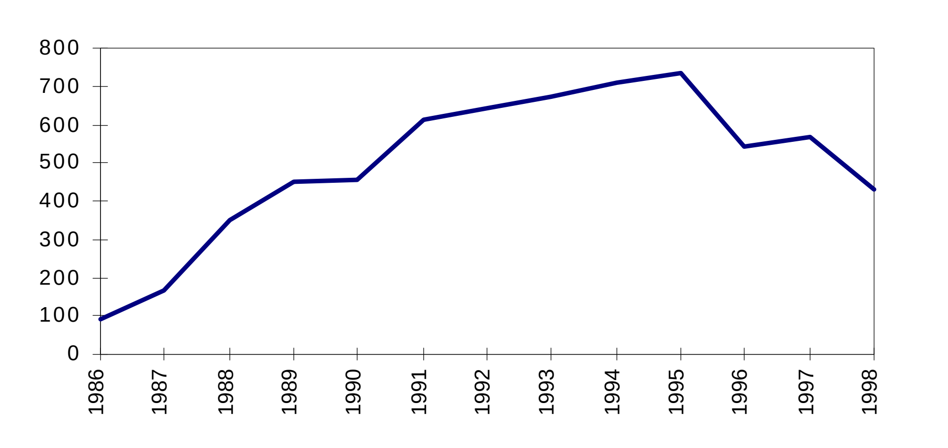
[5] Office Fédéral de la Santé Publique (1999), SIDA et VIH en Suisse: Situation épidémiologique fin 1998, Berne

[6] Bulletin épidémiologique hebdomadaire (1998), Surveillance du Sida en France, vol. 37 : 157-163, Paris

Figure 2: Yearly number of AIDS declarations



Source: Office Fédéral de la Santé Publique (1999), SIDA et VIH en Suisse: Situation épidémiologique à la fin 1998, Berne

One of the main difficulties in assessing the actual number of **new AIDS cases** is the reporting delay[7]. Taking the latter into consideration, the SFOPH has estimated the number of **new AIDS cases** between **275 and 325** for 1998. Reporting delays together with a downward trend in AIDS cases explain the difference between **new AIDS cases (275-325 cases)** and **new AIDS declarations** (**426** cases in 1998, according to Figure 2).

1.2 HIV & AIDS PREVALENCE

The **prevalence** of a disease is defined as the proportion of people with the disease at a specific time[8]. The prevalence of HIV infection in Switzerland can be estimated by subtracting the cumulative number of deaths due to AIDS from the cumulative number of HIV diagnoses communicated to the SFOPH.

For the year 1998, the SFOPH has estimated the number of persons infected with HIV infection residing in Switzerland to be between **13'000 and 19'000.** This number represents a prevalence rate of 0.35 to 0.51 % of the 15-49[9] years old population. By comparison, this rate is estimated to be 0.10 % in Germany, 0.23 % in Austria, 0.35 % in Italy and 0.43 in France[10]. The estimate of AIDS prevalence is significantly lower. The number of individuals living with **AIDS** in Switzerland amounted to **2'000** in 1998 according to the SFOPH .

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[7] The SFOPH has estimated that, over the last years, 66 % of AIDS cases were reported within one year of the diagnosis, 80 % within 2 years and 86 % within 3 years (Office Fédéral de la Santé Publique, (1999), SIDA: Tableaux mensuels, Bern)

[8] J. Giesecke, Modern Infectious Disease Epidemiology, Edward Arnold, London, 1994

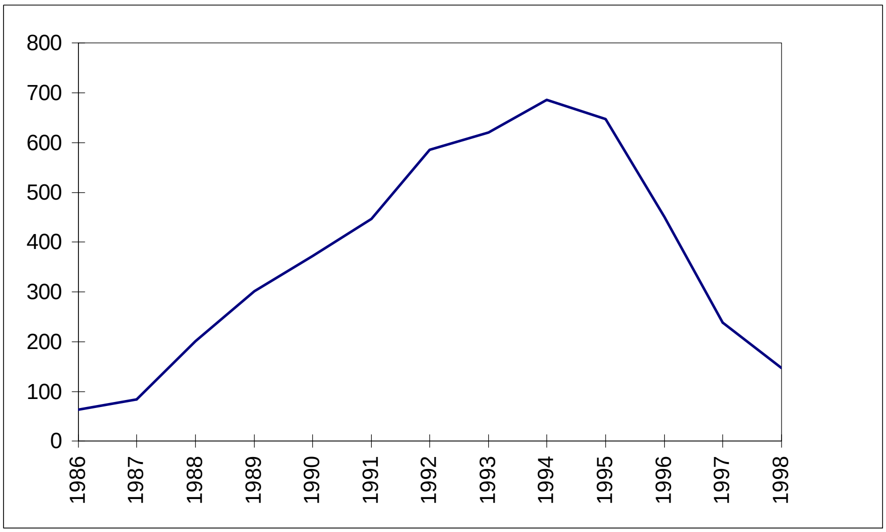
[9] The range 15-49 years old is the standard one regarding HIV infection

[10] UNAIDS (1999), Epidemiological Fact Sheet on HIV/AIDS, Geneva

1.3 AIDS MORTALITY

Another major change in the HIV/AIDS epidemiology over the last years in Switzerland is related to AIDS mortality. Figure 3 depicts the yearly number of deaths of individuals at the AIDS stage[11]. This figure clearly shows that there has been a substantial decline in the number of deaths, from a peak of **686** in 1994 to **147** in 1998. This reduction is associated with the introduction of **HAART.**

Figure 3: Number of yearly deaths of individuals at the AIDS stage



Source: Office Fédéral de la Santé Publique (1999), SIDA et VIH en Suisse: Situation épidémiologique à la fin 1998, Berne

[11] The AIDS mortality statistics of the SFOPH include only deaths of individuals at the AIDS stage. There are no official statistics related to the mortality of positive individuals before they reach the AIDS stage.

2 BOTTOM-UP MODEL: GENERAL DESCRIPTION

2.1 MAIN ELEMENTS OF THE MODEL

In order to assess the social cost of HIV infection in Switzerland in 1998, we consider a «Bottom-Up » model of costs. Under this approach, the various components of the social cost are first estimated separately and compared, and then reassembled. Our assessment is undertaken from a societal viewpoint, i.e., incorporating all relevant costs regardless of who incurs them.

The main elements of the model, detailed in Figure 4, are the following:

- **Prevention costs**

The issue of whether **prevention** costs should be included or not in the social cost is still an object of debate among health economists. Although we do not consider prevention costs as a component of the social cost, we do compare these costs with social cost components.

- **Direct costs**

Inpatient and outpatient care are the main components of direct costs. The methodology that we adopt for the assessment of **direct costs** is largely based on the approach discussed by Rice (1966) and Drummond et al. (1997).

- **Indirect costs**

Indirect costs refer to productivity loss resulting from morbidity or mortality. Our appraisal relies on the « human capital approach », which places monetary value on healthy time using market wage and alternative measures (Gold et al.,1996).

The issue of **intangible costs** will not be addressed in our study. Intangible are associated with uncertainty, pain, and distress due to illness. The methodologies for assessing intangible costs, that is the methods of revealed preference or contingent valuation, have been discussed by Johannesson (1996), Drummond et al. (1997), and Donaldson (1993, 1995). They are quite complex to implement and the results often difficult to interpret, particularly in a context of ongoing changes as is the case for HIV.

Figure 4 : Cost components and main data sources for the assessment of the social cost attributable to HIV infections in 1998.

SOCIAL COST

3. PREVENTION COSTS

3.1 Primary Prevention
Source :SFOPH[12]
Source : SHCS

3.2 Secondary Prevention

3.2.1 HIV Screening
Source : SFOPH
Swiss Red Cross

3.2.2 PEP
Sources : CHUV[14]
SHCS[15]

4. DIRECT COSTS

4.1 Outpatient Care

4.1.1 Drug Treatments
Sources : SHCS
Pharma Information

4.1.2 Medical and Paramedical Care

4.1.2.1 Ambulatory Medical Visits
Sources : CHUV
Private Practitioners

4.1.2.2 Psychotherapy
Source : Expert Opinion

4.1.2.3 Home care

4.2.Inpatient Care

4.2.1 Hospital Care
Sources CHUV
SFOS[13]

4.2.2 Psycho-social care
Source : Le Soleil Levant

5. INDIRECT COSTS

5.1 Morbidity
SFOS

5.2 Mortality
Source : SFOS

[12] Swiss Federal Office of Public Health
[13] Swiss Federal Office of Statistics
[14] Centre Hospitalier Universitaire Vaudois
[15] Swiss HIV Cohort Study

Source : Home Care Federation

2.2 MAIN DATA SOURCES

- **Service de la Santé Publique du Canton de Vaud** (SSP): data on prevention expenses.

- **Pharma Information**: data on antiretroviral sales in Switzerland.

- The **Swiss HIV Cohort Study**[16] (SHCS): data on antiretroviral and HIV co-morbidity drugs, and on morbidity.

- **Private practitioners**:
  The following HIV specialist medical doctors have accepted to provide us with data on the ambulatory costs of their HIV infected patients:

  . Dr Joelle Wintsch, Internal medicine, Geneva
  . Dr Christian Jaccard, Internal medicine, Lausanne
  . Dr Christian Junet, Internal medicine, Geneva
  . Dr René Jaccard, Internal medicine, Zurich

- The **Centre Hospitalier Universitaire Vaudois** (CHUV): data on hospitalisation and ambulatory costs.

- **Swiss Federal Offices:**
  For data related to: Prevalence - Incidence
  Number of deaths
  Number of hospitalisations
  Prevention and public research expenses

- **Unpublished data:**
  M. Alberti, CHUV: data on HIV and home care
  C. Marzolini, CHUV: data on co-medication

- **Experts' opinion:**
  The following experts have provided advice on data collection and estimation of various parameters:

  . Dr Martin Postma, Economist, Groningen University, Netherlands
  . Dr Jan Hendricks, Statistician, Nijmegen University, Netherlands
  . Dr Martin Gebhardt, MD (Public Health), SFOPH, Bern
  . Dr C. Jaccard, Internal Medicine, Lausanne
  . Dr R. Jaccard, Internal Medicine, Zurich
  . Dr Amalio Telenti, HIV outpatient clinic, CHUV, Lausanne
  . Dr Gilbert Greub, HIV outpatient clinic, CHUV, Lausanne

[16] This data base is an ongoing cohort established in 1988 and is the result of the collaboration between the five Swiss university hospitals and two cantonal hospitals. There were approximately 4'500 individuals under observation in 1998.

3 PREVENTION COSTS

In this section, we evaluate HIV prevention costs in Switzerland for the year 1998. Because of their number and variety, an exhaustive review and cost assessment of all prevention activities directly or indirectly associated with HIV would be extremely difficult. We therefore concentrate on the main programmes related to HIV prevention.

We do not consider prevention costs as a part of the social cost, but in order to allow a cost comparison between the latter and the social cost components, we have included in this study an assessment of prevention costs. Research funding was not viewed as a social cost component either. We did, however, assess public research costs funded by the SFOPH[17].

Despite the fact that our review of prevention activities is not exhaustive, our results show that expenses for primary and secondary prevention are substantial, totalling approximately **53 million Sfr.** This amount is divided almost equally between primary and secondary prevention.

Following the rapid development of the HIV epidemic, various prevention activities such as the "Stop AIDS" campaign, the syringe exchange programme, and HIV screening were initiated. Although there has been a clear improvement in the treatment of HIV patients over the last years, particularly due to the development of new antiretroviral drugs, prevention remains an essential tool against HIV infection.

We distinguish **primary** from **secondary** prevention activities. The former is defined by the World Health Organisation as all measures designed to reduce the incidence of disease in a population, by reducing the risk of onset[18]. The latter encompasses all measures designed to reduce the prevalence of a disease in a population, by shortening its course and duration.

3.1 PRIMARY PREVENTION

HIV primary prevention activities takes various forms and covers a wide range of activities in Switzerland, as shown by Vitali et al. (1997). It includes general information to the public such as the "Stop AIDS" campaign, programmes targeted at specific groups such as homosexuals, intra-venous drug users, prisoners, foreign workers, schoolchildren etc. Many actors are involved in primary prevention (the Swiss Federal Office of Public Health, cantons and cities, Associations, etc.). An exhaustive review of all costs related to HIV primary prevention would be therefore very complex. Instead, we focus our analysis on key contributors of HIV primary prevention, i.e., the Swiss Federal Office of Public Health, Swiss cantons, and the Swiss AIDS Federation. In addition, we also include condom sales and the syringe exchange programme in our review of primary prevention activities. Although not exhaustive, our review provides a general idea of HIV primary prevention expenses in Switzerland.

[17] The AIDS research budget of the Swiss Federal Office of Public Health amounted to approximately 7.5 million Sfr. in 1998 (J.-J. .Thorrens , Personal communication, SFOPH)

[18] World Health Organization (1978), Glossary of health care terminology, Regional office for Europe, Copenhagen

- **Swiss Federal Office of Public Health (SFOPH) HIV prevention budget**

The budget of the SFOPH regarding HIV prevention amounted to **9.3 million Sfr**. in 1998[19]. This sum was mainly allocated to the "Stop AIDS" campaign (2.5 million Sfr.) and to the Swiss AIDS Federation (3.3 million Sfr.) which is the parent organisation of 21 cantonal and regional AIDS associations and another 24 organisations engaged in combating HIV and AIDS

- **Swiss cantons and cities HIV prevention expenses**

Swiss cantons and cities do incur expenses related to HIV prevention. Data collection is difficult due to the number of Swiss cantons and cities, and because HIV prevention activities are often just one component of a prevention programme. Therefore, we have decided to concentrate our efforts on data from Vaud which we consider as representative of Switzerland. Thus, the « cantonal budget » and the « Lausanne city budget » are extrapolated in order to derive prevention costs for all the Swiss cantons and cities. On the one hand, this approach may overestimate Swiss prevention costs because prevention activities in Vaud are various and well developed, in comparison to other Swiss cantons, as shown by Vitali et al. (1997). On the other hand, since we did not review all prevention activities, we may actually underestimate Swiss prevention costs.

The HIV prevention budget of **Vaud** amounted to approximately **700'000 Sfr**[20] in 1998 and has been allocated to various associations active in the field of HIV prevention such as Sid'action, Vogay, Point Fixe, etc. In addition to the "cantonal budget", "the city of Lausanne" has its own budget dedicated to Aids prevention which approximately amounted to **400'000 Sfr**[21] in 1998. Since associations in the field of HIV prevention also benefit from other sources of income such as donations, off-budget contributions, etc., our estimate probably tends to underestimate actual prevention expenses.

In addition to HIV specific prevention activities, there are programmes such as the syringe exchange programme. The budget for Vaud for this programme was evaluated at **493'000 Sfr.** during the year 1998. Since it also aims at preventing other health problems such as hepatitis B and C, we consider as a baseline that only **50 %** of the budget, or **246'500 Sfr**, directly related to HIV.

The above elements lead to a total of **1'346'500** Sfr. for HIV prevention in Vaud. In order to extrapolate to all the Swiss Cantons and cities, we make the following assumption. Since Vaud represents approximately 10 % of the Swiss population, its HIV prevention expenses should also reflect around 10 % of that of all Swiss cantons and cities. In the present study, we shall adopt this assumption whenever we extrapolate data from **Vaud** to the **Swiss level.** On the basis of the above assumption, we therefore estimate **primary prevention costs** for Swiss cantons/cities at **13.5 million Sfr.**

- **Condom sales**

[19] J.J. Thorens, personal communication, SFOPH, Bern
[20] J. Resplendino, personal communication, Service de la Santé, Lausanne
[21] Y. Loehle, personal communication, Secrétariat Général - Direction de la sécurité sociale, ville de Lausanne

Condoms represent an effective protection against HIV infection. There has been a substantial rise in condom sales over the last years, from **7.6 million units** in 1986 to **17 million units** in 1998[22] [23]. The average unit price being **0.85**[24] **Sfr**, and assuming that **50 %** of the increase can be attributed to HIV prevention, i.e., **4.7 million units**, total condom sales associated with HIV/AIDS prevention are evaluated at **4 million Sfr.**

- **Voluntary work**

Our estimate of voluntary work focuses on associations dedicated to HIV prevention. Voluntary work represents an important component of human resources within these associations. According to the annual report of the Swiss AIDS Federation, there were, in 1998, 530 volunteers working in the various associations, for a total of 23'600 hours. Voluntary work is valued using the "market cost approach". This approach places a monetary value on voluntary work by applying the wage rate that the volunteer would have obtained for a similar task performed on the labour market. We accept the estimate of **32** Sfr per hour provided by Schmidt et al. (1999) to value voluntary work. Therefore, total voluntary work amounts to approximately **0.76 million Sfr.**

- **Total Primary Prevention Expenses:**

On the basis of the different primary prevention elements presented above, we estimate total primary prevention expenses to represent approximately **27.5 million Sfr.** Alternative hypotheses have also been examined. Attributing the entire syringe exchange program and condom sales increase to HIV prevention would result in a total cost of **34 million Sfr**. By contrast, excluding the syringes exchange program and condom sales from HIV/AIDS prevention lead to a total cost of **21 million Sfr.**

3.2 SECONDARY PREVENTION

We shall now address the issue of secondary prevention. In this study, we consider **HIV screening** and **post-exposure prophylactic treatment (PEP**) as secondary prevention.

3.2.1 HIV SCREENING

We differentiate between "regular" HIV screening and "systematic screening", the latter referring to blood donations.

3.2.1.1 REGULAR HIV SCREENING (WITHOUT BLOOD DONATIONS)

Our estimate of the total HIV screening costs relies on the following elements:

- Total number of HIV tests performed in Switzerland in 1998 (positive and negative tests)
- Cost of an HIV test
- Cost of drawing a blood sample
- Yearly number of counselling visits
- Cost of a counselling visit
- Administrative fees

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[22] Dubois-Arber, Jeannin A. et al. (1997), Evaluation of the AIDS prevention strategy in Switzerland, Cahier de
recherche et de documentation IUMSP no 120b, Lausanne

[23] Société pour le développement de l'économie suisse (1999), Sida: une maladie « à part », Numéro 29/2

[24] F. Blassel (1999), Prix du condom, l'hebdo, No 52.

The issue of **fees** versus **cost** arises for HIV screening components such as HIV tests and blood sample drawing. We define as a baseline that fees are relatively close to the actual economic cost. However, we shall also contemplate the possibility that fees and actual cost differ.

- **Total number of HIV tests performed in Switzerland in 1998**

There are no official statistics on the number of HIV tests performed in Switzerland. However, the number of HIV tests, not in connection with blood donations, was estimated at **300'000** in 1994[25]. This assessment relies on a study carried out before the introduction of HAART. Figures comparing HIV testing at the CHUV outpatient clinic before and after the introduction of these therapies were analysed to determine if HAART had an impact on the number of anonymous HIV tests performed. These data do not show any major changes (see Appendix 2). We thus assume that approximately **300'000 HIV tests** (without blood donations) have been performed in Switzerland in 1998.

- **Cost of one HIV test**

The usual test performed is an ELISA test**.** It corresponds to position 9116.01 of the medical analyses list of the Swiss Federal Office of Social Insurance (SFOSI) and its price is **35 Sfr**.

- **Cost of drawing a blood sample**

For each HIV test, a blood sample has to be drawn. It corresponds to position 9702.00 of the SFOSI medical analyses list and its price is **12 Sfr**. The blood sample can be used to perform other analyses but we do not know the extent of this practice. Assuming that on the average two analyses are performed with one blood sample, the price of blood sampling is then **6 Sfr.**

- **Yearly number of counselling visits**

A counselling visit may take place before the test and/or when the test result is communicated to the patient. Assuming that one medical visit occurs before the test, and one when the result is communicated to the patient, would mean, on a basis of 300’000 annual HIV tests, 600’000 medical visits. Nevertheless, the following elements tend to favour a lower figure:

(i) It appears that when HIV tests are routine, as is the case with pregnant women (80'000 cases per year), pre-test counselling is less frequent[26].

(ii) Approximately 50 % of doctors always or often communicate HIV negative results by telephone[27].

Taking these facts into account, a figure of **500'000** yearly counselling visits seems more accurate.

- **Cost of a counselling visit.**

We rely on the Nomenclature Médicale Tarifée Vaudoise (NMTV), position 0001, to derive the price of the counselling visit. On the basis of a counselling visit of 9 minutes, estimated by Dubois–Arber et al. (1997), we obtain a price of **14 Sfr.** for a counselling visit**.**

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[25] M. Gebhardt, Personal communication, SFOPH, Bern

[26] Dubois-Arber F., Jeannin A. et al. (1997), Evaluation of the AIDS prevention strategy in Switzerland, Cahier de recherche et de documentation IUMSP no 120b, Lausanne

[27] idem

- **Administrative fees**

An administrative fee of up to **12 Sfr.** (position 9700.00 of SFOSI medical analyses list) can be charged for each HIV test. If we again assume that two laboratory analyses are performed on each blood sample, the administrative fee per HIV test will be **6 Sfr**.

3.2.1.2 HIV SCREENING OF BLOOD DONATIONS

In Switzerland, **blood donations** are collected through the Swiss Red Cross and are systematically screened for HIV. The yearly number of blood donations is around 500'000[28]. It has decreased over the last years. The Swiss Red Cross itself performs the HIV tests, with Elisa and PCR tests, which correspond to positions 9616.01 and 9116.37 of the SFOSI list of analyses, at prices of **35 Sfr.** and **275 Sfr.,** respectively (unit cost: 310 Sfr.)

We will, however, consider lower costs, as one can expect substantial economies of scales. In addition, pooling, a practice that also reduces costs, is performed by the laboratories. In the context of blood donations, we consider that screening can be performed on 30 blood samples at a time[29]. Pooling means that around 16’670 HIV tests are performed instead of 500’000. Taking into account that economies of scales further decrease the price, we assume a unit cost ranging from 150 Sfr. to 300 Sfr.

4.1.1.1 TOTAL HIV SCREENING COST

According to the above estimates, the total cost of HIV screening is evaluated at **24.85 million Sfr.** under the main scenario detailed in Table 1.

Table 1: Total HIV screening costs: « main scenario »

Number of HIV tests (1)	**HIV cost per test (2)**	**Blood sampling cost per test (3)**	**Administration fee per test (4)**	**counselling (5)**	**Counselling Price (6)**	**Total Cost (1)*(2+3+4) + (5)*(6) (1)*(2)**
300'000	35	6	6	500’000	14	21'100’000
16’670 (blood donations)	225	-	-	-	-	3'750’000
Total						**24'850’000**

Two alternative scenarios have been considered as well and are detailed in Appendix 3. **The first one** reflects higher costs. It assumes that there are two counselling visits per test, i.e., 600’000 altogether, as well as a cost of 10 Sfr. per blood donation, instead of 7.5 Sfr. Under this scenario, total HIV screening costs amount to approximately **27.5 million Sfr.**

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[28] J. Niklaus, Personal communication, Swiss Red Cross, Bern

[29] R. Peitrequin, Personal communication, Laboratory of immunology, CHUV, Lausanne

The second one is a lower cost scenario with 400’000 counselling visits instead of 500'000. HIV test fee is assumed to be 28 Sfr. instead of 35 Sfr., and we consider a fee of 4.8 Sfr. rather than 6 Sfr. for drawing blood sample. Under this scenario, total cost is evaluated at **19.7 million Sfr**.

3.2.2 POST EXPOSURE PROPHYLACTIC TREATMENT (PEP)

The last prevention activity that we are considering is the post exposure prophylactic treatment. This type of treatment reduces the risk of infection after an HIV exposure and should be administered shortly thereafter. PEP following **professional exposure** of health care workers to HIV is usually distinguished from **non-professional exposure** (sexual contacts, needle exchanges etc.).

In order to estimate total PEP costs, we are considering the following elements:
- **Number of PEP in 1998**
- **Average treatment duration of a PEP**
- **Cost of a PEP treatment**

- **Number of PEP in 1998**

The **official reported number** of initiated PEP following an **professional exposure** to blood has increased from **11** in 1990 to **74** in 1998 and has been stable over the last years. PEP related to **non-professional exposure** is relatively recent and official data are only available since 1997. For the year 1998, the number of reported non-professional PEP amounted to **80.**

The **degree of underreporting** for PEP treatments for both types of exposure is not well known. It seems that it is higher for non-professional exposure. We have taken into account the phenomenon of underreporting when assessing the total PEP cost at the Swiss level. On the basis of SFOPH data and discussions with Dr Philippe Sudre, responsible for data collection related to non-professional exposures, and Dr Gilbert Greub responsible for data collection related to professional exposures, rates of underreporting of **20 %** for professional exposures and of **70 %** for non-professional exposures have been assumed.

Under these hypotheses, we estimate the **number** of PEP treatments in 1998 to be **93** for **professional exposure** and **267 for non professional exposure**.

- **Average treatment duration of PEP**

Treatment is similar for both types of exposures. It usually lasts **one month** and combines three antiretroviral drugs. Official recommendations regarding PEP initiation have been issued by the SFOPH[30 31].

A fraction of PEP treatments are discontinued prematurely. Side effects or the confirmation that the source patient is negative are the main reasons for treatment interruptions. In 1998, **50 %** of PEP following an occupational exposure, but only 25 % following a non-professional

[30] OFSP (1997), Mise à jour sur les expositions au VIH en milieu médical, *Bulletin OFSP*, 7 : 5-12
[31] OFSP (1997), Recommandations prélimaires de prophylaxie postexposition du VIH, *Bulletin OFSP*, 50 : 4-8

exposure, were interrupted[32]. We have estimated that premature interruption of PEP takes place on the average after **4 days,** in the case of **professional exposure**. This is based on reported professional PEP data of 1998 (G. Greub, personal communication, CHUV). Detailed data were not available for non professional PEP. The fact that premature interruption of PEP treatment occurs sooner for professional exposures because it is easier to test for HIV status of the potential infection source led us to consider a duration of **8 days** before interruption for **non-professional exposure.**

- **Cost of a PEP**

The cost of a standard PEP lasting one month, i.e., antiretroviral treatment, laboratory analyses and medical visits, has been estimated at approximately **2'300 Sfr[33].**

- **Total PEP costs for Switzerland**

Components of the **total cost of PEP** are depicted in Table 2. Total cost associated with PEP is estimated at **603'000 Sfr.** for the year 1998, which is less than 1 million Sfr. However, due to the unavailability of precise data on PEP treatment, these results should be treated cautiously. But, no matter what the scenario, the total cost would not reach 1 million Sfr. Under the hypothesis of an underreporting rate of 30 % for professional exposure and 80 % for non professional exposure, as well as a treatment completion rate of 50 % and 80 % respectively, total cost would be **923'000 Sfr.** By opposition, assuming there was no underreporting regarding the official number of PEP treatments in Switzerland would result in a total cost of **232'000 Sfr.** Both alternative scenarios are detailed in Appendix 4.

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[32] P.Sudre, Non-professional Post-HIV exposure prophylaxis in Switzerland, 1997-1999, (not published)

[33] P. Sudre & B.Broers (1997), Chimioprophylaxie de l’infection VIH après exposition sexuelle ou sanguine, *Médecine et Hygiène*, 55 : 2229-2234,

Table 2 : Cost of PEP treatments « main scenario »

Type of PEP	Official reported PEP number	Underreporting of PEP (%)	Total estimated number of PEP	Completed PEP (%)	Interrupted PEP (%)	Number of completed PEP	Number of interrupted PEP	PEP cost for 1 unit (completed)	PEP cost for 1 unit (interrupted)	TOTAL cost
Professional exposure	74	20 %	93	40 %	60 %	37	56	2'300	307	102'120
Non professional exposure	80	70 %	267	75 %	25 %	200	67	2'300	613	500'880
										603'000

3.3 PREVENTION COSTS: SUMMARY AND DISCUSSION

The above discussion leads to an estimate of prevention costs ranging from **41** to **62 million Sfr.** A recapitulation of these costs is given in Table 3. Total prevention cost is divided almost equally between primary and secondary prevention.

Table 3: Prevention cost components

Prevention tegy	**«Lower bound scenario»**	**« Main scenario »**	**« Higher bound scenario »**
Primary prevention	21'060'000	27'525'000	33'990'000
Secondary Prevention	19'972'000	25'453'000	28'423'000
HIV screening	*19'740'0000*	*24'850'000*	*27'500'000*
PEP treatment	*232'000*	*603'000*	*923'000*
TOTAL	**41'032'000**	**52'978'000**	**62'413'000**

Most probably, focusing on the main HIV prevention programmes led us to underestimate the actual prevention cost. However, our estimate provides a basis to discuss the impact of prevention policy.

The issue of whether prevention cost savings compensate prevention expenses or not is of interest to health policy makers. As we have seen in the first chapter, prevention is associated with a decline in the number of new HIV infections during the last years. It is difficult to determine the precise contribution of HIV prevention to this decline. Assuming that in comparison with 1991 (2'144 new infections), 50 % of the decline in the number of new infections in 1998 (657 new infections in 1998) were attributable to prevention, means that prevention avoided **744** yearly cases at a cost of approximately **52.98 million Sfr.,** i.e., **71'210 Sfr per avoided HIV infection case**. We adopted 1991 as our baseline year because it is since that year that the yearly number of new HIV infections began to decline. Our estimate may actually overestimate the actual cost per avoided HIV cases, since it ignores the impact of prevention until 1991. In addition, we also consider that over the last years prevention expenses have been relatively stable. Now, if we were to consider **140 million Sfr** for total prevention costs at Swiss level, as estimate earlier by Vitali et al. (1997), the cost per avoided case would then amount to **188'170 Sfr**. These results should then be compared to the costs attributable to one case of a HIV infection. These costs will be analysed in the following chapters.

4 DIRECT COSTS

In this chapter, we evaluate the direct costs of HIV infection. We differentiate between **outpatient** and **inpatient** care. The former relates to drug treatments (including antiretroviral treatments), ambulatory medical visits, psychotherapy, and home care, whereas the latter is associated with hospital and institutional psycho-social care.

Due to HIV infection characteristics, assessing HIV direct costs is complex. Persons living with the HIV infection may suffer from very different diseases and the causality between the latter and the HIV infection can sometimes be difficult to determine.

This issue can be approached from two different points of view:

- The first one consists in determining a percentage of associated diseases **attributable to HIV infection**. For instance, 80 % of all zona cases among HIV infected individuals can be **attributed to HIV infection**.

- The second one is a **case control approach**. HIV positive and negative individuals are matched by age, risk group (homosexual, intra-venous drug users, heterosexual), social class, etc., and their health costs are then compared.

While the second approach is in principle preferable, it is very demanding in practice because of difficulties associated with the matching procedures. Our data did not allow us to pursue this approach and as a result the first approach , despite a certain arbitrariness in determining the percentage **attributable to HIV infection**, was adopted.

4.1 OUTPATIENT CARE

We consider two outpatient care categories, i.e., **HIV related drug treatments** and **HIV related medical and paramedical care (**ambulatory medical visits, psychotherapy, and home care).

4.1.1 DRUG TREATMENTS RELATED TO HIV

Since HAART introduction, drugs have become the key element in HIV care. It should be noted that drug consumption is not limited to antiretroviral drugs. Other medications are also taken by HIV infected individuals. The following drug categories are analysed:

. Antiretroviral drugs
These drugs aim at preventing HIV replication. They are only used against HIV infection. Our main data source was Swiss Pharma data and SHCS data.

. Co-morbidity drugs
These drugs are used either to prevent or to treat HIV co-morbidity. They are aimed at preventing and/or treating pneumocystis *carinii pneumonia*, toxoplasmosis, mycobacterial, fungal, viral infections and neoplasms. The SHCS data were our main source of information.

. Co-medication
We also incorporated drugs that are less specifically related to HIV infection, such as neuroleptics, antidepressants, vitamins, etc. For these drugs, consumption data of HIV infected individuals are based on a recent study[34] assessing the impact of such drugs on HAART effectiveness.

- ***ANTIRETROVIRAL DRUGS***

Figures related to **antiretroviral drug sales** in Switzerland are scarce. Pharma Information[35] provides a global estimate of **91.4 million Sfr.** for 1998. To gain insight of the different antiretroviral drug cost components, detailed costs were calculated for the **SHCS individuals** in 1998.

The following elements were determined in order to derive the cost for each drug:

- **Treatment duration**
  The treatment duration was derived from the SHCS data base.

- **Standard daily dose**
  Our figures are based on the standard dosage of each antiretroviral drug as administered to HIV patients.

- **Cost per unit**
  We selected public prices to calculate the cost per unit of each drug.

Based on these elements, we estimated the total antiretroviral drug costs for the SHCS individuals at **58.3 million Sfr.** in 1998. The details are found in Table 4.

[34] Marzolini C. (2000), Therapeutic drug monitoring for protease inhibitors and effavirenz, CHUV, Lausanne (Unpublished data)
[35] Pharma Information (Association des Maisons de Recherche Pharmaceutique Suisses), Bâle

The five most frequently prescribed drugs are Combivir®, Zerit®, Viracept®, Crixivan® and Epivir®, which represent approximately **80 %** of the total cost.

Table: 4 Antiretroviral cost of the SHCS in 1998

Trade Mark	Daily dose		Price per unit Sfr.	Daily Price Sfr.	Total consumption (days)	Total Cost Sfr.
COMBIVIR®	2	tab	13.52	27.04	446 571	12 075 283
ZERIT®	2	cps	7.90	15.80	705 323	11 141 584
VIRACEPT®	10	tab	2.41	24.14	408 557	9 864 382
CRIXIVAN®	6	cps	3.43	20.58	347 094	7 143 195
EPIVIR®	2	tab	7.89	15.79	399 914	6 313 976
NORVIR®	8	cps	1.81	14.45	266 898	3 855 405
VIDEX®	4	tab	4.22	16.88	182 339	3 077 882
INVIRASE®	4	cps	2.41	9.66	213 961	2 066 388
ZIAGEN®	2	tab	11.70	23.40	38 449	899 771
RETROVIR®	2	cps	8.46	16.93	39 991	676 848
VIRAMUNE®	2	tab	7.63	15.26	31 691	483 710
AGENERASE®	16	tab	2.11	33.68	7 118	239 734
HIVID®	4	tab	3.98	15.91	10 145	161 366
STOCRIN®	3	cps	5.62	16.85	9 462	159 435
LITALIR®	3	tab	1.41	4.23	23 983	101 556
FORTOVASE®	18	cps	1.48	26.60	1 637	43 546
					TOTAL	**58 304 060**

Based on the SHCS data, we found that in 1998 approximately 70 % of the patients were under HAART (3 or more antiretrovirals), 10 % were under a bi-therapy (2 antiretrovirals), while around 20 % were not treated. Of the 20 %, 10 % were not treated at all during 1998 and the remaining 10 % corresponds to a time equivalent of patients who only received treatment during part of the year.

We estimate at 15’000 Sfr. the average yearly cost for an individual under antiretroviral treatment in the SHCS. This amount accounts for the fact that 10 % of SHCS individuals are under bi-therapy (less expensive than HAART) and that others had treatment interruptions.

Estimating the number of individuals under antiretroviral treatment in Switzerland is of interest to public health decision makers. Under the hypothesis that average treatment cost is similar for individuals treated within or outside the SHCS, the number of HIV individuals in Switzerland under antiretroviral treatment would reach a total of approximately **6’100** in 1998 (91.4 million Sfr./15’000 Sfr.). Out of the estimated 6’100 treated patients, 4’050 are in the SHCS. i.e., **65 %** of all HIV patients treated in Switzerland would belong to the SHCS. These results indicate that SHCS patients account for the majority of treated patients in Switzerland. Furthermore, since the estimated number of persons living with HIV infection in Switzerland is between 11’000 and 21’000, the figure of 6’100 treated patients means that a large fraction of HIV positive individuals are not treated. Our data and the framework of the study do not allow us to investigate further this interesting public health issue. However, the discrepancy between the number of individuals living with HIV infection in Switzerland and our estimate of treated patients might also be explained by the lack of data on the actual number of individuals living with HIV infection in Switzerland.

- ***CO-MORBIDITY DRUGS***

The cost of these drugs has been estimated for the SHCS. Estimates are significantly lower than for antiretroviral drugs and vary between **1.7 million Sfr**. for anti-fungal drugs and **0.630 million Sfr**. for anti-mycobacterial drugs. The total amount for these drugs is estimated at **5.8 million Sfr**. which corresponds to approximately 10 % of SHCS antiretroviral drug costs. The detailed data for these drugs are displayed in Appendix 5.

Extrapolation of these costs for Switzerland is based on a ratio representing the share of SHCS antiretroviral costs in the total cost of antiretroviral drugs at Swiss level. This ratio was estimated to be **65 %** (58.3/91.4 million) which gives a total co-morbidity drug cost in Switzerland of **9.1 million Sfr.**

- ***CO-MEDICATION DRUGS***

A good picture of such drugs is provided by the "therapeutic drug monitoring for protease inhibitors and effavirenz" study". Approximately 750 HIV patients are enrolled in this study and are regularly asked to indicate which medication (any medication) they are taking at the time of the interview. The most consumed co-medication by HIV patients are antidepressants and neuroleptics. Details related to co-medication drugs are found in Appendix 6. On the basis of these data, we estimate a yearly consumption per capita of **730 Sfr.**

These drugs are not specifically related to HIV infection. In addition, some are even "over the counter" drugs. Remaining conservative, we assume that 50 % of these drugs are related to HIV infection, which represents a total cost of **2.92 million** Sfr. at the Swiss level, considering that there are 8'000 medically followed HIV patients[36]. The difficulty to determine the extent to which co-medication drugs are related to HIV and the number of medically followed persons living with HIV infection led us to consider two alternatives. On one hand, assuming that these drugs are not related to HIV infection means a total co-medication drug costs of zero. On the other hand, co-medication drug costs would reach **7.30 million Sfr**. if we consider 10'000 HIV patients in Switzerland instead of 8'000 and that these drugs are entirely related to HIV infection.

[36] See sub-section 4.1.2.1 for details on the assessment of the number of HIV patients in Switzerland

4.1.1 MEDICAL AND PARA-MEDICAL CARE

In this section, we examine medical and para-medical care associated with HIV infection. The following sub-categories are differentiated:

(i) Ambulatory medical visits
We rely on two different sources of information to determine ambulatory medical care costs, namely the CHUV HIV outpatient clinic and private practitioners. Four private practitioners collaborated with our study and accepted to provide us with data on HIV positive patients (50 patients altogether).

(ii) Psychotherapy
Since HIV infection can affect mental health, psychotherapy is also included in our study. Expert opinion was our main source of information, since data related to HIV patients and psychotherapy are scarce**.**

(iii) Home care
For some patients, home care is an alternative to hospitalisation or to inpatient care in a specialised institution. Our cost assessment is based on home care federation data and on an unpublished study by M. Alberti[37] on HIV and home care in Vaud.

4.1.2.1 AMBULATORY MEDICAL VISITS

The measurement of ambulatory medical visit costs for the year 1998 combines the following elements:

. Yearly medical visit costs per HIV patient
. Number of HIV patients under medical follow-up in Switzerland

Drug costs are not included in ambulatory medical visit cost assessment as they are already accounted for in sub-section 4.1.1.

I) YEARLY MEDICAL VISIT COST PER HIV PATIENT

The CHUV HIV outpatient clinic and four private medical practitioners helped us determine the yearly medical visit cost per HIV patient.

- **CHUV HIV Outpatient clinic**

The CHUV financial department provided us with cost data for the 416 HIV infected patients followed by the HIV outpatient clinic in 1998[38]. Costs attributable to HIV infection were determined with the collaboration of Dr Greub[39]. A systematic review of each patient in order to determine costs attributable to HIV infection was not feasible, due to the number of

[37] M. Alberti (1999), L'infection VIH en 1998, Lausanne (unpublished data)
[38] Data were anonymised
[39] CHUV HIV outpatient clinic, Lausanne

patients. Instead, we concentrated on the different types of medical acts and determined which proportion was attributable to HIV infection.

- **Private Medical Practitioners**

Four private medical practitioners treating HIV patients collaborated with our study[40]. They provided us with data about their patients (50 altogether), including patients' bills[41]. The same approach as for the CHUV HIV outpatients was adopted. In addition, the smaller number of patients allowed us to perform a systematic review, using a questionnaire elaborated with the help of the private practitioners (see Appendix 7).

- **Average yearly cost**

Based on the above elements, we estimate yearly medical visit costs per HIV patient at **3'000 Sfr.** This amount reflects the average yearly cost attributable to HIV infection.

II) NUMBER OF HIV PATIENTS UNDER MEDICAL FOLLOW UP IN SWITZERLAND

In sub-section 4.1.1, we established that the number of HIV individuals under antiretroviral treatment was approximately 6'100 in Switzerland in 1998. However, these patients do not represent the total number of HIV individuals under medical follow-up. A fraction of HIV patients seen by medical doctors are not under antiretroviral treatment. A panel of experts[42] estimated that these patients could represent between 20 % and 30 % of HIV patients followed by either specialists for infectious diseases or general practitioners. Therefore, **8'000** medically followed HIV patients seems a more accurate figure. This figure remains below the estimated 11'000 to 21'000 individuals living with HIV infection in Switzerland.

III) TOTAL AMBULATORY MEDICAL VISIT COSTS

Combining the above elements result in a total ambulatory visit cost of **24 million Sfr**. in Switzerland for the year 1998. Alternatively, we also considered the impact on ambulatory medical visit costs of a higher and a lower number of medically followed HIV patients in Switzerland. If we assume that there are **10'000 HIV patients**, this would mean a total ambulatory medical visit cost of **30 million Sfr**. On the other hand, hypothesising that only 10 % of all HIV treated patients are not under antiretroviral treatments, i.e. **6'800 HIV patients under medical follow-up**, would result in a total cost of **20.4 million Sfr.**

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[40] Dr C. Jaccard, Lausanne, Dr C. Junet, Genève, Drs J. Wintsch, Genève, Dr. R. Jaccard, Zurich
[41] Bills have been anonymised in order to preserve medical secrecy
[42] Dr C. Jaccard, Lausanne, Dr R. Jaccard, Zurich, Dr M. Gebhardt SFOPH, Bern, Dr A. Telenti, CHUV, Lausanne

4.1.2.2 PSYCHOTHERAPY

Psychotherapy treats a wide range of mental problems that are common to persons living with HIV infection such as anxiety, depression and social dysfunction[43].

The psychotherapy cost assessment relies on the three following elements:

- **Proportion of HIV infected patients undergoing a psychotherapy**
- **Session frequency**
- **Cost of a psychotherapy session**

- **Proportion of HIV infected patients undergoing a psychotherapy**

Our estimate relies on the proportion of CHUV HIV outpatients undergoing psychotherapy. This proportion is estimated at 10 % (P. Cochand, personal communication, CHUV). Since there are 8'000 medically followed patients in Switzerland (see sub-section 4.1.2.1), one can expect approximately **800** HIV patients under psychotherapy. Some patients might have been undergoing a psychotherapy before contracting HIV infection. However, as one can assume that HIV infection is also a central element of their mental health problem, we consider all psychotherapy as related to the HIV infection.

- **Session frequency**

Our estimate of session frequency is also based on the frequency patterns of the CHUV HIV outpatient clinic. Among patients under psychotherapy, approximately **60 %** are seen three times a year and **40 %** once per week (P. Cochand, personal communication, CHUV).

- **Cost of a psychotherapy session**

The average cost of a session varies between **115 Sfr.** (Nomenclature Médicale Tarifée: Position 13) and **150 Sfr.** (Tarifs Vaudois de remboursement des assurances complémentaires: Position 7001). We consider an average cost of **130 Sfr.**

Total psychotherapy costs for Switzerland in 1998 are evaluated at **2.35million Sfr**. This amount would reach **2.94 million** for HIV patients**,** if we consider 1'000 patients rather than 800. This increase would be based on a total number of 10'000 medically followed HIV patients. On the other hand, if we assume that they were 6'800 HIV patients, this would result in a total cost of **2 million Sfr.** for psychotherapy.

[43] Catalan J. Meadows J. and Douzenis A. (2000), The changing patterns of mental health problems in HIV infection, AIDS Care, 12 : 333-341

4.1.2.3 HOME CARE

Home care includes various types of care such as nursing care, ergotherapy, social workers visits, and housework help. Data on HIV and home care are scarce in Switzerland.

Since HIV patients are relatively young, we assume that home care for HIV infected individuals is entirely attributable to HIV infection, 70 % of home care beneficiaries being above 64 (OFAS, 2000).

We derive total home care costs on the basis of:

- **Total number of home care hours for persons living with HIV infection in Vaud and extrapolation for Switzerland**
- **Average cost per hour**

- **Total number of home care hours for persons living with HIV infection in Vaud and extrapolation for Switzerland**

A study estimated the number of HIV infected individuals benefiting from **nursing care** in Vaud to be around **44** in August 1999[44]. Of these, 34 had regular care, i.e., one visit every 2 weeks, while 10 had sporadic visits, i.e., one visit per month on average. This corresponds to approximately **78 visits** on a **monthly basis** or **936** on a **yearly basis**.

As average nursing care visit lasts 30 minutes[45], the corresponding yearly number of home care hours adds up to **468 hours** for Vaud in 1998.

No similar studies exist for the remaining types of home care. We therefore estimated these hours calculating the ratio between nursing care visits and the other types of care, based on official home care statistics of Vaud. The result, a total of **2'476** hours for 1998, is detailed in Table 5.

Table 5: Home care monthly visits in Vaud

Type of Visits	Number of monthly visits	Ratio Nurses visits wrt other visits	Number of monthly visits (HIV patients)	Average length of visit	Total number of yearly hours (HIV patients)
Nurses	31’609	1	78	30 minutes	468
Social workers	2’664	0.08	6	40 minutes	48
Ergotherapist	2’079	0.07	5	50 minutes	50
House work help	77’456	2.45	191	50 minutes	1’910
TOTAL					**2’476**

[44] M.Alberti (1999), l’infection VIH en 1998, Lausanne (unpublished data)
[45] Centres Médico-Sociaux (1997), Les prise en charge médico-sociales intensives à domicile, OMSV, Lausanne

We again apply the 10 % ratio to extrapolate from Vaud to Switzerland. Under this hypothesis, the number of home care hours in Switzerland would be **24'760** for the year 1998.

- **Average cost per hour**

Swiss home care statistics published by the Swiss Federal Office of Social Insurance estimate the Swiss average cost per hour at **72 Sfr**[46].

- **Total costs of home care for persons living with HIV infection in 1998**

We evaluate the total cost of home care for HIV infected individuals at **1.8 million Sfr**. (24'760 hours * 72 Sfr.).

We also examined two different scenarios detailed in Appendix 8. The first one assumes a more extensive use of home care, whereas the second one is more conservative. Their respective costs are **4 million Sfr** and **1 million Sfr.**

4.2 INPATIENT CARE

In this section, inpatient care costs are measured. We differentiate between **hospital care** and **institutional psycho-social care**.

4.2.1 HOSPITAL CARE

In order to assess hospital care costs in Switzerland for the year 1998, we consider the following elements:

- **Number of hospitalisations of HIV infected individuals in Switzerland**
- **Proportion of hospitalisations attributable to HIV/AIDS**
- **Cost per « All Patient Diagnosis Related Group » (APDRG) for HIV/AIDS related diseases**

- **Number of hospitalisations of HIV infected individuals**

HIV infected individuals are hospitalised with a large spectrum of diagnoses and hospitalisations might be **exclusively**, **partially** or **totally unrelated** to HIV/AIDS.

We collected data about all hospitalisations of HIV individuals in Switzerland during 1998, whatever the cause of hospitalisation. The Swiss Federal Office of Statistics (SFOS) provided us with Swiss hospitalisation data of HIV positive patients. Diagnosis classification is currently based on 10th version of the International Classification of Diseases (ICD-10). Swiss hospitals are now required to use ICD-10 for their hospitalisation statistics. **Primary** and **secondary** diagnoses are used to classify hospitalised patients. The primary diagnosis is the main reason for hospitalisation, whereas secondary diagnoses relates to co-morbidity factors.

These statistics have been recently implemented in Switzerland. It is estimated that for the year 1998, the SFOS collected data for 60 % of all Swiss hospitalisations (Gaspoz, personal communication, SFOS). The SFOS registered 1'536 hospitalisations of HIV patients in

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46 Office Fédéral des Assurances Sociales (2000), Statistique de l'aide et des soins à domicile 1998, Berne

Switzerland for the year 1998. Extrapolating this figure to all hospitalisations in Switzerland, we estimate that the number of hospitalisations of HIV patients in Switzerland amounted to **2'560** in 1998.

We differentiate between HIV patients hospitalised with an **HIV primary diagnosis** from those hospitalised with another primary diagnosis, meaning HIV is a **secondary diagnosis**. The former represent **845 cases** or **33 %** of all hospitalisations of HIV patients, and the latter **1'715 cases** or **67 %** of all hospitalisations.

Table 6 displays the 845 HIV primary diagnoses. The most frequent diagnoses are unspecified HIV disease (290 cases or 34 %), HIV disease resulting in multiple infections (85 cases or 10 %), HIV disease resulting in encephalopathy (57 cases or 7 %), and HIV disease resulting in pneunocystis *carinii pneumonia* (53 cases or 6 %).

Table 6: HIV primary diagnoses

ICD-10	Diagnosis	Number of cases
B 24	Unspecified HIV disease	290
B 207	HIV disease resulting in multiple infections	85
B 220	HIV disease resulting in encephalopathy	57
B 206	HIV disease resulting in Pneumocystis *carinii pneumonia*	53
B 208	HIV disease resulting in other infectious and parasitic disease	48
B 238	HIV diseases resulting in other specified conditions	42
B 200	HIV disease resulting in mycobacterial infection	40
B 209	HIV infection resulting in unspecified infectious or parasitic disease	38
B 201	HIV disease resulting in other bacterial infections	37
B 212	HIV disease resulting in other types of non-hodgkin's lymphoma	27
B 204	HIV disease resulting in candidiasis	25
B 227	HIV disease resulting in multiple diseases	18
B 202	HIV disease resulting in cytomegaloviral disease	15
B 230	Acute HIV infection syndrome	13
B 222	HIV disease resulting in wasting syndrome	10
B 203	HIV disease resulting in other viral infections	8
B 231	HIV disease resulting in (persistent) generalised lymphadenopathy	7
B 232	HIV disease resulting in haematological and immunological abnormalities	7
B 210	HIV disease resulting in Kaposi's sarcoma	5
B 221	HIV disease resulting in lymphoid interstitial pneumonia	5
B 205	HIV disease resulting in other mycoses	3
B 211	HIV disease resulting in Burkitt's lymphoma	3
B 213	HIV disease resulting in other malignant neoplasms of lymphoid, haematopoietic and related issue	3
TOTAL		**845**

The most frequent primary diagnoses of hospitalisations with HIV as secondary diagnosis are depicted in Table 7 (see Appendix 9 for a review of all diagnoses). There is a large variety of diagnoses covering 492 ICD-10 codes. This variety is illustrated by the fact that the 10 most frequent diagnoses account for less than 30 % of all diagnoses.

Table 7: Most frequent primary diagnoses with HIV as secondary diagnosis

ICD-10	Diagnosis	Number of cases
F 192	Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances	77
J 159	Bacterial pneumonia	35
F 112	Mental and behavioural disorders due to use of cannabinoids	32
A 630	Anogenital (venereal) warts	30
J 189	Pneumonia	28
R 509	Fever	28
J 013	Acute sphenoidal sinusitis	25
K 85	Acute pancreatitis	25
L 024	Cutaneous abscess, furuncle and carbuncle of buttock	22
O 049	Medical abortion	22
N 871	Moderate cervical dysplasia	17
Z 515	Palliative care	17

- **Proportion of hospitalisations attributable to HIV/AIDS**

In order to estimate the proportion of hospitalisations attributable to HIV infection, we adopted the following five categories reflecting five different causality levels between HIV infection and hospitalisation:

. Exclusively related (100 %)
. Strongly related (80 %)
. Moderately related (50 %)
. Weakly related (20 %)
. Not related (0%)

These percentages will allow us to determine hospitalisation costs attributable to HIV infection. Each primary diagnosis of hospitalisation with HIV as secondary diagnosis was reviewed and classified in one of the five categories. This work was done by medical doctors treating HIV patients[47]. The results are detailed in Appendix 10.

- **Cost per APDRG for HIV/AIDS related diseases**

We rely on APDRGs to estimate hospitalisation costs. APDRGs are a hospitalisation classification scheme originally developed as a means of relating the type of patients a hospital treats to the cost it incurs. Homogenous categories from both a clinical and economic

[47] Dr. G. Greub, CHUV, Dr C. Jaccard, Internal Medicine, Lausanne

perspective have been established. The 12th version APDRG is composed of 25 major diagnosis categories (including one HIV category) and 641 hospitalisation groups[48].

Hospitalisations are classified in APDRGs according to the following variables:

. Diagnoses (primary/secondary),
. Intervention (surgical procedures)
. Age and sex

Cost per APDRG should become the official reimbursement mode for Swiss hospitals within a few years. We have adopted this system to calculate hospitalisation costs because it better reflects actual hospitalisation cost than the current system based on a average reimbursement per day paid to hospitals whatever the diagnosis.

In order to implement this new system, the CHUV, the Hôpital Cantonal de Genève , the Zürich Universitätsspital, the Hôpital de Morges, and the Group of regional hospitals from Canton of Ticino have estimated cost weights for each APDRG. For our calculation, we used the APDRG cost-weights 2nd version[49]. The average unit cost (cost-weight of value 1) has been estimated at **10'000 Sfr[50].** Diagnoses of HIV positive patients hospitalised in Switzerland during 1998 were matched with their corresponding APDRG and cost-weight. This procedure was realised by the SFOS.

- **Total hospital care costs for Switzerland**

Our assessment of hospital care costs related to HIV/AIDS in Switzerland for the year 1998 combines the previous elements. An example of the calculation mode per hospitalisation is provided in Table 8. The primary diagnosis of hospitalised HIV patient is displayed in column two, and the average proportion of hospitalisations attributable to HIV infection in the third column. The corresponding APDRG, and its cost-weight constitute the fourth and fifth column respectively.

Table 8: Cost per APDRG attributable to HIV infection

ICD-10	**Diagnosis**	Average proportion attributable to HIV **(1)**	**APDRG denomination**	**Cost-Weight[51] (2)**	**Total cost (1000)*(1)*(2)**
B 24	Unspecified HIV disease	100 %	HIV with major related diagnosis without multiple major or significant diagnosis without TB	1.26	12'600
B 207	HIV disease resulting in multiple infections	100 %	HIV with multiple major related infections	6.34	63'400

48 Major groups are detailed in Appendix 11
49 Institut d'Economie et de la Santé (2000), Manuel APDRG Suisse: version 2.0, Lausanne
50 H. Guillain, Personal communication, Institut d'Economie et de la Santé, Lausanne
51 For the same diagnosis, the cost-weight might vary according to the average hospital length of stay

			without TB		
F 192	Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances	20 %	Cocaine or other drug abuse or dependence with complications	0.68	1’360
J 159	Bacterial pneumonia	80 %	Respiratory disorder except infections, bronchitis, asthma with major complications.	1.8	14’400

We obtain hospitalisation costs by multiplying together the average proportion attributable to HIV infection, its respective cost-weight and the average cost-weight (10'000 Sfr)

We evaluate total hospital care costs related to HIV infection in Switzerland to be **32.3 million Sfr**. for the year 1998. Detailed data are presented in Appendix 12.The average cost per hospitalisation for patients with an HIV primary diagnosis is **24’000 Sfr**. This amount is lower for HIV patients hospitalised with a primary diagnosis other than HIV. The average cost per hospitalisation attributable to HIV is **7’100 Sfr**., whereas the overall cost per hospitalisation is estimated at **14’800 Sfr**.

Since defining the extent to which a diagnosis is related to HIV is somewhat arbitrary, we also consider the two extremes in which only AIDS defining conditions are included and another in which any cause of hospitalisation of HIV patients is assumed to be entirely related to HIV infection. Total hospitalisation would amount to **20.15 million Sfr** and to **45.59 million Sfr.** respectively.

4.2.2 SPECIALISED INSTITUTIONAL PSYCHO-SOCIAL CARE

Finally, we assess costs resulting from specialised institutional psycho-social care for HIV patients. “Le Soleil Levant”, an example of such an institution in Lausanne, provides psycho-social support, palliative care, adaptation to therapies and follow up for hospitalisation. We consider the type of care as inpatient care globally, since ambulatory care represents only a small portion of the services provided by the “Soleil Levant”.

We derive our assessment of specialised institutional psycho-social care at the Swiss level from the “Soleil Levant” institution. Since such institutions are specialised in psycho-social care for persons living with HIV infection, we consider the care they provide as entirely attributable to HIV infection. Psycho social support activities at the Soleil Levant corresponded to 2’771 inpatient days and 381 outpatient days in 1998. Costs associated with such activities are estimated at **430’000** Sfr[52]. Extrapolating to the Swiss level means that this type of care represented approximately **4.3 million** Sfr. in 1998. Our extrapolation, based on the assumption that Vaud costs represent 10 % of Swiss costs, might be questionable because institutions like the “Soleil levant” do not exist in every Swiss canton. Therefore, institutional psycho-social care costs might be overestimated. This may be balanced by the fact that there are other parallel psycho-social structures which we have not considered. Assuming that our cost assessment overestimates total institutional psycho-social care by approximately 20 %,

[52] Monique Prahin, personal communication, Le Soleil Levant, Lausanne

means that total cost would be **3.44 million Sfr**. Alternatively, total institutional psycho-social care would reach **5.16 million Sfr**. if we actually underestimate costs by the same proportion.

4.3 DIRECT COSTS: SUMMARY AND DISCUSSION

Total direct costs attributable to HIV/AIDS in Switzerland amounted to approximately **168 million Sfr.** for the year 1998**.** Alternative assumptions, detailed in the previous sub-sections, were also examined. More conservative hypotheses would result in a **total cost** of **143 million Sfr**, whereas it would reach **201 million Sfr.** under less conservative assumptions, as illustrated in Table 9.

One central result presented in Table 9 is the importance of **antiretroviral costs**, estimated at **91.4 million Sfr.,** emphasized by the fact that they account for more than **50 %** of total direct costs. In addition, their share remain significant under both alternative scenarios. One of the consequence of the magnitude of antiretroviral drug costs is that outpatient care costs exceed inpatient care costs. The different **outpatient care** categories add up to **132 million Sfr**. whereas **inpatient care** reaches **36 million Sfr**. **Medical visit costs**, the second outpatient main category, are significantly lower than antiretroviral costs and amount to **24 million Sfr.** Finally, **Hospital care costs**, the major inpatient cost component, are estimated at **32 million Sfr.**

This cost pattern is not unique to Switzerland. Bozette et al. (2000), in their study assessing HIV medical care costs in the United States, estimate that drug costs account for about **50 %** of total direct medical costs. Prior to the introduction of HAART therapy, costs patterns were characterised by the importance of hospital care costs. Postma et al. (1995) estimated that hospital care costs, in 1993, represented up to 85 % of total direct costs in the Netherlands. The transfer from inpatient to outpatient care cost is confirmed by the observational cohort study of Gebo et al. (1999) who found that, between 1995 and 1997, hospital inpatient payments decreased significantly for patients under HAART whereas pharmacy payments increased significantly.

Table 9: Direct cost components (Sfr.)

Direct cost components	Lower Bound Scenario	Percentage	Main scenario	Percentage	Higher Bound Scenario	Percentage
OUTPATIENT CARE						
HIV related drug treatments						
Antiretroviral drugs	86’830’000	61 %	91’400’000[53]	54 %	95’970’000	48 %
Co-morbidity drugs	8’683’000	6 %	9'140’000[54]	6 %	9’597’000	5 %
Co-medication	-	-	2’292’000	2 %	7’300’000	4 %
Medical and Para-Medial Care						
Ambulatory medical visits	20’400’000	14 %	24’000’000	14 %	30’000’000	15 %
Psychotherapy	1’998’000	2 %	2’350’000	1 %	2’938’000	1 %
Home care	1’080’000	1 %	1’780’000	1 %	4’080’000	2 %
TOTAL OUTPATIENT CARE	**118’991’000**	**84 %**	**131’590’000**	**78 %**	**149’885’000**	**75 %**
INPATIENT CARE						
Hospital care	20’150’000	14%	32'290’000	19 %	45’590’000	23 %
Institutional psycho-social care	3’440’000	2 %	4’300’000	3 %	5’160’000	3 %
TOTAL INPATIENT CARE	**23’590’000**	**16 %**	**36’590’000**	**22 %**	**50’750’000**	**26 %**

[53] This figure represents a global estimate communicated by Pharma Information (see sub-section 4.1.1). We consider a variation of plus or minus 5 % of the standard amount
[54] For both alternative scenarios, we still assume that co-morbidity drugs represent 10 % of antiretroviral drugs

TOTAL COSTS	**142’581’000**	**100 %**	**168’180’000**	**100 %**	**200’635’000**	**100 %**

One question arising is whether the increase in antiretroviral drug costs over the last years has been outweighed by a decrease in hospital care costs. Bozette et al. (2000) provide a positive answer to that question. They conclude that on average, annual heath care expenditures per HIV patient in the United States declined from **20’300 USD** in 1996 (1 USD = 1.24 Sfr., 1996) to **18’300 USD** in 1998 (1 USD = 1.45 Sfr., 1998). However, this difference is not very large and one should be cautious when generalizing this result to other countries.

In Switzerland, we estimate annual direct costs per HIV patient at **21’000 Sfr.** (171’229’000 Sfr./8’000 patients) for the year 1998. Güntert et al. (1997) evaluated at **70’500 Sfr**. the lifetime cost of treating an HIV patient prior to the introduction of effective antiretroviral treatments. As they assumed a life expectancy of 12 years for HIV infected patients, this means an average annual cost per patient of **5’875 Sfr.** On the basis of this figure, one might consider that HAART costs are not outweighed by a corresponding decrease in hospitalisation costs. However, one should bear in mind that different methodologies were used, and that a long time period separates both studies. Güntert et al. cost assessment reflect the lifetime cost of patients deceased between 1991 and 1993. Therefore, these patients did not actually benefit from antiretroviral drugs. Since then, HIV disease prognosis has so drastically changed, that a comparison relying only on costs is not very meaningful, and one should also take into consideration life expectancy gains resulting from HAART introduction.

As mentioned above, the annual cost per HIV infected patient is substantial and amounted to **21’000 Sfr**. in Switzerland for the year 1998. However, total HIV direct costs at Swiss level are inferior to other public health concerns such as tobacco related diseases and stress. Direct costs associated with tobacco related diseases were evaluated at 1’211 million Sfr. in 1995 (Frei, 1998). The amount for stress direct costs is even more important and was estimated at 1’761 million Sfr. in 1998 by Ramaciotti and Perriard (2000). The relatively low HIV prevalence explains this phenomenon.

All in all, HIV infection direct costs accounted for approximately **0.5 %** of total Swiss health care costs (37 billion Sfr) in 1998. This result was relatively similar for the United States where HIV total direct costs were estimated at 6.8 billion (Bozette et al., 2000), representing around **0.6 %** of total US health care expenditures in 1996. One should not however conclude that HIV direct costs are not important. The annual cost per patient remains high (21’000 Sfr.) and prevention cannot be neglected within the frame of a public health policy.

Finally, one limitation of our cost assessment stems from the fact that it does not include direct non health care costs. The latter are non-health care resources consumed as a part of an health care intervention (Gold et al. 1996). They include, for example, transportation cost to and from the outpatient clinic and costs resulting from a specific dietary prescription.

5 INDIRECT COSTS

In this chapter, indirect costs attributable to HIV infection in Switzerland are measured. Assessing indirect costs requires the evaluation of the following elements:

- Morbidity costs which relate to lost or impaired ability to work
- Mortality costs which are associated with premature death

Morbidity and mortality costs represent the value of goods and services that HIV positive individuals would have produced had they not contracted the disease.

In what follows, we describe our methodological approach. Then, we move on to the presentation of the results, and finally summarize and discuss our major findings.

5.1 METHODOLOGY

We adopt the **human capital** approach to assess indirect costs. **Human capital** refers to the productive capacities of human beings as income producing agents in the economy[55]. Human capital is the stock of skills and productive knowledge embodied in people. This method is a standard one and has been used for many years. It measures productivity losses to society, using market wage. Since this approach focuses on market activities, productivity losses are not calculated beyond the age of retirement.

Under the **human capital** approach, assessing **morbidity costs** involves estimating lost workdays attributable to HIV infection in 1998, and then applying an economic value, i.e., market wage rate, to these lost workdays. **Mortality cost** measurement combines the number of deaths caused by the HIV infection in 1998 and an economic value of each potential year of life lost. Notice that time horizon differs between morbidity and mortality cost assessment. The former relates to work days lost during 1998 while the latter corresponds to the number of potential years of life lost by HIV individuals deceased in 1998. Since we assess future potential earnings, the latter are discounted.

Discounting is the process of converting future earnings into their present value. A higher discount rate signifies that future outcome is valued less than the immediate one, or in other words, it reflects a higher preference for the present. The choice of the discount rate is a matter of substantial debate. One differentiates between the social opportunity cost approach and the social rate of time preference (Drummond et al. 1996). The former is based on the real rate of return to society foregone in the private sector. The latter is a measure of society's willingness to forego consumption today in order to have greater consumption tomorrow. Interest rate on a risk-free investment such as long term government bonds is commonly accepted as reflecting social rate of time preference.

In practice, a rate of 5 % has commonly been used in health economics evaluations. Recent official recommendations tend however to favour lower discount rates. For instance, the US

[55] S. Rosen, Human Capital, in: The New Palgrave: Social Economics, J. Eatwell, M. Milgate, P. Newman,MacMillan, 1990, Hong-Kong

Public Health Service Panel on Cost-Effectiveness in Health and Medicine (Gold et al. 1996) estimates that 3 % would be the most appropriate real discount rate for economic evaluation. In our study, we consider a rate of **3 %** as our baseline for discounting future potential earnings. This rate reflects the rate of return on long term Confederation bonds. Alternative discount rates of 0 % and 5 % are also applied to discount future potential earnings.

Another element to be taken into consideration when estimating future potential earnings is the **annual growth rate**. The **growth rate** captures the notion of future productivity growth. Since the human capital approach assumes that market wage rate reflects marginal productivity, applying a growth rate to future earnings allows to account for future productivity gains. We adopt a **growth rate** of **2 %,** corresponding to the forecasted average Gross Domestic Production (GDP) growth until 2005 by the Institute of Economic Research (BAK), Basel.

5.2 MORBIDITY COSTS

Morbidity costs associated with HIV infection in Switzerland during 1998 are estimated for permanent disability (full or partial) and temporary disability until the age of 64. Our main source of information are the SHCS data and the Enquête Suisse sur la Population Active (ESPA)[56].

The SHCS data base provides information on patients' income resources and working rates. Data were analysed for 4'166 individuals. To assess lost productivity due to HIV infection, we compare the working rate of SHCS patients with the corresponding rate in the general population, and then value productivity losses using market wage. When comparing both groups, labour force participation rates for different age groups and shifting patterns of earning at successive ages are taken into consideration. We rely on the ESPA for data on general population labour force participation and market wage. The median annual gross income of the general population is displayed in Table 10.

Table 10: Median annual gross income: general population

Age	Median annual gross income (full time)
	46'000 Sfr.
15-24	65'000 Sfr.
25-39	74'000 Sfr.
40-54	75'400 Sfr.
55-69	40'500 Sfr.

Source: Enquête Suisse sur la Population Active (1998), Office Fédéral de la Statistique, Neuchâtel

[56] Office Fédéral de la Statistique (1999), Enquête Suisse sur la Population Active : Résultats Commentés et Tableaux, Neuchâtel

The results obtained for SHCS patients are then extrapolated to the estimated 8’000 HIV patients in Switzerland. We assume that morbidity losses for HIV infected persons not medically followed are similar to those of the general population.

On the average, the mean working rate of HIV infected individuals reached **50 %** in 1998. By comparison, this rate was around **70 %** for the general population aged between age 20 and 64. Morbidity losses at Swiss level are depicted in Table 11. These results show that morbidity costs are the most important within the age group 30-40 years old. The morbidity cost per patient is estimated at **14’400 Sfr**. (115’000’000 Sfr./8’000 patients). Details of the calculation are displayed in Appendix 13.

Table 11: Morbidity lost market activities attributable to HIV infection, 1998

Age	Morbidity losses at Swiss level
20-24	1’290’000 Sfr.
25-29	11’743’000 Sfr.
30-34	30’203’000 Sfr.
35-39	35’685’000 Sfr.
40-44	19’800’000 Sfr.
45-49	8’342’000 Sfr.
50-54	3’132’000 Sfr.
55-59	2’733’000 Sfr.
60-64	2’172’000 Sfr.
TOTAL	**115’100’000 Sfr.**

The figure of **115 million Sfr**. illustrates the costs for a total number of 8’000 HIV patients in Switzerland. If we consider a total number of patients of either 6’800 or 10’000 as in sub-section 4.1.2.1, total morbidity costs would then amount to 97.9 million Sfr. or 144 million Sfr., respectively.

5.3 MORTALITY COSTS

According to the SFOPH, AIDS caused **140 deaths** in the 20-64 years old age group in Switzerland during 1998. The corresponding number of potential years of life lost, depicted in Table 12, amounts to 3'505. Deceased individuals are relatively young, the mean age at death being 40 years.

Table 12: Potential life years lost between 25 and 64 years old, 1998

Age	Number of death cases	Potential life years lost
25-29	13	481
30-34	30	931

35-39	45	1'230
40-44	23	523
45-49	11	184
50-54	10	119
55-59	4	27
60-64	4	10
TOTAL	**140**	**3'505**

Based on a discount rate of **3 %,** an annual growth of **2 %**, and adjusting for labour force participation, earning patterns and survival probability, the present value of total loss of future production is estimated to be **160 million Sfr** at the Swiss level, as shown in Table 13 (see Appendix 14 for the details). Since death occurs at a relatively young age, the average cost per death is substantial.

Table 13: Mortality lost market activities attributable to HIV infection, 1998

Mortality Costs	**At Swiss level**	**Average cost per death**
Market losses	160'040'000 Sfr.	1'143'000 Sfr.

Alternative discount rates of 0 % and 5 % were also examined. Mortality costs would reach **241.67 millions Sfr** with a **0 %** discount rate, whereas they would amount to **126.92 million Sfr** with a **5 %** discount rate.

5.4 INDIRECT COSTS: SUMMARY AND DISCUSSION

In 1998, total indirect cost amounted to **275 million Sfr**. in Switzerland, as depicted in Table 14. Under alternative scenarios, total indirect cost range from **225 million Sfr.** to **385 million Sfr.** These scenarios rely either on other HIV patients figures or on different discount rates.

Table 14: Total morbidity and mortality lost market activities in Switzerland, 1998

Indirect Costs	**Lower Bound Scenario**	**Main Scenario**	**Higher bound Scenario**
Morbidity costs	97'920'000 Sfr.	115'100'000 Sfr	144'000'000 Sfr.
Mortality costs	126'923'000 Sfr.	160'040'000 Sfr	241'166'000 Sfr.
Total Costs	224'843'000 Sfr.	275'140'000 Sfr.	385'166'000 Sfr.

Similarly to direct costs, HIV infection indirect costs per patient are significant. Morbidity cost per patient is estimated at **14'400 Sfr**. and the average cost per death at above **1 million Sfr**.

Hansvelt et al. (1994) estimated the average cost per death for HIV infection at **558'000 USD** in Canada (1 USD = 1.37 Sfr. 1994), a figure relatively close to ours. The young age of deceased individuals contributes to the fact that average cost per death is quite substantial for AIDS. Hansvelt et al., who also examined other causes of death such as ischaemic heart diseases, suicide, motor vehicle accidents, and lung cancers, found that cost per death of all these health conditions was lower than for AIDS.

As with direct costs, HIV indirect costs at Swiss level are less important in comparison with other public health concerns such as tobacco consumption and stress. Indirect costs related to tobacco consumption in Switzerland were estimated at **4'416 million Sfr** (Vitale et al. 1998). This study included the measurement of lost non-market activities. Ramaciotti et Perriard (2000) evaluated indirect costs of stress at **2'433 million Sfr**. The scope of HIV indirect costs tends to be similar to the one of asthma. Szucs et al. (1999) estimated asthma indirect costs in Switzerland at **490 million Sfr**.

Several methodological limitations should be noted in the context of our analysis. First, SHCS data on working rates of persons living with HIV infection are self-reported data by SHCS patients. Data on severely ill individuals unable to work and missing SHCS follow-up visits because of their health state should therefore be missing. This may cause the actual working rate of individuals living with HIV infection to be overestimated.

Second, persons with HIV are assumed to have had the same earnings and labour force participation rates as the overall Swiss population. This may however not be true since it has been noted that, on the average, homosexual men who represent up to 35 % of HIV infected individuals[57], are likely to have higher average earnings[58]. On the other hand, other HIV subpopulations such as injecting drug users may be expected to have lower than average income profile. Whether these two effects counterbalance each other is not known.

Third, we also assume that persons living with HIV infection have had the same life expectancy than the general population. Since many HIV patients tend to suffer from co-morbidities such as chronic hepatitis C infection, (37 % of SHCS patients receiving antiretroviral therapy are coinfected with chronic hepatitis C[59]) or have high risk behaviours, (25 % are injecting drug users[60]), mortality costs might therefore be overestimated.

Fourth, our estimate was restricted to indirect costs associated with the lost value of market output among individuals aged 25-64 years old. The **human capital approach** does not value time not sold for a wage. In other words, skills utilised outside the market sector such as house work, child education, care to family members etc. are not valued by the human capital approach. The monetary assessment of these activities in Switzerland has been undertaken by

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57 P. Sudre et al. (2000), The Swiss HIV cohort study: Semi-annual report on recruitment and follow-up, SHCS Data Centre, Lausanne

58 Scitovsky A., Rice D. (1989), The cost of AIDS: an agenda for research, *Health Policy* vol. 11 : 197-208

59 Greub et al. (2000), Clinical progression, survival, and immune recovery during antiretroviral therapy in patients with HIV-1 and hepatitis C virus coinfection: the Swiss HIV cohort study, *The Lancet*, vol. 356 : 1800-1805

60 P. Sudre et al. (2000), The Swiss HIV cohort study: Semi-annual report on recruitment and follow-up, SHCS Data Centre, Lausanne

Schmid et al. (1999). They found that non market activities represented in 1997 between **38 %** and **58 %** of the Swiss Gross Domestic Product. Relying on the estimate of Schmid et al (1999) gives a general sense of the losses associated with non-market activities. If we remain conservative and assume that on the average non-market activities correspond to **38 %** of earnings, non-market activity would be estimated at **104,5 million Sfr**. (morbidity and mortality altogether) in Switzerland. All in all, we consider our estimate of **275 million Sfr**. for indirect costs related to HIV infection in Switzerland for the year 1998 as prudent and even conservative.

6 SUMMARY AND CONCLUSION

In this section we summarize our main points, and then we move on to a discussion of some policy implications of our results.

The aim of Part I was to assess HIV social cost for the year 1998. The assessment of HIV social cost in 1998 relied on a "Bottom-Up" model which reassembles the different components of the social cost. Our evaluation of social cost focused on HIV direct and indirect costs. Since methodologies for estimating intangible costs are quite complex to implement and the results often difficult to interpret, particularly in a context of ongoing changes as is the case for HIV, we have not included such costs in our study. Although we did not incorporate prevention costs in the social cost, such costs were included in our study for comparison with other cost categories.

We initially undertook a general overview of HIV epidemiology in Switzerland. HIV epidemiology has significantly changed over the last years. The years 1995-1998 are characterized by a decrease in new HIV and AIDS cases, and a decline in AIDS mortality. The decline in new AIDS cases and AIDS mortality is clearly associated with the introduction of HAART.

Our estimate of HIV prevention costs at the Swiss level in 1998 ranges from **41** to **62 million Sfr**., as illustrated in Table 15 summarising the different cost categories. Despite the fact that we concentrated only on the main prevention programmes, the above figures demonstrate that HIV prevention expenses are quite substantial. On the basis of conservative assumptions, we evaluated the cost of avoiding one HIV case at around **71'210 Sfr**.

As for direct costs displayed in Table 16, one central result is the importance of antiretroviral costs**, estimated at** 91 million Sfr**., and accounting for more than 50 % of total direct costs, evaluated at** 168 million Sfr**. This phenomenon illustrates a transfer from inpatient to outpatient care. Prior to the introduction of HAART, hospital care costs represented the main share of direct costs. For instance, they represented in 1993 up to 85 % of total direct costs in the Netherlands (Postma et al., 1995). HAART introduction reversed this situation. We estimate that hospital care costs, in Switzerland, represented** 32 million Sfr**. or 19 % of total HIV direct costs in 1998. Taken together, HIV direct costs accounted for approximately 0.5 % of total Swiss health care costs. One should not however conclude that HIV direct costs are unimportant. The annual cost per patient, evaluated at** 21'000 Sfr**. in Switzerland, remains high.**

We furthermore examined indirect costs, i.e., morbidity and mortality costs, and adopted the human capital approach to evaluate them. Both morbidity and mortality costs were assessed for individuals until the age 64. Productivity losses associated with HIV morbidity were estimated at **115 million Sfr**. in 1998, whereas mortality costs were evaluated at **160 million Sfr.,** as displayed in Table 16. It should be noted that our estimate is conservative since we only considered losses resulting from market activities.

Table 15 : Prevention cost components (Sfr.)

COST COMPONENTS	Lower Bound Scenario	Main scenario	Higher Bound Scenario
Primary prevention	21’060’000	27’525’000	33’990’000
Secondary Prevention	19’972’000	25’453’000	28’423’000
TOTAL PREVENTION COSTS	**41’032’000**	**52’978’000**	**62’413’000**

Table 16 : Direct and indirect cost components (Sfr.)

COST COMPONENTS	Lower Bound Scenario	Main scenario	Higher Bound Scenario
OUTPATIENT CARE			
HIV related drug treatments	95’513’000	103’460’000	112’867’000
Medical and Para-Medial Care	23’478’000	28’130’000	37’018’000
TOTAL OUTPATIENT CARE	**118’991’000**	**131’590’000**	**149’885’000**
INPATIENT CARE			
Hospital care	20’150’000	32'290’000	45’590’000
Institutional psycho-social care	3’440’000	4’300’000	5’160’000
TOTAL INPATIENT CARE	**23’590’000**	**36’590’000**	**50’750’000**
TOTAL DIRECT COSTS	***142’581’000***	***168’180’000***	***200’635’000***
MORBIDITY COSTS	97’920’000	115’100’000	144’000’000
MORTALITY COSTS	126’923’000	160’040’000	241’166’000
TOTAL INDIRECT COSTS	***224’843’000***	***275’140’000***	***385’166’000***
SOCIAL COSTS	**367’424’000**	**443’310’000**	**586’301’000**

We estimate HIV social cost at **443 million Sfr**. (direct and indirect costs) in Switzerland for the year 1998. Under alternative assumptions, reflecting either more or less conservative views, social cost was estimated at **367** and **586 million Sfr.,** respectively. We consider our estimate of HIV social cost as reliable and even rather conservative.

The annual cost per patient is high, **21'000 Sfr**. and **14'400 Sfr**. for direct and morbidity costs, respectively. In addition, since HIV infection affects relatively young people, average cost per death due to AIDS is one of the highest among all causes of death. HIV infection cannot therefore be neglected within the frame of a public health policy. The success of prevention during the last years contributed to decrease current HIV social costs. It may be noted that our estimate of cost per avoided HIV case (71'210 Sfr.) corresponds approximately to 3.4 years of inpatient/outpatient care costs. Thus nowadays avoiding a HIV case costs less than a lifetime treatment of an infected patient. As mentioned, our estimate of prevention costs is rather conservative. Therefore, we also assessed the cost per avoided HIV case, as displayed in Table 17, assuming larger HIV prevention budgets. We also do consider different effects of prevention with regards to the decline of new HIV infection cases. We adopted 1991 as our baseline year because it corresponds to a peak in the number of new HIV infections in Switzerland. There were, in 1991, 2144 new HIV infection cases and only 657 in 1998, i.e. a decrease of 1'487 cases. We examine the hypotheses that between 10 % to 90 % of the reduction in the number of HIV infection cases is attributable to prevention. For instance, assuming that prevention is at the origin of 75 % of the 1'487 avoided cases, means that the cost per avoided case amounts to **47'510 Sfr**. under the hypothesis that prevention budget totals 52.978 million Sfr., and to **95'020 Sfr.**, if we were to consider a prevention budget of 105.956 million Sfr.

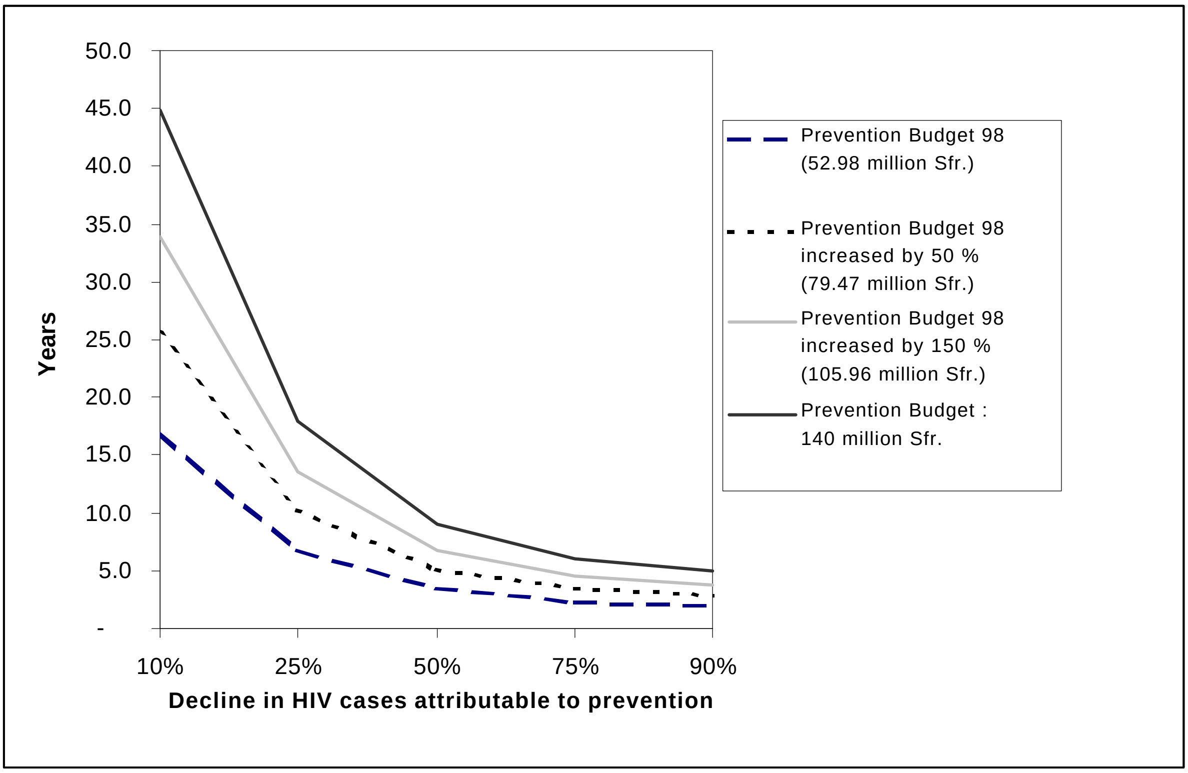
Table 17: Cost per avoided HIV case

Decline in new HIV infection cases attributable to prevention	Cost per avoided HIV case Budget 98: 52.978 million Sfr	Cost per avoided HIV case Budget 98: + 50 % 79.467 million Sfr.	Cost per avoided HIV case Budget 98: + 100 % 105.956 million Sfr.	Cost per avoided HIV case Vitali et al. (1997) 140 million Sfr.
10 % (149 cases)	355'560 Sfr.	533'340 Sfr.	711'110 Sfr.	939'600 Sfr.
25 % (372 cases)	142'410 Sfr.	213'620 Sfr.	284'820 Sfr.	376'340 Sfr.
50 % (744 cases)	71'210 Sfr.	106'820 Sfr.	142'420 Sfr.	188'170 Sfr.
75 % (1'115 cases)	47'510 Sfr.	71'270 Sfr.	95'020 Sfr.	125'560 Sfr.
90% (1'338 cases)	39'590 Sfr.	59'390 Sfr.	79'190 Sfr.	104'630 Sfr.

Figure 5 indicates after how many years the cost per avoided HIV case equates the annual health care costs per patient. For instance, under the hypothesis that 90 % of the decline in HIV cases is attributable to prevention and that the prevention budget reaches 52.98 million Sfr., the cost per avoided HIV case would correspond to 1.9 years of health care treatment. In contrast, assuming that only 10 % of the reduction in new HIV cases is the result of prevention and that the prevention budget amounts to 140 million Sfr., the cost per case avoided would equate annual health care costs after 44.8 years. One can notice that under the relatively conservative assumption that prevention only contributes to 50 % of the decrease in the number of new HIV infection cases, the break-even point is reached after 3.4 to 9 years.

This makes prevention a cost-effective intervention, under the hypothesis that life expectancy of a patient under treatment is longer than 10 years.

<u>Figure 5: Yearly health care costs per patient and Cost per avoided HIV case</u>



These results underline the importance of prevention and we strongly believe that prevention should not be neglected as a tool to limit social cost. This is particularly true within the current context suggesting a certain disregard of HIV prevention messages illustrated by the increase in the number of sexual transmitted diseases like gonorrhoeae[61]. Similarly, recent studies undertaken within the framework of the evaluation of the AIDS prevention strategy in Switzerland show that high risk sexual behaviour has not further decreased, and has even slightly risen among homosexuals (F. Dubois-Arber, personal communication, IUMSP, Lausanne).

Another element emphasized by our study is related to the number of HIV infected individuals not under antiretroviral drug treatment. Knowing that the number of HIV positive individuals living in Switzerland is estimated at between 11'000 and 21'000 (SFOPH, 1999), and that we evaluate the number of HIV treated patients at 6'100 in Switzerland, demonstrate that a relatively important number of HIV infected individuals are not under antiretroviral drug treatments. Our data and the framework of the study did not allow us to further investigate this interesting public health issue. However, our estimate should be treated very carefully due to the lack of data.

[61] Office Fédéral de la Santé Publique (2001), Déclaration de maladies infectieuses, Berne

One should also take into account treatment recommendations. In 1998, the SFOPH[62] recommended antiretroviral treatment for individuals with a CD4 cell count under 500 x 10^6/l. Individual who do not fall in this category maintain a certain immunity and therefore do not necessarily need to be treated. However, their number cannot explain the difference between the total number of individuals living with HIV infection and the number of treated patients. Further research should be undertaken in order to obtain more accurate figures and to determine the reasons why a fraction of HIV positive individuals are not receiving antiretroviral treatment. This question should be answered since it addresses the general issue of access to health care.

[62] Office Fédéral de la Santé Publique (1998), Sous-commission clinique de la commission fédérale pour les problèmes liés au SIDA: Recommandations pour le traitement de l'infection à VIH en 1998, *Bulletin OFSP*, 44 : 5-9

PART II:
HIV SOCIAL COST: PROJECTIONS FOR 2001 & 2005

INTRODUCTION

In the previous chapters, we have established that the 1998 social cost (direct and indirect costs) of the HIV disease amounted to **443 million Sfr.**. We shall consider, in this second part, future HIV social cost. The ongoing changes and progress over the last ten years demonstrate that long term projections are hazardous, so we shall focus on a short time span and estimate social cost for the years 2001 and 2005.

The future cost per patient and the demography of the HIV epidemic in the forthcoming years are the two central elements for the determination of the future social cost of the disease. As for the cost per patient, our projections are based on the current state of knowledge on HIV infection. Therefore, the current HIV drug potency is assumed to remain unchanged in the forthcoming years. To assess future development of the HIV epidemic in Switzerland, we rely on the SHCS cohort. In particular, we hypothesize that the yearly number of new HIV infection cases will remain similar to the level of 2000.

To project patients disease evolution, we rely on a mathematical model that describe patients' transition between different health states. To assess future social cost, we estimate a cost (direct and indirect) per unit of time for each health state, and multiply the latter by the expected time spent by individuals in each health state. We apply our model to SHCS individuals, and then extrapolate SHCS costs to the Swiss level.

One can expect that both the future cost per patient and the demography of HIV epidemic will affect future social cost. On the one hand, the cost per patient is likely to decrease in the forthcoming years. This is because HIV patients are now benefiting from potent drugs such as HAART, which decreases the reliance on hospitalisations. On the other hand, as a result of the combined effect of HAART and of the yearly number of ongoing new HIV infection cases, the number of individuals living with the HIV infection will tend to grow over time, resulting in a potential increase of the social cost. Whether these two effects counterbalance each other is what we shall examine in the following sections.

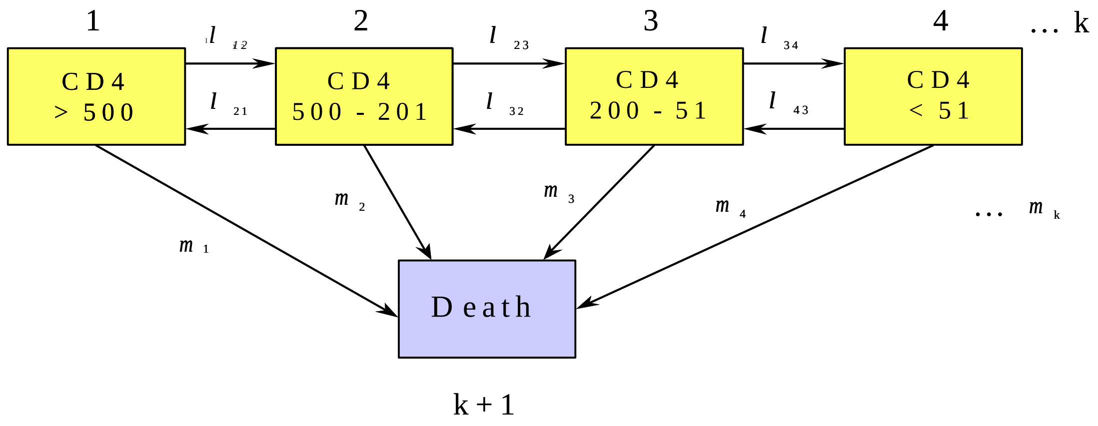
In the following, we first describe the mathematical model and then present, for each cost component, the results of our projections. We begin our presentation with prevention, move on with direct and indirect costs, and finally undertake a discussion of our results. In the discussion, we address the possibility that major changes could take place in the treatment and demography of HIV by the year 2005.

1 THE MULTI-STATE MARKOV MODEL

To describe the HIV disease evolution over time, we consider a continuous time stationary Markov model with five discrete health states. In this model, individuals are at any time in one of a finite set of states of health, and individuals move from state to state according to a set of transition probabilities. Death is a particular state called “absorbing state”. The stationarity assumption signifies that transition intensities do not depend on time, and therefore ageing process is not taken into account, which holds true for relatively short time periods.

The model is depicted in Figure 6. Each transient health state is defined by a CD4 cell count category corresponding to a clinical level of disease severity. Patients move from state to state according to transition intensities $l_{i,j}$ with i, j = 1..4, for the transient states, and m_i with i = 1..4, for the absorbing state. Data about patients’ CD4 cell counts are provided by the SHCS data base. The model, based on the SHCS data, was estimated by the method of maximum likelihood. This type of model is particularly useful for analysing data that are irregularly spaced in time and that are strongly censored. Characteristics of the process such as survival function, hazard function, waiting time in the different health states, and mean total time spent in the health states were determined. A detailed presentation of the model, of the results of the transition rates estimation, and of various functions is given in Appendix 15.

<u>Figure 6: A Multi-State Markov Model of HIV Disease Evolution</u>



The estimated annual transition probabilities for SHCS cohort (treated or non treated) between the different health states are presented in Table 18. The first column details the different CD4 cell count categories. The transition probabilities are displayed in the third up to the fifth columns. For instance, an hypothetical individual with a CD4 cell count above 500 x 10^6/l in the beginning of the year, has after one year a probability of 56.69 % to remain in the same CD4 stratum, of 36.68 % to move to the 500-201 x 10^6/l CD4 category, of 5.7 % to be in the 200-51 x 10^6/l CD4 category, of 0.45 % to be in the CD4 cell count category below 51 x 10^6/l, and 0.48 % to decease.

An interesting result is that individuals have a greater probability to remain in the same CD4 stratum or to attain a superior one than to end up in a lower CD4 stratum.

Table 18: Transition matrix from 01.01.01 to 31.12.01

CD4 cell count category	December 31st	> 500 x 10^6/l	500-201 x 10^6/l	200-51 x 10^6/l	< 51 x 10^6/l	Death	
January 1st							
> 500 x 10^6/l		56.69 %	36.68 %	5.7 %	0.45 %	0.48 %	**100 %**
500-201 x 10^6/l		32.55 %	51.91 %	12.93 %	1.43 %	1.19 %	**100 %**
200-51 x 10^6/l		17.27 %	44.15 %	29.76 %	5.83 %	2.99 %	**100 %**
0-50 x 10^6/l		7.78 %	27.94 %	33.37 %	19.55 %	11.36 %	**100 %**
Death		0 %	0 %	0 %	0 %	100 %	**100 %**

To make projections of future social cost, one must formulate hypotheses about the future demographic evolution of the SHCS, that is, the annual number of patients joining the SHCS (incident cohort cases), the survival of the prevalent cohort of 1998 and of incident cohort cases, and finally the number of patients lost to follow-up who, consequently drop out of the SHCS.

The number of incident cohort cases and lost to follow up is available in the SHCS data base until the year 2000. For the year 2001, we assume that the number of incident cohort cases and their CD4 structure at entry are the same as in 2000. Concerning patients lost to follow-up, we hypothesize that the drop out process is at random, which holds approximately true for the patients lost to follow-up in 2000, and that their number is the same as in 2000, i.e., 250 patients. The survival until January 1st, 2001 and beyond 2001 of the prevalent cohort of 1998 and incident cohort cases is determined, using our estimated Markov model. For the year 2005, we adopt the same approach and again consider the number of incident cohort cases to be the same as in 2000 and the drop out process to be at random.

The expected number of patients in the different CD4 stratum on December 31st, 2001 and 2005 are depicted in Table 19. The following two elements from the results presented in Table 19 should be emphasized. First and foremost, the number of patients rises from 4’569 to 5’143 in 2001, and to 5’898 in 2005 (see Appendix 16 A and 16 B for the details). Second, CD4 cell count of SHCS individuals increases. The proportion of individuals in the CD4 stratum > 500 x 10^6/l rises from 26.6 % to 39.8 %. Furthermore, the proportion of individuals in low CD4 cell count categories tends to decrease. These results pertain to the potency of HAART. This trend becomes less apparent when comparing the figures for 2001 and 2005.

Note that the hypothesis of a constant number of incident cohort cases and of a similar CD4 cells distribution beyond 2000, as well as the stationarity assumption, all contribute to the fact that the model converges quite rapidly to a steady state.

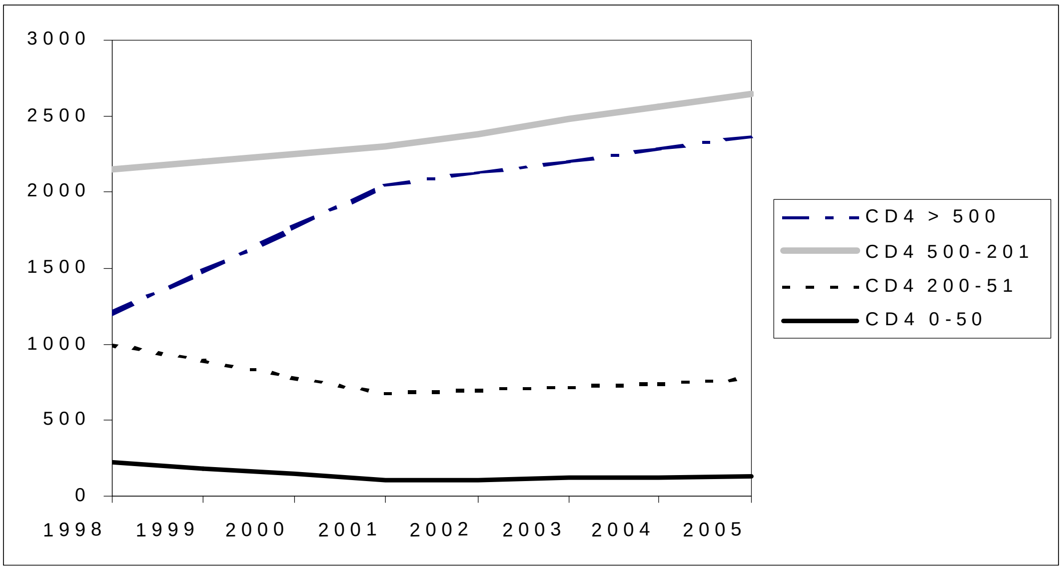
Table 19: Number of SHCS patients and CD4 distribution

CD4 cell count	Patients 31.12.1998	Percentage	Patients 31.12.2001	Percentage	Patients 31.12.2005	Percentage
CD4 > 500 x 10^6/l	1'199	26.3 %	2'047	39.8 %	2'359	40.0 %
CD4 500-201 x 10^6/l	2'145	46.9 %	2'304	44.8 %	2'642	44.8 %
CD4 200-51 x 10^6/l	1'001	21.9 %	678	13.2 %	767	13.0 %
CD4 0-50 x 10^6/l	224	4.9 %	114	2.2 %	130	2.2 %
Total	**4'569**	**100 %**	**5'143**	**100 %**	**5'898**	**100 %**
Percentage change		**1998-2001**	**+ 13 %**	**2001-2005**	**+15 %**	

The number of deaths in the SHCS is expected to rise slightly, from 71 in 1998 to 77 in 2001, and to reach 85 cases in 2005.

One can also represent the HIV epidemic characteristics in the near future as displayed in Figure 7. This table shows the number of individuals in the different CD4 cell count categories over time.

Figure 7: Number of individuals in the different CD4 cell count categories over time



Finally, the model enables us to determine the mean time an individual will spend in each CD4 cell count category over a one year time period. Results are displayed in Table 20 (see Appendix 17 for a detailed presentation). For instance, an hypothetical individual, with a CD4 cell count above 500 x 10^6/l at the beginning of the year will spend on the average 8.8 months in the corresponding stratum, 2.86 months in 500-201 x 10^6/l stratum, 0.3 month in the 200-51 x 10^6/l stratum, and only 0.02 month in the lowest stratum, i.e., 0-50 x 10^6/l.

Since the death probability of an individual is non-zero, the expected mean time spent in the death state is, in this example, 0.02 month.

Table 20 : Mean time spent in each health state during one year (months)

CD4 cell count category	December 31st	> 500 x 10^6/l	500-201 x 10^6/l	200-51 x 10^6/l	< 51 x 10^6/l	Death	Total Months
January 1st							
> 500 x 10^6/l		8.8	2.86	0.3	0.02	0.02	**12**
500-201 x 10^6/l		2.54	8.19	1.13	0.08	0.06	**12**
200-51 x 10^6/l		0.91	3.85	6.44	0.62	0.18	**12**
0-50 x 10^6/l		0.31	1.62	3.55	5.68	0.84	**12**

Our final remark concerns the intrinsic limitations of the multi-state Markov model that we adopted. First, the memoryless Markovian assumption means that two individuals in the same CD4 cell count category face the same transition probabilities whatever their previous history was. This assumption does not reflect all the medical complexity of the HIV disease. Second, the stationary assumption which holds true for relatively short time periods would lead to a serious bias in a long term study.

Below, we present our projections for the future social cost. Based on the same classification as in Part I, we review each social cost component. For each component, we first evaluate a unit time cost associated with each health state, i.e., CD4 cell count category. To perform the projections, we then combine the unit time cost with the expected number of individuals in each health state as estimated by the multi-state Markov model.

2 PREVENTION COSTS

We consider public prevention expenses as a public health policy decision and assume that prevention costs, in the forthcoming years, will remain stable, lying between **53 million Sfr.** and **64 million Sfr.** These figures represent the standard scenario and the higher bound limit of estimated prevention costs for 1998.

3 DIRECT COSTS

In this section, we detail how we estimate the health care costs associated with each CD4 cell count category and present the results of the projections for the year 2001 and 2005. We begin with antiretroviral drug costs, followed by ambulatory and hospital care costs. Such an approach allows to differentiate costs according to health states. However, we shall observe that for antiretroviral drugs (the main direct cost component), the cost per patient is independent of the health state. As for the remaining direct cost components, i.e., co-morbidity drugs, co-medication, psychotherapy and institutional psycho-social care, it was impossible to perform a cost stratification by CD4 cell count category due to the lack of data. Therefore, an average cost was calculated for the these cost components grouped under the denomination "other direct costs".

3.1 ANTIRETROVIRAL DRUG COSTS

We differentiate between two antiretroviral drug categories, HAART (3 or more antiretrovirals) and bi-therapy (2 antiretrovirals). Antiretroviral drugs constitute a particular case since dosage is independent of CD4 cell count. In other words, annual mean treatment cost, depicted in Table 21, for HAART and bi-therapy, is similar, whatever the CD4 stratum. To derive the mean annual treatment cost, we combined standard daily dose of antiretroviral drugs and the corresponding cost per day.

Table 21: Annual mean treatment cost per patient

Treatment	Annual Mean Treatment Cost
HAART	17’000 Sfr.
Bi-therapy	11'000 Sfr.

One should also account for the proportion of individuals treated in each CD4 stratum. The SHCS data do not show any significant differences of treatment distribution between CD4 strata. On a yearly basis and within each CD4 stratum, around **70 %** of SHCS patients were receiving HAART in 1998, **10 %** bi-therapy and **20 %**[63] no treatment at all. We assume that these proportions and the annual mean treatment cost per patient will remain unchanged.

The expected antiretroviral drug cost for the year 2001 and 2005 is obtained by combining annual mean treatment cost and the expected number of individuals under each treatment in 2001 and 2005. This amount, representing the SHCS antiretroviral drug costs, is then extrapolated to the Swiss level. Since SHCS antiretroviral drug costs represented around 65 % of Swiss antiretroviral costs in 1998, we adopt the same ratio for the year 2001 and 2005[64]. The results are presented in Table 22. The second column displays the actual cost at the Swiss level in 1998. Projections of future antiretroviral drug costs are presented in the third and fourth column, respectively. Antiretroviral drug costs increase by approximately 4 % a year, as a result of the rise in the number of treated patients.

[63] This percentage consist of patients who are not treated at all and of patients having treatment interruptions.

[64] In appendix 18, we display the ratios comparing SHCS costs and costs at the Swiss level. These ratios are used to extrapolate the different SHCS cost components to the Swiss level.

Table 22: Total antiretroviral drug costs at the Swiss level

Costs at the Swiss level	1998	2001	2005
Antiretroviral drug costs	91’400’000 Sfr.	102’882’000 Sfr.	117’986’000 Sfr.
Percentage change		**1998-2001: + 13 %**	**2001-2005: + 15 %**

A change in the price of antiretroviral drugs would have a significant effect on our projections since they represent the main direct cost component. For instance, if we were to consider a hypothetical policy aiming at controlling total antiretroviral drug expenses in Switzerland, establishing that total antiretroviral drug expenses could not exceed the amount attained in 1998, i.e., 91.4 million Sfr., this policy would require a reduction of 11 % of antiretroviral drugs prices by the year 2001 and of 23 % by the year 2005. These price reductions would allow a decrease of the social cost of **11.5 million Sfr** in 2001 and **26.6 million Sfr** in 2005, respectively.

3.2 AMBULATORY MEDICAL VISIT COSTS

In this sub-section, we first evaluate ambulatory medical costs according to CD4 cell count categories, and then present the results of the projections for the year 2001 and 2005.

The ambulatory medical visit cost stratification relies on the annual mean number of medical visits per patient, stratified by CD4 stratum, and the average cost per medical visit. The estimate of the number of annual medical visits stratified by CD4 stratum was derived from HIV positive outpatients (CHUV and private practitioners who collaborated with our study), representing altogether around 450 patients. The CD4 cell count closest to the medical visit date was used. The annual mean number of visits, depicted in Table 23, ranges from 6 to 12. We notice that the number of visits is quite similar with the exception of individuals with low CD4 cell counts. The average cost of a medical visits was estimated at **400 Sfr.** Multiplying the average cost of a medical visit by the annual number of medical visit per patient gives the annual mean medical visit cost per patient, as illustrated in Table 23.

Table 23: Annual mean medical cost per patient according CD4 count level

CD4 cell count category	Annual number of medical visits per patient	Annual mean medical visit costs
CD4 >500 x 10^6/l	6	2’400
CD4 201-500 x 10^6/l	7	2’800
CD4 51-200 x 10^6/l	9	3’600
CD4 0-50 x 10^6/l	12	4’800

Future social cost is obtained by combining the annual mean medical visit costs stratified by CD4 cell count category, the number of expected individuals in 2001 and 2005, and the expected time spent in each CD4 stratum by these individuals. The amount, corresponding to future SHCS ambulatory medical visit costs, is then extrapolated to the Swiss level. Total ambulatory medical visit costs at the Swiss level for the years 2001 and 2005 are displayed in the third and fourth column of Table 24, respectively.

Table 24: Total ambulatory medical visit costs at the Swiss level

Costs at the Swiss level	1998	2001	2005
Ambulatory medical visit costs	24’000’000 Sfr.	26’089’000 Sfr.	29’843’000 Sfr.
Percentage change		**1998-2001: + 9 %**	**2001-2005: +14 %**

The annual ambulatory medical cost per patient is expected to decrease, as a result of an average increase in CD4 cells, from 3000 Sfr. in 1998 to approximately 2’800 Sfr in 2005. However, due to the additional number of expected patients in the forthcoming years, total ambulatory medical costs are expected to further increase within the next years as shown in Table 24.

3.3 HOSPITAL CARE COSTS

In this sub-section, we first estimate an expected hospital care cost stratified by CD4 stratum, and then present the outcome of our projections for the years 2001 and 2005.

We obtain the expected hospital care cost by multiplying hospitalisation rate associated with each CD4 stratum by the corresponding hospital care costs. Hospitalisation rates, derived from SHCS data, are significantly higher for individuals with low CD4 cells, as illustrated in Table 25.

To stratify hospital care costs by CD4 stratum, we matched cost per hospitalisation with the CD4 cell count closest to time of hospitalisation. This procedure was undertaken for approximately 100 HIV patients hospitalised in the CHUV in 1998. The expected hospital care costs are displayed in the fourth column of Table 25. One can note that low CD4 level count categories are associated with high hospital care costs.

Table 25: Expected hospitalisation cost stratified by CD4 cell count categories

CD4 cell count category	Hospitalisation rate (1)	Cost per Hospitalisation (2)	Expected hospitalisation cost per patient (1)*(2)
CD4 >500 x 10^6/l	23 %	6’000 Sfr.	1’380 Sfr.
CD4 201-500 x 10^6/l	24 %	10’800 Sfr.	2’590 Sfr.
CD4 51-200 x 10^6/l	39 %	17’100 Sfr.	6’670 Sfr.
CD4 0-50 x 10^6/l	69 %	27’000 Sfr.	18’630 Sfr.

One should note some methodological limitations of our approach. Hospitalisation data used to estimate the cost per CD4 cell count category are self-reported by SHCS patients. Therefore, data on patients shortly deceased after being hospitalised might not be recorded in the SHCS data base, and hence hospitalisation rates could be underestimated. On the other hand, since the SHCS data indicate whether or not an individual was hospitalised within the last six months, but do not provide information on the number of hospitalisations within that time period, hospitalisation rates might be underestimated. Whether these two effects counterbalance each other is unclear.

Total hospital care costs for 1998, 2001 and 2005 at the Swiss level are displayed in Table 26. In the short run, hospital care costs are slightly declining. The cost per hospitalisation decreases from **12'700 Sfr.** in 1998 to **11'500 Sfr.** in 2001. This is explained by the expected health improvement of HIV patients. However, the decreasing trend in total hospital care costs should be offset by a rise in the number of HIV patients over the next years. Total hospital care costs is expected to increase by 13 % between 2001 and 2005.

Table 26: Total hospital care costs

Costs at the Swiss level	**1998**	**2001**	**2005**
Hospital care costs	32'290'000 Sfr.	31'390'000 Sfr.	35'418'000 Sfr.
Percentage change		**1998-2001: - 3 %**	**2001-2005: + 13 %**

Different elements could contribute to a different evolution in hospital care costs. One major issue is the magnitude and importance of treatment side-effects. So far, few cases of treatment side-effects are reported. It is estimated that they account for approximately 2 % of hospitalisations in the CHUV (A. Telenti, CHUV, personal communication). However, one might not exclude that this could change in the near future. For instance, under the hypothesis that the cost per hospitalisation for side-effects is similar to the average cost per hospitalisation, an increase in the number of hospitalisations of 3 % by 2001 due to treatment side-effects, assuming that side-effects hospital care costs are equal to the average hospitalisation, would be enough to outweigh the expected hospital care costs decline between 1998 and 2001.

3.4 OTHER DIRECT COSTS

An average cost, evaluated at **2'561 Sfr.,** was calculated for the "other direct costs" category. This amount was derived by adding up each "other direct cost" component that we estimated in Part I, and dividing the sum by the estimated 8000 HIV patients medically followed in Switzerland.

The results for the years 1998, 2001 and 2005 are displayed in Table 27. Total "other direct costs" are expected to increase as a result of the growing number of HIV patients.

Table 27 :Total "other direct" costs

Costs at the Swiss level	1998	2001	2005
Other direct costs	20'490'000 Sfr.	23'065'000 Sfr.	26'451'000 Sfr.
Percentage change		**1998-2001: + 13 %**	**2001-2005: + 15 %**

4 INDIRECT COSTS

In this section, we examine future morbidity and mortality costs. We initially examine morbidity costs and then mortality costs. For the former, we first detail our assessment of costs stratified by CD4 stratum before displaying our forecasts for the years 2001 and 2005. For the latter, we consider an average cost per AIDS death that was estimated in section 5.2 in Part I.

4.1 MORBIDITY

In order to stratify morbidity costs by CD4 level cell count categories, we differentiate working rate according to CD4 stratum and place an economic value on productivity losses using wage rate. Our main source of information are the SHCS data and the "Enquête Suisse sur la population active" (ESPA). The SHCS data base provides information on working rate of HIV patients. The latter, displayed in Table 28, is then compared to the working rate of 38 years old individuals – the mean age of SHCS patients - of the general population. Relying on ESPA data, the working rate of 38 years old individuals is **71 %.** The difference between the working rate of HIV patients and of the corresponding general population is displayed in the third column and represents the productivity loss associated with HIV infection.

We used the number of **65'000 Sfr**., corresponding to the median annual gross income of individuals of 38 years according to the ESPA, to value productivity losses. Annual productivity losses, illustrated in the fourth column, range between **9'750 Sfr**. and **26'000 Sfr.**

Table 28 : Productivity loss associated with HIV infection

CD4 cell count category	Working rate of HIV patient	Working rate difference with the general population	Annual Productivity Loss
CD4 >500 x 10^6/l	55 %	- 16 %	10'400
CD4 201-500 x 10^6/l	50 %	- 21%	13'650
CD4 51-200 x 10^6/l	40 %	- 31 %	20'150
CD4 0-50 x 10^6/l	30 %	- 41 %	26'650

Since we rely on SHCS data to stratify morbidity costs, one might expect that individuals severely ill and unable to work, i.e., with low CD4 levels, do not attend follow-up visits, and hence may cause the working rate of individuals with low CD4 levels to be overestimated.

The results of the projections of morbidity costs at the Swiss level indicate that morbidity costs per patient decreases over time, from **14'200 Sfr**. in 1998 to **13'400 Sfr**. in 2005. This is explained by the rise in the number of individuals in superior CD4 strata over time. However, this effect is offset over time by the increase in the number of HIV patients as displayed in Table 29. All in all, morbidity costs are expected to slightly rise, at a annual rate of approximately 3 % per year.

Table 29 : Total morbidity costs at Swiss level

Costs at the Swiss level	1998	2001	2005
Morbidity costs	115'090'000 Sfr.	122'714'000 Sfr.	140'157'000 Sfr.
Percentage change		**1998-2001: + 7 %**	**2001-2005: + 14 %**

4.2 MORTALITY COSTS

Finally, we examine mortality costs. In order to assess future mortality costs, we multiply the average cost per AIDS death, estimated at **1.1 million Sfr.** in sub-section 5.3 in Part I, by the number of expected deaths caused by AIDS in 2001 and 2005. Since the expected number of deaths is expected to rise slightly from 140 in 1998 to 168 in 2005, mortality costs increases as well. The results are presented in Table 30.

The mortality rate is relatively stable and is estimated at around 1.5 %. The rise in the number of AIDS deaths stems from the increase in the number of HIV patients.

Table 30 : Mortality costs at the Swiss level

Costs at the Swiss level	1998	2001	2005
Mortality costs	160'040'000 Sfr.	173'564'000 Sfr.	191'597'000 Sfr.
Percentage change		**1998-2001: + 8 %**	**2001-2005: + 10 %**
Number of deaths	140	152	168

5 SUMMARY AND CONCLUSION

HIV social cost in the forthcoming years is characterised by two opposite trends. On the one hand, as a result of an expected average improvement in the health state (CD4 cells) of individuals living with HIV infection, the direct and morbidity cost per patient will decline. On the other hand, the number of individuals living with HIV infection will increase, even under the hypothesis of a constant number of incident cohort cases. On the basis of our hypotheses, the rise in the social cost generated by the demographic evolution of the HIV epidemic should outweigh the downwards trend in the social cost associated with the decline in the cost per patient. All in all, HIV social cost is expected to increase in the forthcoming years.

The results at the Swiss level for the different components of the social cost are presented in Table 31. The social cost for the year 1998, derived from the “Bottom-Up” model, is displayed in the second column. The third and the fourth column indicate the forecasted social cost for the years 2001 and 2005. HIV social cost is expected to rise, from **443 million Sfr.** in 1998 **to 541 million Sfr**. in 2005, corresponding to an annual total increase of approximately **3 %**.

Table 31: HIV social cost at the Swiss level

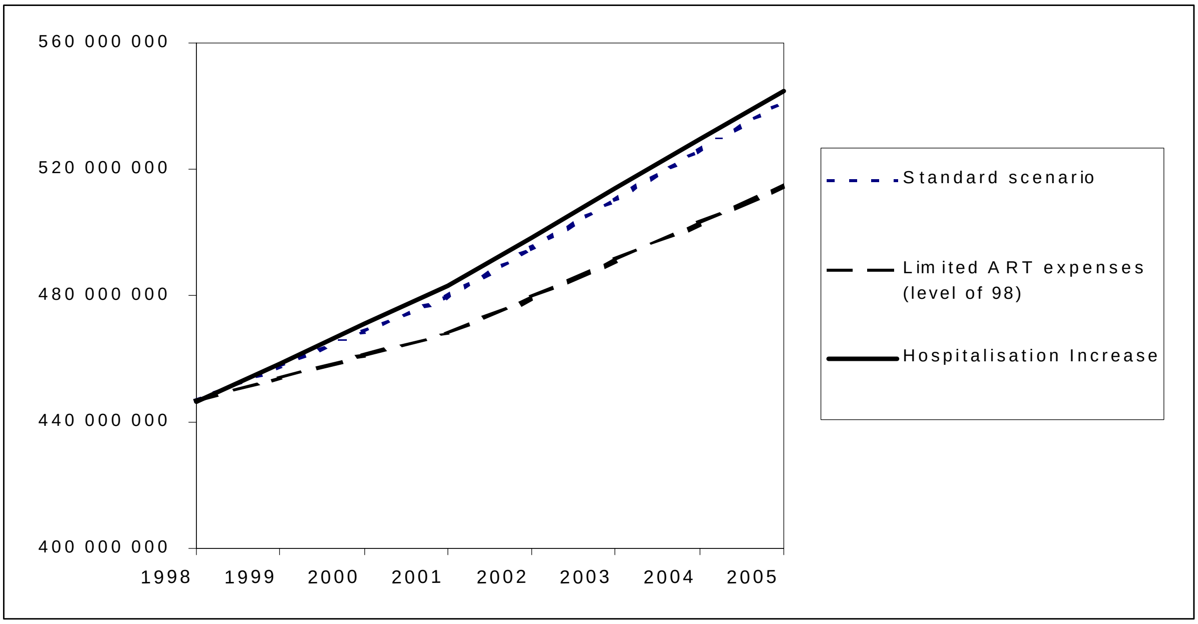
Cost category	1998	2001	2005
ART costs	91’400’000 Sfr.	102’882’000 Sfr.	117’986’000 Sfr.
Ambulatory costs	24’000’000 Sfr.	26’089’000 Sfr.	29’843’000 Sfr.
Hospital care costs	32’290’000 Sfr.	31'389’000 Sfr.	35’418’000 Sfr.
Other direct costs	20’490’000 Sfr.	23’065’000 Sfr.	26’451’000 Sfr.
Total Direct Costs	**168’180’000 Sfr.**	**183’425’000 Sfr.**	**209’698’000 Sfr.**
Morbidity Costs	115’090’000 Sfr.	122’714’000 Sfr.	140’157’000 Sfr.
Mortality Costs	160’040’000 Sfr.	173’565’000 Sfr.	191’597’000 Sfr
Total Indirect Costs	**275’130’000 Sfr.**	**296’279’000 Sfr.**	**331’754’000 Sfr.**
Total Costs	**443’310’000 Sfr.**	**479’704’000 Sfr.**	**541’452’000 Sfr.**
Percentage change		**1998-2001 : + 8 %**	**2001-2005 : 13 %**
Total number of patients medically followed	**8’000**	**9’010**	**10’330**

Different elements, however, could modify these conclusions. First, a change in the price of antiretroviral drugs would have a significant effect on social cost since they represent the main direct cost component. Some pharmaceutical companies have announced significant price reductions of antiretroviral drugs for developing countries. Obviously, one cannot expect such reductions in developed countries, but the projected increase of antiretroviral drug costs in the near future represent an argument in favour of a policy aimed at controlling antiretroviral drug expenses in Switzerland.

We demonstrated that with a policy maintaining total antiretroviral drug expenses in Switzerland at the level of 1998, i.e., 91.4 million Sfr., the price of antiretroviral drugs would have to decrease by 11 % by the year 2001 and of 23 % by the year 2005. Under this hypothesis, social cost would reach, ceteris paribus, **468 million Sfr.** in 2001 and **515 million Sfr.** in 2005 as illustrated in Figure 8. If we were to further maintain the social cost of 1998, i.e., 446.6 million Sfr., this would mean a decrease of then antiretroviral drug price of 35 % by 2001 and of 83 % by 2005. In the current context, such examples are only hypothetical, but are good examples of the potential impact of a price reduction of antiretroviral drugs.

Second, new therapeutic options could be developed in a near future, namely intermittent antiretroviral drug treatments (Hirschel et al. 2001). Assuming that treatment discontinuation will become common practice in the near future, it will lead to a decrease of total antiretroviral drug costs, depending on the number of patients meeting the criteria. In addition, treatment discontinuations might reduce the frequency of drug side-effects.

Figure 8 : Future social cost : Different scenarios



Third, an increase in the number of hospitalisations due to treatment side-effects/toxicity would also affect our projections. The introduction of HAART was followed by a decrease in the number of hospitalisations. However, one cannot exclude that the number of toxicity/side-effects treatments might increase in the forthcoming years. We demonstrated that a small increase in hospitalisation rate would outweigh the expected decline in hospitalisation cost between 1998 and 2001. Under the hypothesis that the number of hospitalisations due to treatment side-effects/toxicity would substantially rise, resulting in a 10 % growth in the number of hospitalisations, social cost would reach, ceteris paribus, **483 million Sfr**. in 2001 and **545 million Sfr**. in. 2005. As shown in Figure 7, the impact on social cost is small, but could be greater if we also consider that more frequent hospitalisations could lead to a rise in morbidity and mortality.

Fourth, a change in the number of deaths in the forthcoming years would have an impact on social cost. On the basis of the epidemiological trend of the last years, one could expect that the number of deaths could either become stable or even further decrease. If we were to assume that the number of deaths, in the forthcoming years, would be similar to the level of 1998, i.e., 140 cases, total social cost would reach **466 million Sfr**. in 2001 and **510 million** in 2005. In order to maintain the social cost of 1998, i.e., 443 million Sfr., the number of deaths should reach in 2001 120 cases, instead of the expected figure of 152, and 82 cases in 2005 rather than the expected 168 cases. The actual impact of a decline in the number of AIDS deaths might even be greater, since we did not account for the potential decrease in health care and morbidity costs associated with a lower mortality rate.

Finally, a substantial change pertaining to the future number of yearly new HIV infection cases would have an impact on future social cost. We implicitly assumed that the future yearly number of new HIV infection cases would remain similar to the present level. However, a certain disregard of prevention messages as mentioned in Part I, section 6, could suggest that the number of new HIV cases could increase over the next few years. In that case, we would have underestimated future social cost. On the other hand, a further decline in the number of new HIV cases would result in a lower social cost.

The above elements lead us to consider the role of prevention in the forthcoming years. The decline in the number of new HIV infection cases over the last years and the relatively small share represented by HIV in the Swiss health care costs could suggest that HIV prevention might become less important in the future. Our projections suggest, on the contrary, that HIV prevention should remain a key element in the battle against HIV since our projections show that the social cost is expected to rise in the forthcoming years. In that context, prevention constitutes an essential means to limit or reduce the HIV social cost over the next years.

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