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ASSESSING THE RETURN ON INVESTMENTS (COST-BENEFITS) OF PREVENTION IN SWITZERLAND:

A FEASIBILITY STUDY
(Full Report)

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CONTEXT

The Swiss Federal Office of Public Health (FOPH) is organized along the lines of results based management. Since 1987, therefore, evaluation is considered an important tool for helping the Office to improve the effectiveness of its measures. In September 2005, the Department of Home Affairs appointed the Special Commission of Prevention and Health Promotion (SC-PHP 2010) to debate the future of health promotion and disease prevention in Switzerland, particularly with respect to the structures and legal framework. The SC-PHP 2010 presented its report and recommendations for enhancing promotion and prevention procedures in September 2006. One of its recommendations was that the effectiveness and efficiency of prevention measures should be enhanced[1]. As a consequence, Ms. Marlène Laübli, head of the Research Policy, Evaluation and Reporting Section at the Swiss Federal Office of Public Health (FOPH) commissioned us, the Institute of Health Economics and Management (IEMS) from Lausanne University, in collaboration with the Winterthur Institute of Health (WIG), to examine the feasibility of conducting a cost-benefit analysis of Swiss prevention programmes. For the same reasons Health Promotion Switzerland[2] (Promotion Santé Suisse), a national foundation in charge of stimulating, coordinating and evaluating health promotion had previously commissioned the Winterthur Health Institute (WIG) to carry out a literature survey of the various cost-benefit analyses of prevention programmes in Switzerland and abroad. The results showed that few cost-benefit studies exist for Switzerland.

[1] "Vision et thèses sur la nouvelle réglementation de la prévention et de la promotion de la santé en Suisse" – Document de la Commission spécialisée "Prévention + Promotion de la santé" du 13 mars 2006. Thèse n° 7. OFSP – p. 25.

[2] Acting under the terms of Article 19 of the Sickness Insurance Act (LAMal 1996), Health Promotion Switzerland stimulates, coordinates and evaluates measures for health promotion and disease prevention.

AIM OF THE MANDATE

In short, there is an obvious need for economic evaluation of prevention programmes in Switzerland. The recent OECD report on the health system of Switzerland also emphasises the relatively low spending on prevention as one of the main shortcomings of the Swiss health system (OECD 2006). Therefore, following the Australian CBA approach (Abelson et al. 2003), we propose to assess the feasibility of conducting a cost-benefit analysis of some prevention programmes.

The aim of this report is threefold:

(1) To present the best economic evaluation approach for assessing prevention, with a debate on methodological issues, and
(2) To present three risk factors for which a cost-benefit analysis would be appropriate and why: tobacco consumption, alcohol abuse and high-risk drinking, and road accidents,
(3) To consider whether or not a cost-benefit analysis of the prevention measures related to these risk factors is feasible in Switzerland, and the likely costs.
(4)

The feasibility study will mainly focus on federal prevention measures as it is difficult to disentangle the health impact of federal from cantonal prevention measures, as well as to isolate the costs of local and cantonal prevention measures. Our choice of risk factors were driven by (1) existing Swiss studies on the social costs of risk factors, (2) the comparability between the social costs studies for these risk factors, (3) the economic burden of the risk factors for the Swiss Society, and (4) an existing history of prevention measures for these risk factors in Switzerland.

The first section presents a short review on the Swiss cost-benefit studies. The second section deals with definitions and issues of prevention. In the third section, we present the method of cost-benefit analysis applied to prevention. Then, the fourth to sixth sections present each risk factor, the issues in doing CBA of prevention and our proposals. The last session summarizes our proposal.

GLOSSARY

AFs			Attributable Fractions
AI			Disability insurance
ARE			Federal Office for Spatial Environment
ASTRA			Federal Road Agency
bfu	**or**	**BFA**	Swiss Council for Accident Prevention
CBA			Cost-Benefit Analysis
CBU			Cost-Utility Analysis
CCE			Evaluation Competence Centre, FOPH
CEA			Cost-Effectiveness Analysis
CER			Cost-Effectiveness Ratio
CVD			Cardio-vascular diseases
DALYs			Disability Adjusted Life Years
EBM			Evidence Based Medicine,
ESPA		**survey**	Swiss survey on Working Population
ETH			Swiss Federal Institute for Technology Zurich
EU			European Union
FOPH	**or**	**SFOPH**	Swiss Federal Office of Public Health
FOS	**or**	**SFSO**	Swiss Federal Office of Statistics or Swiss Federal Statistical Office
GDP			Growth Domestic Product
HP			Health problem
IVT/ETH			Institute for Transport Planning and Systems
NPAA			National Programme of Action against Alcohol (FOPH)
NPV			Net Present Value (
OECD			Organisation for Economic Co-operation and Development
PP			Prevention Programmes
QALYs			Quality Adjusted Life Years
SAB	**or**	**RFA**	Swiss Alcohol Board
SC-PHP 2001			Special Commission of Prevention and Health Promotion
SFA-ISPA			Swiss Institute for Prevention of Addictions
SHS			Swiss Health Survey
TCS			Touring Club Swiss
TGP			The Tobacco Global Programme
UK			United Kingdom
UVEK			Department of the Environment, Transport, Energy and Communications
VESIPO			New road safety policy (of UVEK)
VTA			Canton Zurich Police's Department for Traffic Engineering
WHO			World Health Organization

1. INTRODUCTION

Over the last decades, the Swiss Federal Government has focused more on developments in curative health care and issues concerned with funding the health system than on prevention and health promotion. However, given changes in social and health conditions, such as the aging of the population or the re-emergence of infectious diseases, the Swiss Confederation and the cantonal governments have increased their efforts to develop and implement health prevention and promotion programs. The legal bases for prevention of injuries, disabilities, illness and disease[3] and health promotion at the Swiss Federal level have been well documented by the foundation "Swiss Health Promotion" (Promotion Santé Suisse). However, there are some drawbacks in the current system, from the lack of legal bases to the lack of coordination at the different administrative levels. Following this statement, a specialised commission on "Health Prevention + Promotion" was set up by the Department of Home Affairs to analyse the issues and, in autumn 2006, put forward its proposals for improving health prevention and promotion programs in Switzerland. However, all of the objectives targeted by this commission concern the coordination and the enforcement of the prevention and health promotion programs. There is neither clear focus on the effectiveness of these programs on the population's health, nor on their returns on investment. Nowadays, in Switzerland and in developed countries, because health expenditures are an important share of the national income (GDP) and are growing faster than the GDP, they are an issue for all governments.
Even if prevention and health promotion programs represent only 2.2% (2006, OECD Report) of these expenditures in Switzerland in 2000, knowing the impact of these programs on the population's health improvement is a concern, as these expenditures could be otherwise used if such programs proved to be inefficient. Doing cost-benefit analyses of these programs could therefore give relevant information to the Swiss Department of Home Affairs to improve their prevention and health promotion policies. Our study proposes to fill this gap.

Background: Cost-Benefit Analysis of Prevention Strategies in Switzerland
The Evaluation Competence Centre CCE (Centre de Compétences en Evaluation), located within the Research Policy, Evaluation and Reporting Section of the Swiss Federal Office of Public Health (SFOPH) aims at promoting, among others, an evaluation culture within the FOPH. The "main purpose of evaluation is to judge the relevance, effectiveness, value (contribution to societal well-being) and efficiency of FOPH public health policies, strategies and measures for preventing disease and generally improving the population's well-being" (FOPH report "Assessing the Effects of Public Health Policies and Actions: Evaluation Strategic Framework", 2005). Efficiency allows taking into account costs and benefits of strategies or prevention measures simultaneously in order to make a choice between competing projects. Benefits can be measured in different ways: cost-effectiveness analysis measures benefits in physical units, such as number of lives saved, cost-utility analysis links quantity and quality of life in a single measure, whereas cost-benefit analysis not only assesses benefits, but then also calculates their money value.
Starting from the extended literature review of the WIG (2003) on cost-benefit analyses of prevention programmes, it appears that there are few publications on this topic for Switzerland. Among the Swiss studies, three are on the costs of HIV infection (1998), stress (2000) and overweight (2004), while the three others analyse the cost-effectiveness of health and physical activities (2001) and vaccination against influenza (2003). Moreover, in their costs computation, some of the social costs studies also take into account the combined costs of federal and cantonal prevention programmes, e.g. as in the case of HIV. In addition, there are also Swiss studies on the social costs of other health risks, such as road accidents (1994), tobacco consumption (1998), alcohol abuse (2003), and drug dependence (2005).

[3] Thereafter, called prevention.

Given these few references, there is a sharp lack in studies on the cost-benefits of prevention programs in Switzerland. Henceforth, the IEMS and the WIG have been mandated by the FOPH to evaluate the feasibility of analysing the cost-benefits of prevention measures in a number of different health areas in Switzerland. Cost-benefit analysis is particularly well suited to assessing the efficiency of prevention as it compares the costs and health benefits of different prevention projects simultaneously in order to identify where public expenditure is best invested to assure the most "cost-benefit" projects. This study sets the stage for conducting cost-benefit analyses of prevention of a limited number of health risks in Switzerland.

2. PREVENTION

2.1. Prevention: definition and targeted public

Prevention focuses more on the injury, disability, health behaviour or disease itself and aims at analysing the causes of the disease with a view to suppressing related risk factors. Prevention measures try to reduce the onset, the spread and the negative effects of diseases or health disorders. The measures adopted include medical, psychological and educational procedures, control of the environment, legal regulation and mass media campaigns. Health protection consists of the measures prescribed by a public health authority that aim at protecting the health's population; for instance the protection against radioactive substances. These measures are called "sanitary policy" in Switzerland, because health is protected through regulation by laws. They belong to the set of *structural prevention* measures. In the field of prevention of health detrimental behaviour, these structural measures aim at regulating the supply of the health damageable product. *Primary prevention* targets the causality channel to prevent the onset of the disease. *Secondary prevention* happens when the causality chain has started in order to stop the subsequent damage. It relates to the domain of curative care. *Tertiary prevention* happens when the main damage has occurred but aims to prevent other damages. Tertiary prevention belongs also to the curative health care field.

Moreover, disease prevention and health promotion strategies can be rated according to the population targeted: "universal prevention" targets the whole population, whereas "selective prevention" the groups at risk and "targeted prevention" the individuals at risk. Thus structural prevention (also called contextual prevention) that sets a legal and social framework for health behaviour targets the overall population to prevent the onset of the disease or to decrease its prevalence. This is also the case of primary prevention. A focus on vulnerable subgroups of the population is the aim of secondary and tertiary prevention as they address disease or risk factors once they have appeared. These prevention approaches are related to health care. Choosing the whole population or a subgroup as a target of prevention measures is a matter of balance between the prevention paradox, that sets that people facing a small relative risk of having a disease are more numerous than those facing a high relative risk of having the same disease, and returns on investment of public expenditures.

2.2. Indicator of effects of prevention measures on the health problem at stake.

Two questions arise in assessing the impact of prevention measures on health problem prevalence. Firstly, how can we assess the impact of a prevention measure? Secondly, how can we measure the time lag and duration between the launch of a prevention measure and its impact on the health problem?

To assess the impact of prevention on a health problem (HP), the most relevant approach is to measure the decrease in the number of HP cases in the population, which is called incidence or prevalence of the HP. However, sometimes evaluation reports focus on the visibility of a campaign, sometimes on the understanding of its message by the population. Assessing the time lag and the time duration of the impact of prevention measures on the health problem are also two issues at stake, which are challenging to solve if not impossible.

To assess the impact of prevention measures on a specific disease's prevalence, researchers have developed three main approaches (Domenighetti, 2006).

- The clinical trial-like experiment (also called quasi-experimental approach) randomly assigns people in a control group where nothing changes – neither prevention measures, nor socio-economic, cultural and environmental factors – and in the treatment group where only one factor changes – a new prevention measure, for instance -, and assesses the differential impact of the measure on health behaviour or health state. However, doing such an experiment is quite difficult, because of issues in controlling for socio-economic or environmental changes, and unethical as well. Thus a "quasi-experimental" approach is more relevant and used for education-based prevention approaches.
- The before-after comparison approach consists in analysing survey data over an extended period of time including time before and after the introduction of a new intervention. Here again, it is simpler to proceed when only one event has occurred at a precise moment in time. However, this approach is also sensitive to cross-impact of other programmes and other factors.
- A last approach, based on Evidence Based Medicine (EBM), allows taking decisions in the light of information coming from systematic literature review and meta-analysis of interventions and best medical practices. This approach also relies on experimental studies such as clinical trial-like studies, and henceforth suffers from the same limitations.

Moreover, any decrease in the prevalence of the primary health problem (HP) also has an impact on its related diseases or injuries, which could be seen as the indirect impact of prevention. There are different methods to assess such impacts:

- Making assumptions and projections concerning the change in prevalence of the related disease, knowing the change in the HP prevalence, by age, sex, generation and/or between people having and not having the HP..
- Using the attributable fraction of the HP for a related disease, and assuming that the decrease in the related disease is partly due to the HP prevalence decrease. Making assumption about the impact of the fall in the HP prevalence on its attributable fractions for its related diseases.
- Setting an econometric model to explain the impact of health problem changes on the related disease mortality or prevalence over time by age, sex and cohort. In this case, the sample size of the dataset should be large enough to detect causal effects.

Concerning the time elapsed between the decrease of the HP prevalence and the one in its related diseases; the potential assessment depends on the health problem considered as well as on the available data.

Finally, given the difficulties to do quasi-experimental or before-after comparison approaches and to assess the impact of the HP on its related diseases, **we propose** to use results of evaluation reports of prevention programmes in terms of prevalence when they are available for Switzerland, and results of international literature otherwise. We propose also to develop an econometric model in order to assess the impact of prevention measures when Swiss data are available over a long time period.

2.3. Other factors influencing health behaviours and diseases prevalence.

In addition of the different types of prevention measures and public targeted, there are other factors that can influence health problem prevalence. As far as possible, these factors should be taken into account in the assessment of the impact of prevention strategies.

- *Interactions between prevention measures* targeting different disease, injury or invalidity, and also *with health promotion measures*. For instance, when considering cardio-vascular diseases (CVD) prevention measures, programmes of health promotion that foster physical activity or prevention programs of obesity or tobacco consumption also have a positive impact in preventing CVD.
- *Public initiatives in other fields* than the health domain. For example, a new regulation on buildings construction can improve safety and sanitary living conditions and thus promotes people's health indirectly.
- *Two levels of governance in Switzerland*, with Federal and Cantonal Laws. These two sets of laws and regulations can be complementary or independent, with pre-eminence of Cantonal Laws. Thus, Cantons and Federal governments can lead prevention measures independently. As a consequence, if there are two prevention programmes, both targeting the same population, but one settled nationally and the other in a single Canton, they could result in a different impact on prevalence in the Cantons with supplementary prevention programme versus Cantons without supplementary programme.
- *Prevention measures and socio-economic factors.* As Switzerland is split in three main different speaking-language's areas, cultural differences can lead to different impacts of prevention measure on health behaviours. Differential impact of prevention measures can also be due to educational levels, living areas and economic activities.

So, because of the multitude of factors that interact with prevention, and because the prevention programmes are comprised of a whole bundle of measures it is often very difficult to measure the impact of a single programme on the disease incidence or prevalence.

2.4. Conclusion: what to assess?

Given the definition of prevention and the interactions between other measures or characteristics of the population and the country, we propose to focus on:

- ***A bundle of measures of a specific health problem*** rather than a single prevention measure. When focusing on a specific health problem, it is more coherent to surround our analysis to the set of all known measures that targets this problem, even though other measures have also a secondary impact on it.
- ***Structural prevention and primary prevention measures***, as by virtue of the prevention paradox, the returns on investment of measures that target the general population are expected to be higher than those which are targeted at a selective, narrower public.
- ***Federal prevention measures***. In terms of costs, it is difficult to identify all the different cantonal prevention measures. In terms of health impact, whilst morbidity and mortality data is available at a national level, such data is not systematically available at cantonal level. The differentiation between what can be attributed to Federal or Cantonal prevention measures is therefore impossible. We therefore propose focusing on federal prevention measures since we can measure both costs and the national health impacts.

3. COST-BENEFIT ANALYSIS: PRINCIPLES

To evaluate prevention along two dimensions, health impact and costs, economic evaluation proposes three methods that link together these two dimensions in one: *cost-effectiveness, cost-utility and cost-benefit analyses*. These three methods relate costs to effects (in terms of

impact on the population's health) of the project assessed. But they measure the impact on health in different units.

- The *cost-effectiveness analysis* (CEA) measures them in physical units, such as years of life gained, number of recoveries, or number of well diagnosed patients. Thus it is a purely quantitative method.
- The *cost-utility analysis* (CUA) measures them in a utility index, which states for the level of preference of an individual for a particular health state. Utility measures such as DALY[4] or QALY[5] mix together quantity and quality of life.
- The *cost-benefit analysis* (CBA) can take into account the quantity and quality of years of life (similar to cost-utility) but can go one step further by transforming them into a monetary value. Once the benefits and costs are transformed into the same unit, the comparison of different projects becomes feasible, and the "return on investments" can also be calculated.

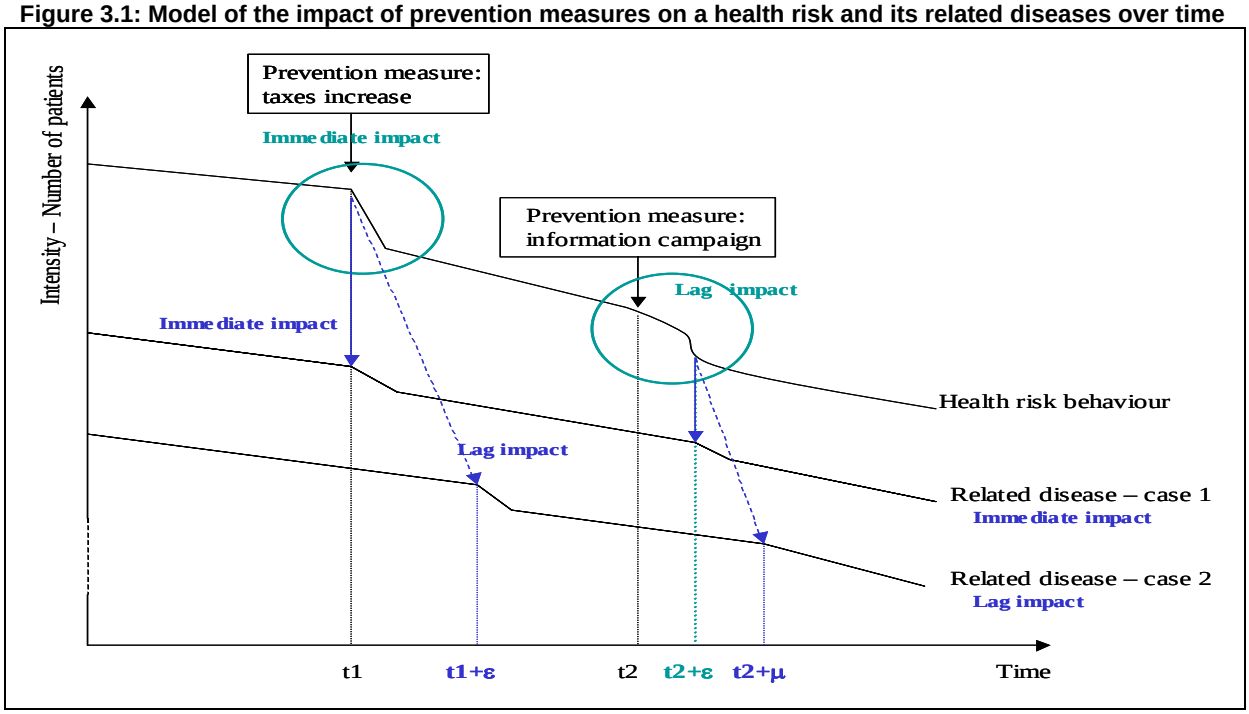
Therefore, given these features of economic evaluation methods, the CBA is the most appropriate: it enables a comparison of different kinds of federal projects and it can be used to calculate the level of "return on investment".
When studying public health issues, the usual point of view chosen is the one of the Society. However, in the field of the prevention of health problem or health risk factors we should first analyse the causal path of the risk factor on people's health, in order to identify all the relevant costs and benefits of both alternatives.

3.1. Causal pathway of risk factors on health

A risk factor is defined as the probability of an adverse outcome, or a factor that raises this probability. Focusing on risks to health is thus important in the prevention of disease or injury. Risk factors can be of different nature, such as environmental, socio-economic or sanitary risks. On the one hand, there are also behavioural risk factors that are detrimental to health such as alcohol drinking and tobacco consumption and, on the other, there are the avoidable adverse events such as those causing road accidents. Detrimental health behaviour follows different causal paths on health. The "patient" can cause himself or someone else an injury (such as a car crash when drunk) or a disease (such as hypertension for smokers). In both cases, we have to list all the effects of a risk factor on health as well as the attributable fraction of the disease or injury it may cause.
The direct burden of a risk factor or detrimental health behaviour can be measured in the diseases and deaths it caused partially or fully. Attributable Fractions (AFs) are used to express the extent to which a risk factor contributes to a health outcome, such as a disease or an accident. The alcohol attributable fraction of road traffic injuries, for instance, is the proportion of road traffic injuries in the specific population that would be eliminated in the absence of alcohol consumption. Henceforth, to circumvent the whole impact of a risk factor, we should recover its prevalence rate in the overall population, as well as the prevalence of its related diseases or injuries with their attributable fractions. However, the causal path of risk factor on health is also time related, given that a change in a risk factor can have immediate or delayed repercussions on its related diseases, as illustrated below.

[4] DALY = Disability Adjusted Life Years
[5] QALY = Quality Adjusted Life Years

Figure 3.1: Model of the impact of prevention measures on a health risk and its related diseases over time

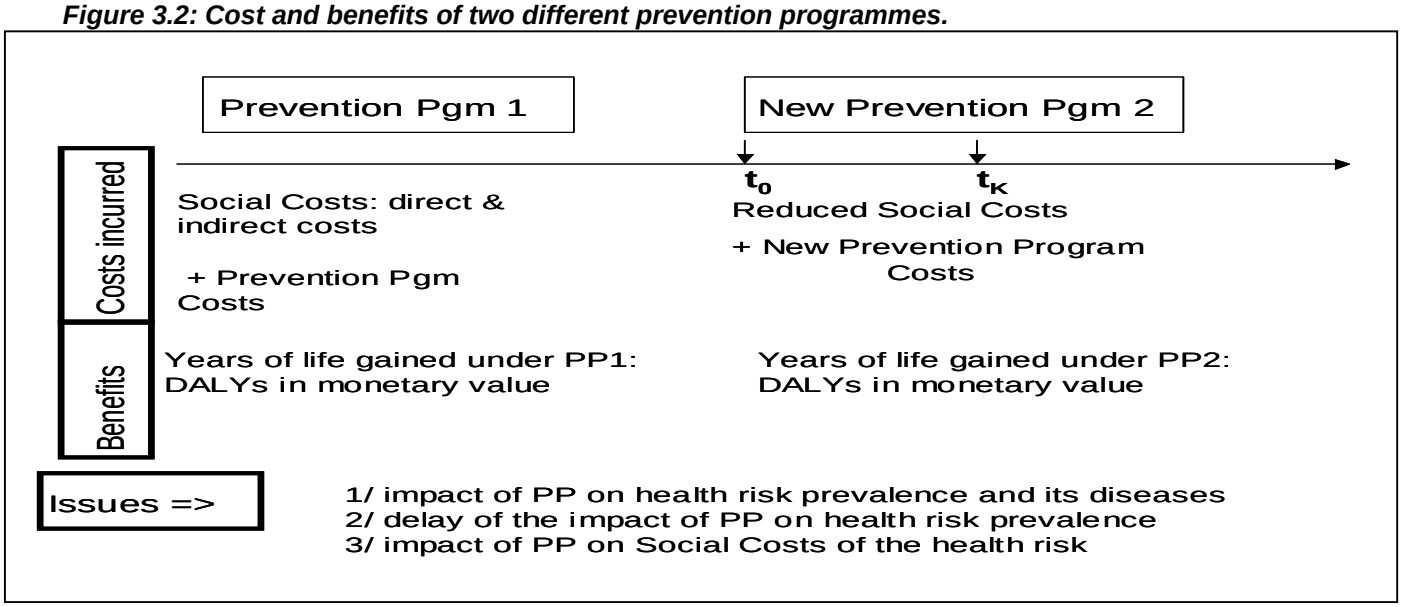


Here the health risk (top line) behaviour changes immediately or with a time lag according to prevention measures. The impact of these changes on the related diseases due to the health risk can lead to different cases. The first one (second line) concerns diseases or injuries for which the transmission of changes in the health risk on the disease is immediate and direct (e.g. road accidents and injuries or deaths caused by them). The second one (last down line) concerns diseases, disability or deaths that will change but with a time lag after changes in the health risk. However, even though these mechanisms are known, there are quite difficult to estimate.

3.2. CBA method for health risk factors

The best approach in doing a cost-benefit analysis of prevention programmes (PP) against a specific health problem would be to compare the PP with the doing-nothing alternative, i.e. without prevention. However, whilst this approach would allow assessing the full effect of prevention measure on the population health, it is quite difficult to implement as very often no data are available under the alternative programme (no prevention at all). We should rather compare a case with prevention programmes versus new prevention programmes (see figure below, with PP1 being the legal ban on advertisement at TV coming from the Federal Swiss law RS 748.40 LRTV, for instance, and PP2 being the 1996-1999 Federal Swiss campaign called Global Tobacco Programme). In both cases, the Society faces social costs due to the health problem (tobacco consumption) and its consequences on the population health (lung cancer, for instance). With PP2, the expected benefits are twofold: a reduction in social costs and positive benefits in terms of years of life gained (DALYs) thanks to a reduction in prevalence of the health problem and its related diseases. However, the costs could increase due to the costs of launching prevention measures. However, these costs are expected to be offset by the decrease in social costs due to prevention. If under the new prevention programme, both benefits compensate the cost increase due to the cost of implementing the new PP, then the cost-benefit ratio should be in favour of the new PP. In this case, it is relevant for the society to implement the new programme.

Figure 3.2: Cost and benefits of two different prevention programmes.



This section describes the costs and benefits expected under both alternatives.

Valuing costs of both alternatives: previous prevention versus new prevention measures

Under both alternatives, the costs incurred by the society are:

- The direct medical and non-medical costs caused by mortality and morbidity due to the risk factor.
- The indirect costs, such as lost production.
- The human costs, also called intangible costs, such as loss of quality of life due to mortality or morbidity incurred by the patients and their relatives. As they are highly subjective and as their assessment is highly controversial, they are not included in our analysis.
- Costs of launching each set of prevention measures.

Estimating social costs of just one health risk is a time-consuming work. Such studies can take about three years (see both studies on social costs of tobacco consumption and alcohol abuse in Switzerland, 1998 and 2003). Henceforth, we rather propose to update social costs of Swiss studies in details, whenever it is possible.

Valuing health's benefits of prevention measures

In cost-benefit analysis, both costs and benefits are valued in monetary terms. Henceforth, we would need to transform physical health benefits into money values. Health benefits are of two kinds: improvement in quality of life or years of life gained.

With prevention programmes, the Swiss population is expected to benefit from ***quantitative and qualitative gains in years of life***, as the expected impact is a decrease in the health problem prevalence and its related diseases: a reduction in mortality and a reduction in morbidity. Different methods to value this double impact on mortality and morbidity are available, such as quality adjusted life years (QALYs) and disability adjusted life years (DALYs) that both belong to the group of health adjusted life years measures (HALYs). QALYs measures life years still to come or the maximum life years won thanks to a treatment or a prevention strategy; whereas DALYs are the health adjusted life years lost because of a disease (not cured here). Thus DALYs are the difference in the number of years of life between the illness condition and a state of prefect health over a time period that has to be chosen. Henceforth, it is obvious that these two health measures diverge. The main differences are the following:

- DALYs are based on experts' judgments that represent social preferences whereas QALYs are based on individual preferences. Hence, there are equity aspects in DALYs.
- DALYs are disease-specific health measures, whereas QALYs are generic health description. So DALYs are more precise, and in case of co-morbidities, DALYs weights can be summed up.
- The weight scales given by DALYs are health specific and internationally comparable (health gap measure developed by the World Health Organization for the Global Burden of Disease project), whereas QALYs gives various weight scales not fully comparable.
- Finally, age weighting is also different between both measures: DALYs allocate higher weights to the middle age of people's life than QALYs.

As our analysis focuses on health risk prevention and targets the whole population, DALYs better suit our approach as they incorporates social preferences. Henceforth, we will use them in assessing the health benefits of prevention. Appendix 1 gives a deeper insight into the conceptual and practical differences between both measures.

Technically, DALYs are a severity index that accounts for years of life lost because of premature death or disability caused by a disease or a health risk, in comparison with full health. DALYs range between 0 for full health and 1 for death. When an individual faces a health risk, the health condition caused by this risk factor can be described by the sum of the years of life lost due to premature death (YLL) plus the equivalent years of life lost due to disability (YLD).

$$DALYs = YLLs + YLDs$$

The weight of premature mortality and morbidity on life is computed by this index. Then the (1-DALYs) index is multiplied by the number of years remaining to live with this health condition. DALYs were groundbreaking in that they could examine the health gap between current health outcomes and potential health targets for specific diseases, risk factors or population groups. As DALYs have been developed for many countries and are an international quality of life measure index, we do not need an alternative specific measure for Switzerland. We can rely on the European DALY index used in neighbouring European countries.

Once the gains (due to the PP) in years of life have been evaluated, we should convert them in monetary value. In the standard economic approach, the range for the value of a healthy life is between US$70'000 and US$175'000 (about 40 years, with a discount rate at 5%) (Tolley et al., 1994; Cutler and Richardson, 1997). Henceforth, by combining this value of healthy life with the number of years of life DALYs-weighted gained, we are able to recover the monetary value of the gain in life due to both PP of the specific health problem.

Cost-benefit ratios

To summarize, the costs incurred to society consist of the direct medical costs and indirect costs due to mortality and morbidities caused by the health problem under study. The prevention programmes have additional costs due to settling the prevention measures. The benefits are twofold: Firstly, the expected reduction of social costs due to the new prevention program which is expected to diminish the prevalence of the health condition and its related diseases. This benefit is accounted for in the costs side of the evaluation. Secondly, the expected increase in health quantity of life expressed in monetary value due to the new prevention program compared to the previous one.

If the difference in costs between both PP is negative (i.e. smaller costs for the new PP), and if the difference in benefits between both PP is positive (i.e. the new PP is more effective on health than the previous one), then the new PP is preferred to the previous one.

Returns on investment of Prevention programmes

Finally, if the Federal government is concerned with the return on investment of its prevention programmes, the net present value (NPV) of these programmes over their lifetime has to be computed. It gives the actual reward of investing a franc in such a program today.

This NPV of PP can be compared with the NPV of other Federal programmes to assess the opportunity of this investment.
The NPV is computed as it follows:

$$NPV = \frac{(B-C)_1}{(1+r)} + \frac{(B-C)_2}{(1+r)^2} + \frac{(B-C)_3}{(1+r)^3} + \cdots + \frac{(B-C)_T}{(1+r)^T}$$

With *B* the benefits of the PP and *C* its costs; *r* is a discount rate that stands for the preference for the present; and *T* is the time duration of the investment. Usually the interest rate is taken as discounting rate, because it also represents the cost of giving up an opportunity of investing in capital. When NPV is positive, the benefits exceed the costs.

3.3. Projection and sensitivity analysis.

To forecast the effect of prevention program in the future, we have to project some of our results. To do so, we should make assumptions concerning the exogenous factors that impact on health behaviour/condition as well as the endogenous ones. Usually, a conservative approach is adopted. Under this approach, almost all exogenous and endogenous factors are assumed to stay identical in the future. The steps to make a forward prediction are the following:

- Make hypotheses on the endogenous factors, which are:
  - Duration and costs of the prevention programmes.
  - Impact of the program on prevalence/incidence of the risk factor and its relative diseases.
  - Impact of the program on social costs of the health risk.
- Make assumptions on the exogenous factors, which are mainly the socio-economic variables of the Swiss population.
- Determine the number of periods and the discounting rate to be used to extrapolate the costs and benefits of the prevention programmes.
- Then compute costs and benefits for the future.

Finally to cope with uncertainty in our results, a sensitivity analysis should be done for the estimated and forecast cost-benefits ratios. The aim of such analysis is to relax the assumptions of the conservative approach and to set more extreme assumptions in order to assess the range of the variability of the results.

3.4. Conclusion: method to assess cost-benefit of prevention in Switzerland.

Starting from existing data in Switzerland on social costs of risk factors, we propose a general framework for cost-benefit analysis in Switzerland that can be used to compare the effects of prevention programs that deal with different public health issues. In turn, this could play an important role in allocating scarce resources to public health programs more efficiently.

Given the existing studies about social costs of risk factors in Switzerland, we have adopted the following approach to select risk factors for a CBA study:

1) Risk factors for which social costs have been computed for Switzerland,
2) Risk factors with the higher social costs, as social costs are a measure of the economic burden of the health problem at the country level.
3) When possible, risk factors for which social costs have been computed by the same methodology.
4) Risk factors for which prevention is not new in Switzerland.

Thus, given our selection process, we consider making ***CBA of prevention in the fields of tobacco consumption, alcohol abuse and road accidents***, as: (1) there is available data from studies conducted on the social costs of these factors for Switzerland (road accident (1994), tobacco consumption (1998), alcohol abuse (2003)); (2) road accidents and tobacco consumption have the higher social costs (direct and indirect costs) of all risk factors in Switzerland: CHF 6 billion and 5 billion, respectively (see table below); (3) social costs of

tobacco consumption and alcohol abuse were assessed by the same research team (University of Neuchâtel, IRER), which allows a direct comparison; (4) prevention is not new in these domains in Switzerland.

Table 3.1: Social Costs and CEA studies of some health risks and conditions in Switzerland.

Health risk/condition	Type of study	Direct costs (in CHF)	Indirect costs (in CHF)	Total costs (in CHF)
Road Accident (1998)	Social costs	3.5 milliards	8.8 milliards	12.3 milliards
Tobacco consumption (1998)	Social costs	1.2 milliards	3.8 milliards	5.0 milliards
HIV (1998)	Social costs	0.17 milliards	0.26 milliards	0.44 milliards
Stress (2000)	Social costs	1.8 milliards	2.4 milliards	4.2 milliards
Physical activities (2001)	Social costs & CEA	1.6 milliards	0.8 milliards	2.4 milliards
Alcohol Abuse (2003)	Social costs	0.7 milliards	1.5 milliards	2.2 milliards
Flu epidemic[6] and vaccination (2003)	Social costs & CEA	0.15 milliards	0.36 milliards	0.51 milliards
Overweight (2004)	Social costs	-	-	2.6 milliards
Illegal Drugs (2005)	Social costs	1.4 milliards	2.3 milliards	3.7 milliards

However, a closer look at the results of the studies on social costs currently available vary considerably not only due to differences in the characteristics of these three public health issues, but also because of the substantial differences in the methodology used for road accidents compared with alcohol and tobacco consumption.

For CBA of each of these three public health issues we could proceed in the following way:

a. Update the direct and indirect costs of Swiss social costs studies.
b. Update the information on mortality and morbidity (number lives lost, number and degree of disabilities) and transform them into DALYs using the weights we obtain from the literature.
c. Transform the DALYs into a monetary measure by multiplying them with "value of life" in Switzerland (as we use the same value for the three different health issues, this is an important advantage of our study). The value of DALYs will be used as the monetary gain in years of life: it is a monetary benefit of prevention measures.
d. Quantify the impact of the prevention programmes in terms of DALYs.
e. Quantify the costs of the prevention programmes.
f. Conduct the cost-benefit analysis by comparing the social costs incurred under the old prevention programmes with those under the new prevention programmes that are monetary gain in DALYs minus new smaller social costs of the risk factor minus costs of prevention programmes.

To conduct comparable analyses, and given that social costs of risk factors are available in Switzerland in 1994 for road accidents, 1998 for tobacco consumption and 2003 for alcohol abuse, we could only realistically take the year used for each of the relevant social costs reports as a baseline to compare with the *new prevention measures* that have been launched since these dates.

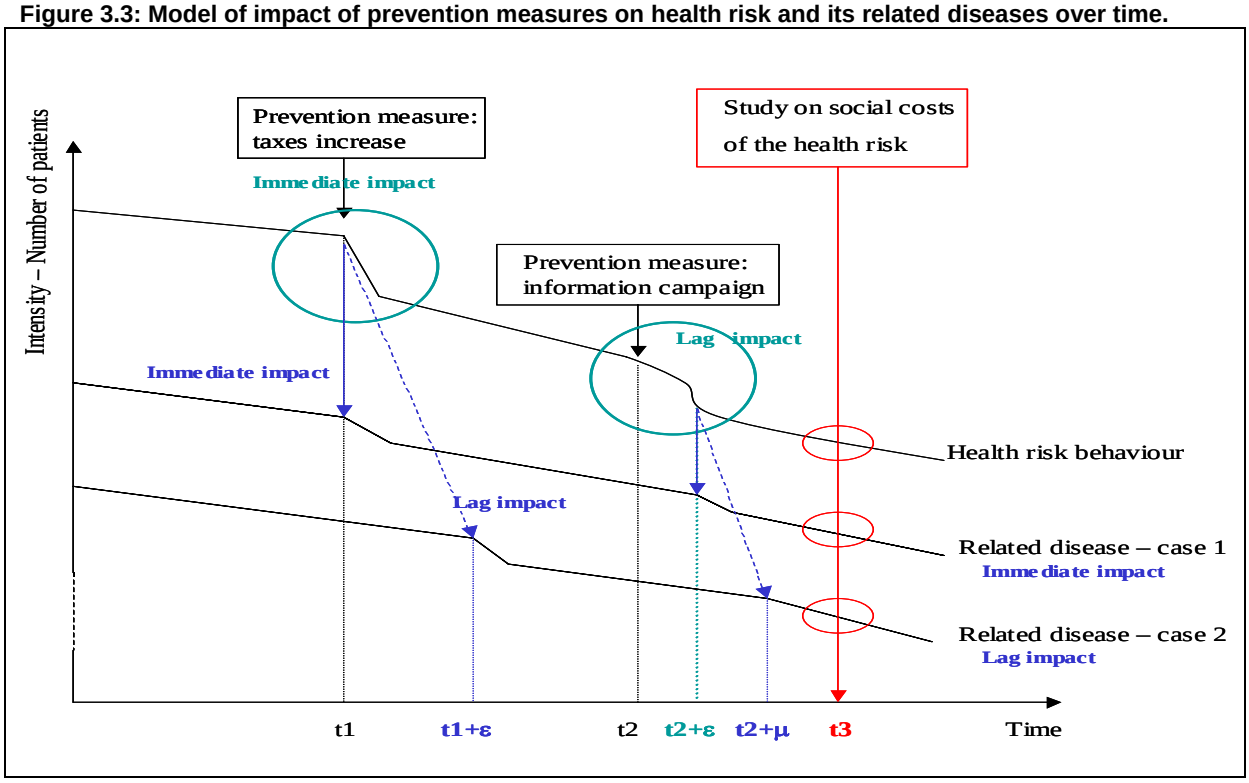
Moreover, since the social costs study for one of the three proposed health risk factors (road accidents) was not made by the same research team, the approach in computing social

[6] In case of a flu epidemic during high season.

costs is neither fully comparable nor replicable, as it was simply not completely explained. We therefore considered adopting a common approach for doing CBA on tobacco consumption and alcohol abuse, with a slightly different one for road accidents. We present the approach adopted for each health problem in each chapter related to the health problem at stake.

Another issue concerns the time elapsed between the prevention measure, its impact on the health risk prevalence and on its related morbidity and mortality, and the date of the evaluation of social costs of the health risk. Assessing the impact of prevention measure on health should be done over time whereas the social costs studies have been done in cross-section, i.e. at a fixed date. The figure below illustrates this problem.

Figure 3.3: Model of impact of prevention measures on health risk and its related diseases over time.



The issues are that (1) we don't know how long the impact of a prevention measure will last; (2) at time t3, we don't know if the magnitude change in health risk behaviour is due to the additional impact of both measures or to only the last one or the more durable one (e.g.: taxes); (3) at time t3, we don't know if the change in related diseases is due to the change in the health risk behaviour at t1, or at t1 and t2; (4) and we don't know the magnitude share of the change in health risk behaviour due to long-term changes in people habits. But social costs, when computed at a fixed date (as in t3), take into account the prevalence rates of the health risk behaviour and its related diseases/injuries/deaths registered in t3, independently of the causes of change in related diseases.

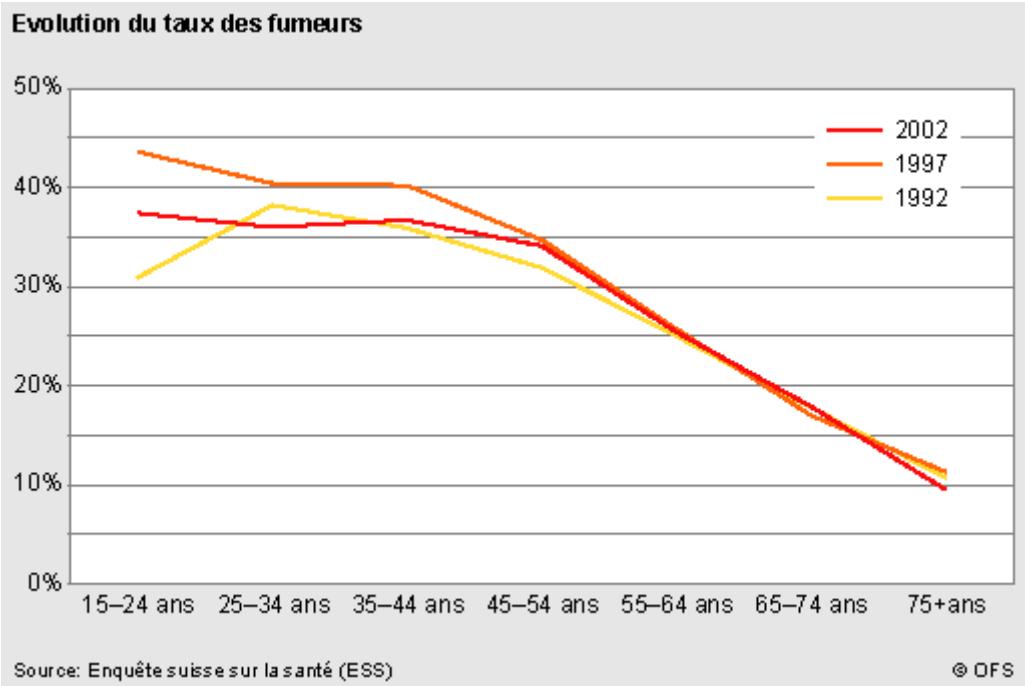
4. TOBACCO CONSUMPTION

4.1. Smoking prevalence evolution in Switzerland

Tobacco consumption is one of the main causes of avoidable diseases in the world. About 8'000 people die from smoking every year in Switzerland, which corresponds to 14% of yearly deaths (Tabac, ISPA, 2006).

Since 1992, every five years, the Swiss Federal Office of Statistics conducts a survey aimed at measuring the health of the population residing in Switzerland (Swiss Health Survey - SHS). It is a cross-section survey, which covers a sample representing 90% of the resident population (15'000 to 30'000 depending on the survey year). The figure below, presenting the proportions of smokers in Switzerland by year, has been computed from this survey.

Figure 4.1: Proportion of smokers in the Swiss population 1992, 1997, 2002.



Source: Swiss Federal Office of Statistics

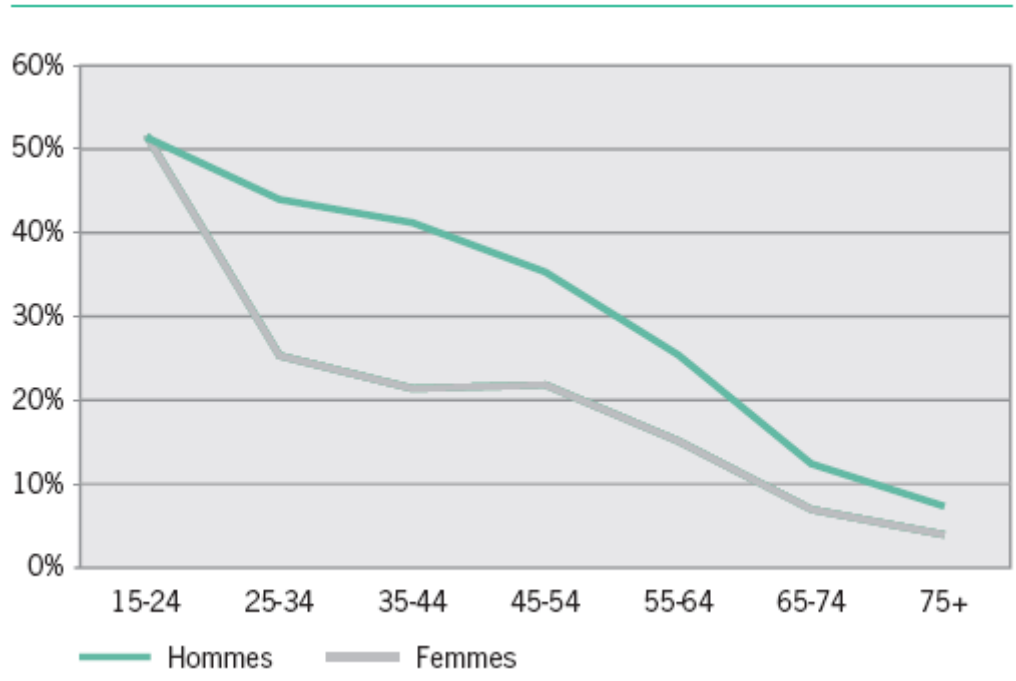
From 1992 to 1997, the percentage of smokers has sharply increased among the younger (15-34), whereas this percentage is almost the same for people aged 55 and older. Between 1997 and 2002, we notice an important decrease in the proportion of smokers for people aged below 45, recovering proportions of 1992, except among the youngest. The proportions of older smokers are converging between 1997 and 2002 at an earlier age than the preceding period, starting at 45 years old. In 2002, 31% of the population smoked, (of which 36% men and 26% women). Among the 15-24 years old, women (35 %) smoke just a bit less than men (40 %). Tobacco consumption varies considerably in relation to linguistic regions and socio-cultural background.

In addition to the SHS, since 2001, a new annual survey has been launched specially on tobacco consumption, called Tobacco Monitoring. It is a phone survey, done every quarter on those aged 14 to 65 years old. This survey covers 10'000 individuals per year. For the period 2001-2005, we've got the following distribution of smokers (daily and occasional smokers) in the resident population: 33% in 2001, 32% in 2002, 31% in 2003, 30% in 2004 and 2005. The figures between both surveys are quite comparable even if the subpopulation sample is not fully the same. We notice that, since 2001,the number of smokers has slowly but steadily decreased in Switzerland.

Even though tobacco consumption is decreasing, it remains the most important health risk factor in Switzerland as it causes many diseases to smokers and non-smokers alike: it has a

negative effect on non-smokers by increasing their risk of diseases and of premature death (passive smoking).

Figure 4.2: Non-smokers exposed to passive smoking more than one hour per day



Sources: Swiss Federal Office of Statistics, 2002.

70% of those aged 14 to 65 years old are non-smokers. However, around one-quarter of non-smokers are exposed to passive smoking for more than one hour every day. 21% are exposed for 1 to 3 hours per day, 6% for more than 3 hours. Men, teenagers and young adults are more affected by passive smoking. Thus, non-smokers face also a higher risk of diseases attributed to smoking, such as lung cancer, cardio-vascular diseases, asthma and pulmonary respiratory infections, as well as of premature death.
Worldwide, tobacco is a major cause of death. According to recent estimates, for the decade 1990-1999, 21 million deaths will be caused ***in developed countries***; more than half of these deaths will be among those aged between 35 and 69, ***making tobacco the largest single cause of premature death*** in these countries. Smoking-related deaths, once largely confined to men in the high-income countries, are now spreading to women in high-income countries (World Bank Report, 1999).

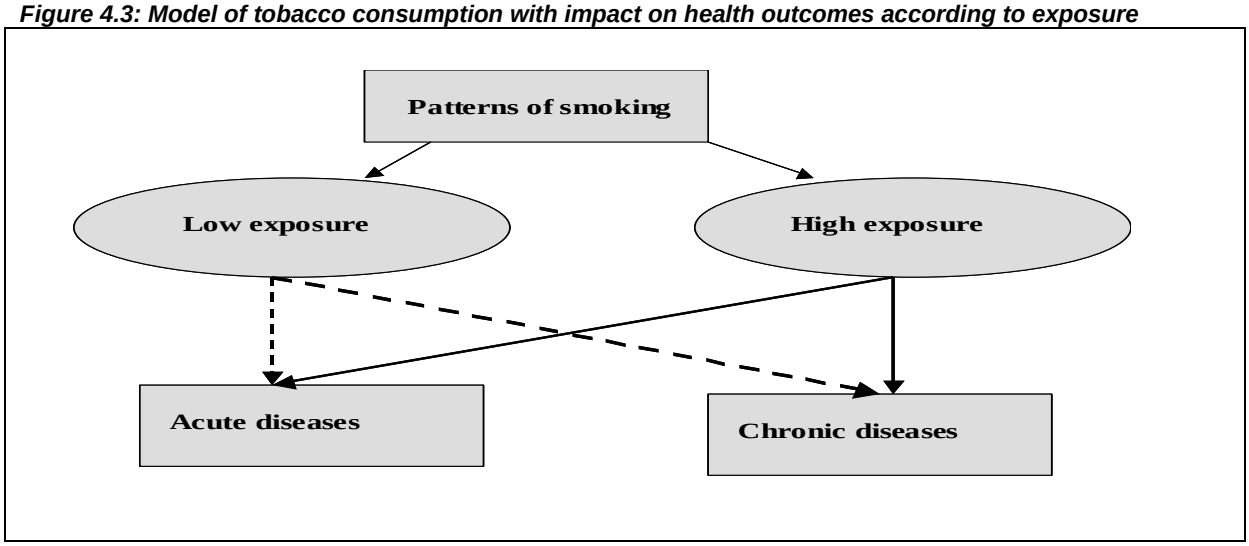
Tobacco consumption is a critical public health concern and one of the primary targets for public health action.

The next section presents the impact of smoking on people's health. The third section gives an overview of the social costs incurred by the Swiss Society because of tobacco consumption. The fourth section will give a detailed picture of smoking prevention measures at Cantonal and Federal levels. The last section will propose a new approach to the cost-benefit analysis of smoking prevention measures in Switzerland.

4.2. Causal path of smoking on health

The impact of tobacco on health has been extensively documented in more than 57'000 studies that have investigated the issue. We briefly summarize the evidence:

Figure 4.3: Model of tobacco consumption with impact on health outcomes according to exposure



Low exposure to smoking (passive or active) leads to a smaller risk of contracting an acute or a chronic disease due to cigarettes consumption (dashed arrows); whereas high exposure (passive or active) leads to higher risks (full arrows). But whatever the pattern of smoking is (high or low consumption), active and passive smokers are subject to a higher risk of mortality and morbidity than non-smokers.

The addictive nature of tobacco smoking

Tobacco contains nicotine, an addictive substance. Among the population, young smokers, more than others, underestimate the risk of becoming addicted. It is of course possible to abstain permanently, as is the case with other addictive substances. However, without cessation interventions, individual success rates are low. In addition, even when smokers want to cease, on average they try 4 times before succeeding. Thus, tobacco consumption is not a free choice made by smokers, as nicotine is an addictive substance.

Long delays between exposure and disease

The effects of tobacco consumption on health take a long time to become manifest. In high-income countries whose populations have been exposed to smoking for many decades, it took 40 years before a clear picture of tobacco-related diseases emerged. Excess risk of dying for smokers has been computed through prospective studies that compare the health outcomes of smokers and non-smokers: nowadays, it has been estimated that smokers face a one-in-two risk of dying because of tobacco (World Bank Report). This burden of death is higher for the 45-64 year old: smokers in this group are three times more likely to die prematurely than lifelong non-smokers of the same age. In the 65-84 age group, smokers are around twice as likely to die compared to lifelong non-smokers.

Smoking and its attributable diseases

Smoking is identified as a major cause of heart disease, stroke, several different forms of cancer, and a wide variety of other health problems (DHHS Publication, 1989).

Deaths caused by smoking occur mainly through development of heart disease and lung cancer, followed by chronic bronchitis, stroke, peripheral vascular disease and other circulatory diseases, and cancers other than lung.

Smoking is also associated with cancers of various other organs, including the bladder, kidney, larynx, mouth, pancreas, and stomach.

Moreover, *a person's risk of developing lung cancer* is *affected more strongly by the amount of time that they have been a smok*er than by the number of cigarettes they have smoked daily. Thus those who start to smoke in their teens and who continue face the biggest risks.

The risks from others' smoke

Smokers affect not only their own health but also the health of those around them.

- Pregnancy: smoking increases the risk for pregnant women to lose the foetus through spontaneous abortion. Babies born from smokers face a higher risk of low birth weight and higher risk of dying (up to 35%) in infancy than those from non-smokers. They also face higher risks of respiratory disease.
- Non-smokers who are exposed to smoke include the children and the spouses of smokers, mostly within their own homes; and also non-smokers working with smokers, or in smoky environments:
    - Adults exposed chronically to others' tobacco smoke also face small but real increased risks of lung cancer and higher risks of cardiovascular disease.
    - The children of smokers have a higher probability of suffering a range of health problems and functional limitations.

Switzerland and smoking attributable deaths

In Switzerland in 2000, Peto *et. al* (1992, 1994, 2006) have estimated the number of deaths attributed to smoking. Their results are presented in tables below:

Table 4.1: Deaths attributed to smoking in Switzerland in 2000, by age groups and sex.

Relative importance of deaths in MIDDLE age (35–69) in the year 2000

Age range (years)	Deaths attributed to SMOKING /total deaths (thousands) Male	Female	Mean years lost PER DEATH FROM SMOKING
0–34	– / 1.2	– / 0.6	–
35–69	2.2 / 8.8	0.6 / 4.9	23 years
70+	3.3 / 20	1.2 / 27	8 years
All ages	5.6 / 30	1.8 / 32	14 years

Smoking contributes to one-quarter of deaths among males aged 35-69. In 2000 the number of women dying from smoking was smaller across all age groups than the corresponding number of men, but the mean number of years lost in the 35-69 age group was especially high for men and for women.

Dying from lung cancer is principally due to smoking in all age groups for both genders. The second cause of deaths attributed to smoking is other types of cancer. Deaths related to vascular diseases and respiratory illnesses are other important consequences.

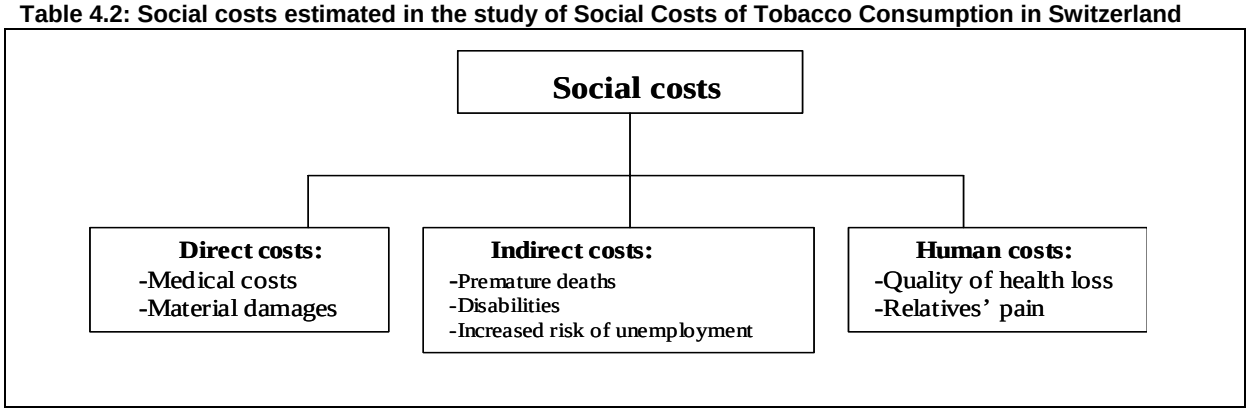
Given the high burden in terms of diseases and deaths due to smoking, several attempts have been made to estimate the social costs of smoking. We now turn to this issue.

4.3. Social Costs of Tobacco Consumption in Switzerland: a snapshot

The World Bank Report on tobacco control policies (1999)has shown that in high-income countries, smoking-related healthcare accounts for between 6 and 15 percent of all annual healthcare costs. From a societal point of view, these annual costs are of great importance.

In Switzerland, a study commissioned by the Swiss Federal Office of Public Health to the University of Neuchâtel (IRER, C. Jeanrenaud, 1998) assessed the social costs of tobacco consumption. Given that the burden of smoking consisted of 8'000 deaths (one over six Swiss people) and more than 16'000 disabilities in 1995, this report aimed at estimating the global financial burden of tobacco consumption for the Swiss Society. The study computed direct, indirect and human costs of smokers for the year 1998. The costs incurred by passive smoking were not assessed in the report.

Table 4.2: Social costs estimated in the study of Social Costs of Tobacco Consumption in Switzerland



Direct costs

Direct costs are composed of all human and material resources dedicated to prevention and recovery (repairing) of damages caused by tobacco consumption. The direct costs considered in the study of the University of Neuchâtel (1998) are those of health care services: ambulatory care, hospital care (acute and long-term hospital stays) as well as pharmaceutical therapies for people with a disease attributed partly or mainly to smoking. In 1998, the direct costs of smoking amount to 1'212 Mio. Francs.

Indirect costs

Indirect costs are the costs incurred by society because of market and non-market production lost due to premature death or disability caused by smoking. Because of premature death or disability, people can't work or do their usual activities. Henceforth, there is loss of value due to loss in production for those working, and to the loss of domestic and voluntary activities that should be done by someone else. The indirect costs[7] of smoking-caused mortality have been based on 4'224 deaths of people aged between 35 and 74. The costs of morbidity concern only smokers aged 20 to 64. Around 386'000 cases of temporary absenteeism from work, and 16'100 cases of disability are attributed to smoking in Switzerland in 1995. In 1998, the indirect costs amount to 3'809 Mio. Francs.

Human or intangible costs

In addition, this study assessed also the human costs of smoking. As we have explained in the section concerning the CBA method (see section 3.2), we do not take these costs into consideration.

[7] To assess these losses in production, the authors have made assumptions on the discount rate (0, 2 and 6%), the growth rate of productivity in Switzerland (1% by year over 20 years).

The total economic costs of tobacco consumption for smokers, composed of direct and indirect costs, thus ***added up to 5'000 Mio. Francs.*** They represent 1.4% of the Swiss GDP. This figure is similar to the results of Rice (1986) for the US where economic costs of smoking are about 2% of the GDP, and to those of Collishaw and Meyers (1984), and Single (1992) for Canada with respectively 1.9% and 1.4% of the GDP.

As ***smoking causes more premature deaths than*** AIDS, drugs addiction, alcohol abuse, murders and suicides ***altogether***, its economic costs are a great concern for Public Health Authorities. Governments of developed countries have thus taken a number of prevention measures. We now present the measures implemented in Switzerland over the last 30 years.

4.4. Prevention measures of tobacco consumption in Switzerland

In the field of primary smoking prevention, there are two kinds of measures: some aim at controlling the supply of tobacco, whereas others try to curb the tobacco demand.

- **In order to control tobacco supply**, the Federal government regulates the entrance of sellers and producers on the market.
  1) It regulates the type and composition of tobacco products produced and sold on the Swiss market.
  2) It delivers authorizations (licenses) to produce and sell tobacco in Switzerland.
  3) It enacts laws that limit tobacco sales through advertisements restrictions.

  References: ***RS 817.0 Loi sur les denrées alimentaires (LDAI), (1995) ; RS 817.02 Ordonnance sur les denrées alimentaires et les objets usuels (ODAlOUs) (2006) and RS 817.06 Ordonnance sur le tabac (OTab) (2004).***

- **In order to decrease tobacco demand**, the Federal and Cantonal states enact laws that raise taxes on cigarettes, prescribe a minimum age for buying tobacco, ban advertisements on cigarettes or ban smoking in public and work places. The authorities also operate by other ways, such as information, campaigns, health warning on cigarettes packs, targeted educational events in schools, sport and leisure's associations, firms, administrations, etc. The table in Appendix 3 presents the main strategies aiming at a reduction of tobacco demand that are used in Switzerland. Federal measures are classified by beginning year.

  As it is difficult to collect all the cantonal measures, we have focused on federal prevention measures. They also target a larger public. They are listed in Appendix 3. The federal specificity of Switzerland is its extended executive and legal power at the cantonal level. Hence, even if a prevention policy of smoking is voted at the federal level, it is often implemented by cantonal associations or governments. This is also the case for the Smoking Prevention Foundation (Fonds de Prévention du Tabagisme), which is administered by the Swiss Federal Office of Public Health. It aims at implementing its own prevention programs, at funding prevention programs organized by third parties and at communicating its activities to the media. Therefore some cantonal programs can be financed by a Federal service, or by a national organisation such as the Smoking Prevention Foundation; this aspect made our information search even more complicated.

  Federal laws on tobacco taxes, advertisements on radio and TV, and smoking restrictions target the whole population, which is composed of both current and future smokers. The other measures target specific subgroups such as the young, public or private employees and the population of specific cantons.

  Two kinds of measures are relevant: firstly the ones that target the whole population as they aim at preventing smoking or trying to decrease the number of smokers; and secondly, the ones that target the young, as the detrimental impact of smoking on health is enhanced with smoking duration over life. However, to find out if these measures are relevant, we now assess their impact on smoking prevalence.

4.5. Impact of prevention measures on tobacco consumption prevalence

To assess the impact of prevention measures on mortality and morbidity caused by tobacco consumption, we first considered the impact of some of the Swiss prevention measures that have been evaluated. In a second step we enlarged our search to include the findings of international studies.

4.5.1. Swiss studies

In Switzerland, two broad anti-smoking prevention strategies have been evaluated: The Tobacco Global Programme (TGP) 1996-1999, and most recently, the National Programme for Tobacco Prevention 2001-2005/7[8] including its related media campaigns e.g. "Smoking is harmful"[9] 2000-2001 and 2003-2004. With a small budget of 1 million francs over 4 years[10], the TGP 1996-1999 did not fully meet its over-ambitious goals. The first goal was to decrease the prevalence rate of tobacco consumption from 30% (the rate of 1995) to 25-28%, corresponding to the prevalence rates of the best European countries, but during the TGP, the prevalence rates increased for men and women alike. The second goal was to make the actions of the program well known to the population, as well as the involvement of the Federal Office of Public Health. This goal has been changed in good visibility among the professionals of tobacco prevention. The last goal that has been fully achieved was to avoid stigmatisation of smokers. Despite a large and ambitious programme, the prevalence has not decreased over the period 1996-1999. The campaign "Smoking is harmful" has also been evaluated but in terms of visibility rather than in terms of impact on the prevalence rate of smokers. However, the campaigns have been a huge impact on smokers' habits, which led them to change their behaviours with non-smokers. In Switzerland, other studies have evaluated the impact of prevention measures on smoking behaviour, such as the one of Nater *et al.* (1985), which assessed successful information of the public about smoking and heart disease. At the University of Lausanne, Etter *et al.* (1999) have analysed the impact of educational and regulation measures on smoking cessation. They found no impact on smoking prevalence that staid stable at 25%.

The evaluation of the 2001-2005/7 Tobacco Prevention Programme was not available to us at the time of writing. We can therefore, not comment on any likely changes to the prevalence rate at this stage. However, the main study would of course, take into account any changes that have happened since 1999..

4.5.2. International studies

In an international context the most complete report on prevention measures of smoking is the "Curbing the Epidemic: Governments and the Economics of Tobacco Control", a 1999 report of the World Bank. This report, realised in collaboration with the World Health Organization (WHO) and led by F. Chaloupka one of the best-known experts in the economics of smoking, assesses the impact of tobacco control policies on the worldwide economies. It evaluates the impact of all prevention measures on tobacco consumption, from those that tend to curb the demand for tobacco to those that target tobacco supply. We summarize below the main results of this report.

Measures to reduce the demand for tobacco

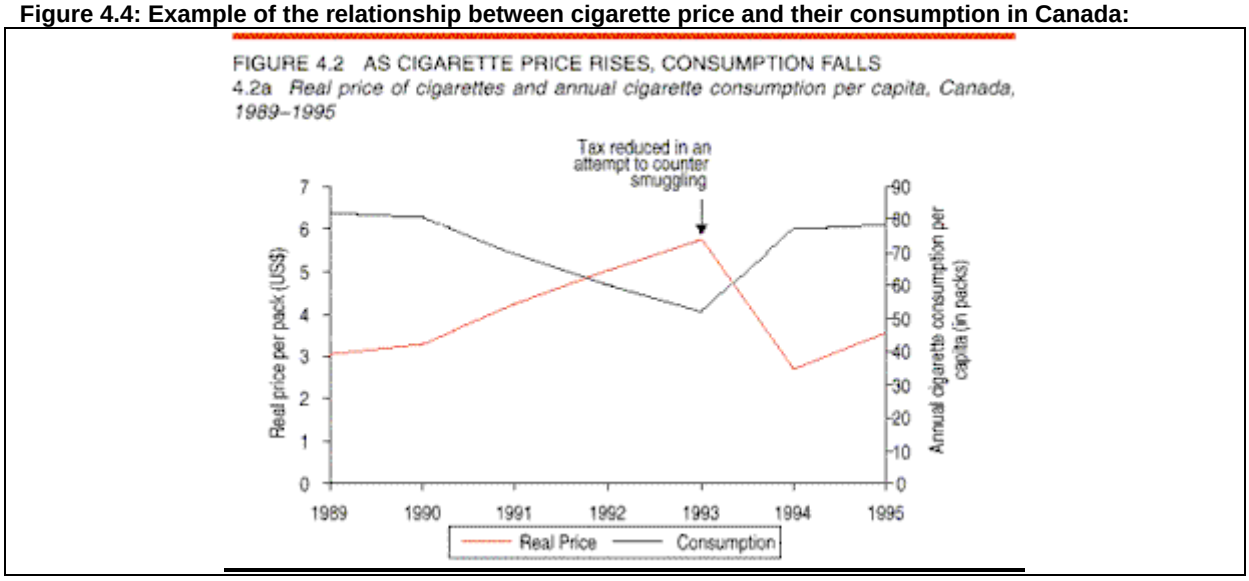
Raising taxes

Evidence from countries of all income levels shows that price increases on cigarettes are highly effective in reducing demand and have an immediate impact on cigarettes consumption. Higher taxes induce some smokers to quit or to reduce their consumption, and prevent other individuals from starting or returning to cigarettes. On average, a price rise of 10 percent on a pack of cigarettes would be expected to reduce demand for cigarettes by

[8] The National Programme for Tobacco Prevention 2001-2005 was subsequently extended to the end of 2007.
[9] Fumer, ça fait mal.
[10] Compare to the budget for prevention of AIDS.

about 4 percent in high-income countries. Children and adolescents are more responsive to price rises than older adults. In order to reduce smoking, the best yardstick tax rule is: the tax component of the price of a pack of cigarettes is between two-thirds and four-fifths of the retail cost.

Figure 4.4: Example of the relationship between cigarette price and their consumption in Canada:



Non-price measures to reduce demand

To curb tobacco demand, governments employ other effective measures, such as bans on advertising and promotion of tobacco; mass media counter-advertising, prominent health warning labels, the publication and dissemination of research findings on the health consequences of smoking as well as restrictions on smoking in work and public places. Each of these measures can reduce the demand for cigarettes.

- "Information shocks," such as the publication of research studies with significant new information on the health effects of smoking, reduce demand, with a greatest impact when a population has relatively little knowledge of the health risks.
- A comprehensive ban on advertising and promotion can reduce demand by around 7 percent, according to econometric studies in high-income countries (EU). The reduction in tobacco consumption is higher when bans on advertising are applied on everybody and concern all type of media. complete (OFSP, 2006).
- Mass media counter-advertising (negative messages about smoking) has been found to permanently reduce tobacco consumption by 11% percent over the period 1954-1981.

School anti-smoking educational programs.

They are widely spread in developed countries, even though they are less effective than many others type of information dissemination. They also appear to have temporary effects.

Restrictions on smoking in public and workplaces

Smoking restrictions in public places clearly benefit non-smokers as they are less exposed to passive smoking. There is also some evidence that restrictions can reduce the prevalence of smoking. In the US they have reduced smoking by 4 to 10%. However, their effectiveness relies on a strong social support as well as knowledge of the damaging effect of passive smoking (World Bank Report on Tobacco, 1999).

Finally, the World Bank report (1999) suggests that, when employed as a package, these non-price measures could persuade 2 to 10% of smokers to quit.

Measures to reduce the supply of tobacco

While some strategies to reduce demand for tobacco have been shown to be effective, measures to reduce supply are less promising. This is due to the fact that on a competitive market, if there is promise of profits, any supplier shut down will be replaced by a new one. Thus prohibiting tobacco to reduce tobacco supply is unwarranted on economic grounds as well as unrealistic. Crop substitution is often proposed as a means to reduce the tobacco supply, but the incentives to farmers to grow tobacco are currently much greater than for most other crops. Similarly, trade restrictions, such as import bans, will only have a limited impact on cigarette consumption, because of smuggling Moreover, even if the subsidies on tobacco production that are found mainly in high-income countries make little sense, their removal would have little impact on total retail price. However, a key supply-side measure that is effective is action against smuggling. Effective measures include prominent tax stamps and local-language warnings on cigarette packs, as well as the aggressive enforcement and consistent application of tough penalties to deter smugglers. Tight controls on smuggling improve governments' revenue yields from tobacco tax increases.

In conclusion, the most effective strategy to reduce smoking seems to be taxing cigarettes. Other non-price measures are also effective if they are introduced as a package. We will not consider strategies that reduce tobacco supply, as they have a small, if any effect.

4.6. Conclusion: approach to do a CBA of tobacco consumption in Switzerland

According to the information and literature collected, and according to the limitations described in the previous paragraphs, doing a cost-benefit analysis of tobacco consumption for Switzerland is feasible. We present below the steps of the CBA study.

- **Updating social costs of tobacco consumption:**
  - **Direct medical costs**:
    - Swiss data on the number of hospitalisations by disease can be recovered from the Swiss Federal Office of Public Health ("Swiss data of hospital stays"). However this statistical report is only complete from 1999;
    - **Ambulatory care and pharmaceuticals number of cases:** available by year from IMS;
    - **Prices or costs of health care**: from Interpharma or Swiss Federal Office of Statistics (by year).
  - **Indirect costs**: Swiss data from different sources. Mainly ESPA survey (Swiss survey on Working Population); Disability insurance (AI) for disability; And the Federal population census
- ***Smoking prevalence from the Swiss Health Survey*** (SHS) for the years 1992, 1997, 2002, and 2007. For tobacco consumption, since 2001 a data from the "Tobacco Monitoring" survey, recording smoking behaviour on a yearly basis.
- ***Morbidity and mortality caused by smoking***
  - Assumption: changes in attributable diseases or deaths are due to changes in smoking behaviour, up to the attributable fraction of smoking.
    - ✓ Diseases partially or fully attributed to smoking/drinking, with their attributable fractions
      - Attributable fraction: *Assumption: no changes in attributable fraction over the period;* Remark: attributable fractions are not Swiss specific
      - Number of cases by disease: Swiss Medical Statistics (FOS)
    - ✓ Deaths by disease, available at the Swiss Federal Office of Statistics by year.
  - When Swiss data are available on a specific disease mainly due to smoking, assessing the Swiss impact of changes in tobacco consumption on the prevalence of the disease (for lung cancer).
- ***Assessing the impact of smoking prevention measures***:

- Make a link between the Swiss prevention measures and those that have been assessed in the international literature, whenever possible.

Table 4.3: Proposed cost benefit analysis of prevention measures of tobacco consumption

Tobacco	**Baseline social costs: 1998**	**New prevention measures**
Prevention	Since 1970s	See table in Appendix 3
Prevalence of smoking	Measured in Swiss Health Survey (SHS) in 1992 and 1997	SHS **2002 and 2007**. Tobacco monitoring, **from 2001**.
Effects on related-diseases	Attributable fraction for diseases due to smoking from international literature	Conservative assumption.
Computing social costs	Done in the report	Update from Fed. Office of Statistics, after 1999 (statistics more complete).
Effects of prevention on prevalence	-	From international literature. For CH, not enough data
Cantonal versus national prevention	-	Difficult to assess: -no full access to cantonal measures
Environmental or contextual effects	-	Impossible to assess (not enough data, except since 2001)
Mixed impact from other prevention field	-	Assumption – Only if at Federal level.

- ***Thus for tobacco, we concluded that CBA analysis would be possible as we have:***
  - ***Baseline social costs for Switzerland in 1998 under older prevention measures (PP1), and***
  - ***Data on tobacco consumption prevalence on a yearly basis from 2001 onwards, and on federal prevention measures covering a broader spectrum than strictly tobacco control measures (orchestrated since 1996),***

And as difficulties arising from assessment of prevention measures on tobacco consumption can be circumvent.

5. ALCOHOL ABUSE

5.1. Alcohol consumption in Switzerland

The time when all types of alcohol consumption were considered as dangerous for health is over. The protective effect of a moderate consumption on health, especially for cardio-vascular disease, is nowadays well known by the public and recognized by the public health authorities. On the other hand, in case of excessive alcohol consumption, people can suffer from many diseases that could lead to disabilities and years of life lost. This detrimental effect is enhanced with chronic alcohol abuse behaviour, in which case people can suffer from highly injurious diseases such as cancer or liver cirrhosis.

Frequency of alcohol consumption

Since 1992, alcohol consumption has diminished and the number of alcohol-abstainers has risen. The proportion of daily alcohol drinkers has changed from 20% in 1992 to 16% in 2002. In parallel, the share of non-drinkers has increased from 16% in 1992 to 23% in 2002 (SAB, 2006). But daily alcohol consumption still concerns more men than women.

Table 5.1: Proportions of alcohol consumers by frequency of drinking: 1992 and 2002

	Men		Women	
	1992	2002	1992	2002
Alcohol consumption				
At least once a day	30.1	22.2	11.5	10.0
Several times per week	14.6	13.9	6.6	6.1
1 to 2 times/week	28.8	32.8	25.6	26.5
Rarely	17.1	16.9	34.0	27.0
Never (abstainer)	9.4	14.2	22.3	30.4

Source: Swiss Federal Office of Statistics

Switzerland is split into three main areas, each dominated by a single language. Therefore, depending of the area, drinking patterns are similar to those of their foreign neighbours who share the same language rather than to those of other linguistic regions in Switzerland. Thus, Swiss Germans consume alcohol more like the Germans than like the Swiss French or Italian speakers. In Switzerland, we recover between linguistic area the drinking pattern of alcohol consumption that exists between Italy, France and Germany: more Swiss Italian speakers drink alcohol at least once a day than Swiss French or German speakers. But there are however a higher proportion of abstainers in Ticino than in the two others speaking areas.

Table 5.2: Proportions of alcohol consumers by speaking language area

	German Swiss	French Swiss	Italian Swiss
Alcohol consumption			
At least once a day	13.5	21.2	27.2
Several times per week	11.1	7.2	4.8
1 to 2 times/week	31.9	25.2	14.2
Rarely	23.4	19.1	17.0
Never (abstainer)	20.1	27.4	36.7

Source: Swiss Federal Office of Statistics

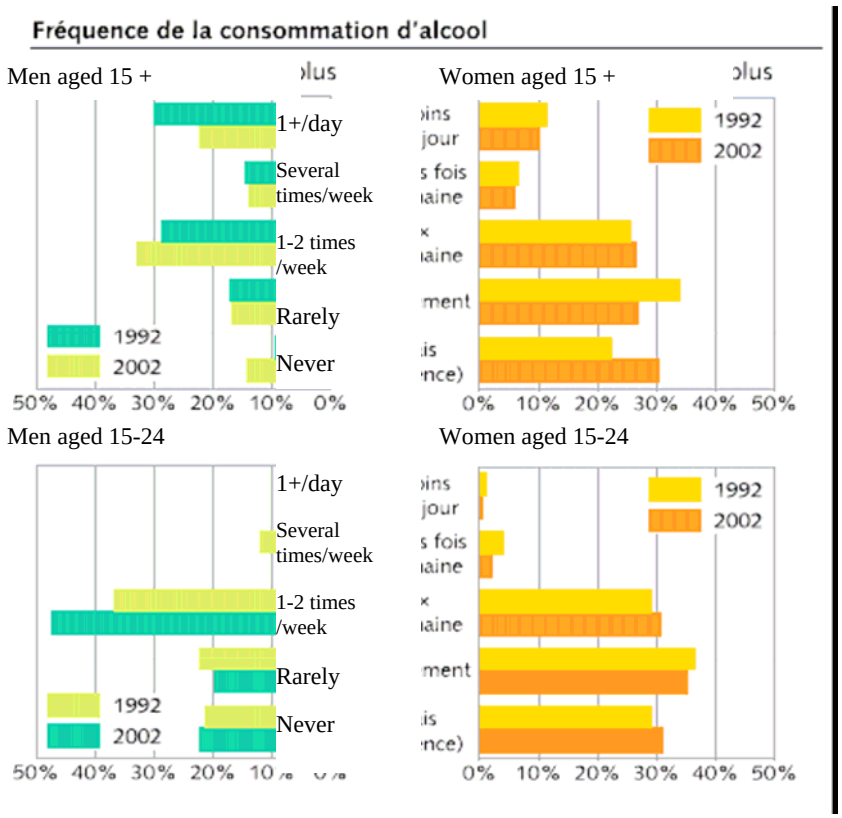
Excessive alcohol consumption

Excessive drinking patterns are defined as a daily consumption of 40gm of pure alcohol or more for women and 60gm or more for men (Swiss Health Survey, FOS).

In general, 'risky' alcohol consumption has fallen since the mid-1970s. But, in the mid-1990s, this decrease slowed down considerably. In 2002, the Swiss Health Survey detected that

1.1% of women and 3.0% of men had 'at risk' type alcohol consumption. Other surveys, particularly of the young, have also shown a rise in occasional risky drinking behaviour.
However, it is not only the frequency of alcohol that is decisive for health-related alcohol problems; significant also is the quantity consumed in one episode of drinking. In the recent past attention has been increasingly drawn, apart from chronic alcohol consumption, alcohol drinking at risk and unsuited consumption (e.g. before driving a motor vehicle), to occasional, but extreme drunkenness, also called binge drinking. From a medical point of view, it is less of a problem to drink often and little rather than seldom, but too much. According to estimates, between 2'500 and 3'000 people die annually in Switzerland as a result of alcohol consumption (SAB, ISPA, FOS). Moreover, the percentage of those Swiss who drink alcohol to an extent damaging to health is also on the increase. Again it is the young people who report more frequent experience of drunkenness than only just ten years ago (source: ISPA 2004). Among the adolescent and young adults, the pattern of binge-drinking consumption is widely spread across Europe and in Switzerland as well. As we can notice from the figure below, there is a higher proportion of men aged 15 to 24 years old that drink alcohol once to twice a week, which is probably binge-drinking consumption during the weekend. In addition, the proportion of Swiss young people that drink once to twice per week has risen between 1992 and 2002.

Figure 5.1: Comparisons of frequencies of alcohol consumption between general population and the young.



Source: Swiss Federal Office of Statistics

Alcohol abuse

In Switzerland, alcohol dependence touched around 300'000 people, 1'000'000 people live with a person suffering from alcohol abuse, and among them around 100'000 are children or teenagers. (ISPA, 2004). Alcohol abuse may lead to injurious diseases as cancer or liver cirrhosis. Under alcohol abuse, people are out of control, thus inducing a dangerous

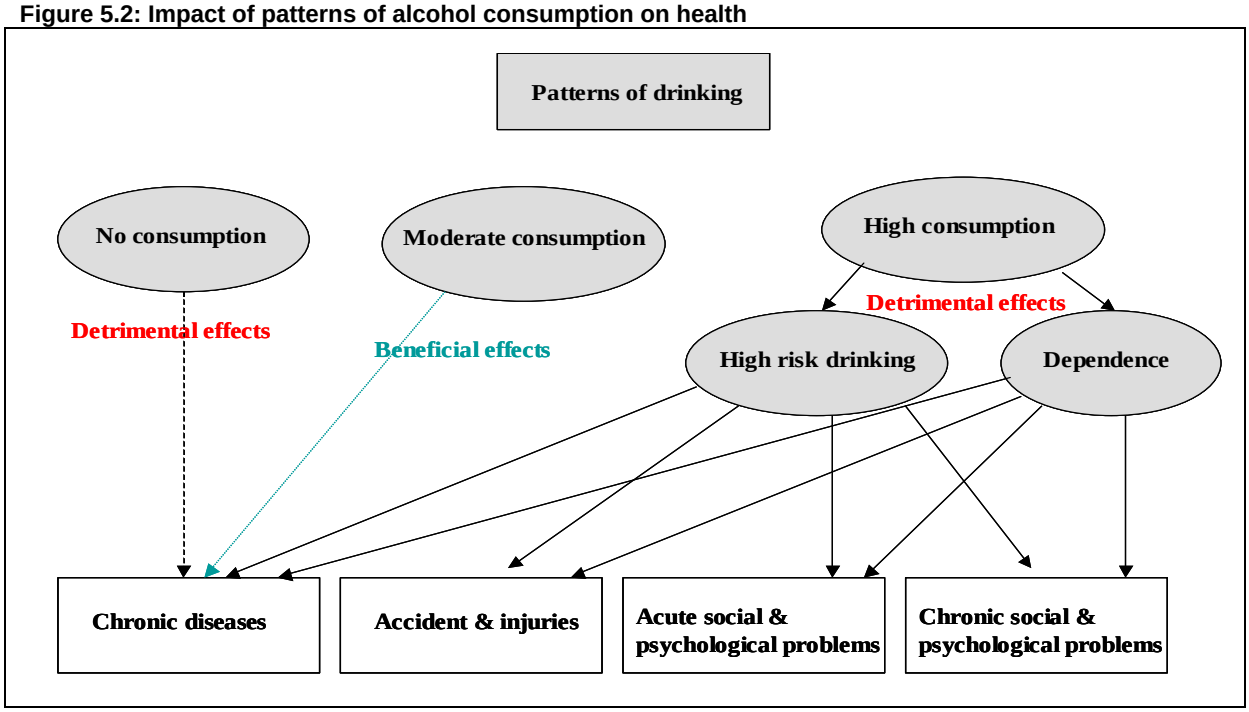
behaviour for them and others: alcohol-related public disturbances, vandalism, accidents, violence, date rape, emergency room admissions, arrests, and car crashes.
All these troubles put a financial burden on patients' families and third party's payers such as the Society. Henceforth, the public health authorities should regulate the consumption of alcohol in order to reach a healthy level of consumption for the whole population.

We will first explain the causal path of alcohol consumption on alcohol-related diseases, injuries and damages. Secondly, in the third section, we will summarize the social costs of alcohol consumption in Switzerland over the last decade. Thirdly, we will present the prevention measures and strategies taken by the Swiss Authorities to tackle the issue of an excessive alcohol-drinking pattern. Fourthly, we will review the Swiss and international literature assessing the impact of prevention measures on alcohol consumption prevalence and related deaths. And finally, we will explain our method to do a cost-benefit analysis of alcohol drinking prevention measures given the availability of Swiss data and information exposed in the previous sections.

5.2. Causal path of alcohol consumption on health

The relationship between alcohol consumption and health and social outcomes is complex and multidimensional (Rehm and others 2003). As the figure below shows, acute and long-term health and social consequences are affected by three different patterns of consumption.

Figure 5.2: Impact of patterns of alcohol consumption on health



Legend: The dashed black arrow represents a small risk of having chronic disease due to no alcohol consumption. Full black arrows represent a high risk of having a disease or an injury due to high alcohol consumption. And the dashed blue arrow represents the beneficial impact of moderate alcohol consumption on the risk of having an alcohol-related disease.

A moderate consumption of alcohol protects against the risk of catching chronic or acute disease (such as acute myocardial infarction) compared to no consumption at all. High patterns of alcohol consumption can lead to high risk drinking and dependency, which are two major causes of increasing risk of acute and, chronic health and social problems.

Alcohol Dependence

Alcohol use disorders (AUDs) are a subset of substance-related disorders characterized by either recurrent, excessive drinking that impairs function and leads to negative physical, legal, or social problems (alcohol abuse); or by physiologic dependence -- with associated tolerance and withdrawal -- and continued use despite knowledge of the physiologic and social psychological ramifications of continued drinking (alcohol dependence). As AUDs is often under-diagnosed, and as it is also recorded in the category high-risk drinking, we present the effects of this heavy alcohol consumption on health with those of high-risk drinking.

High-risk drinking

High-risk drinking is defined in gender-specific terms as drinking 20-grams per day or more of pure alcohol on average for females and 40 grams per day or more of pure alcohol on average for males (a bottle of table wine contains about 70 grams of pure alcohol) (Disease Control Priorities Project, 2006). The exact procedures for quantifying the risk of disease attributable to alcohol are described in Rehm, Room, Graham *et al.* (2003), and Rehm *et al.* (2004). For-most chronic disease categories, investigators have derived alcohol-attributable fractions of disease by combining prevalence and relative risk estimates based on meta-analyses (Disease Control Priorities Project, 2006). For injuries, Rhem *et al.* (2004) took a similar multilevel approach to quantify the interaction of the average volume of consumption and patterns of drinking in determining alcohol-attributable fractions

Thus high risk drinking causes the following major disease categories: among chronic diseases, cancer (mouth and oropharyngeal, esophageal, liver, female breast), neuropsychiatric diseases (AUDs, unipolar major depression, epilepsy), diabetes, cardiovascular diseases (hypertensive diseases, coronary heart disease, stroke), gastrointestinal diseases (cirrhosis of the liver), conditions arising during the perinatal period (low birthweight); injuries are relative to unintentional injury (motor vehicle accidents, drowning, falls, poisonings, other unintentional injuries), intentional injury (self-inflicted injuries, homicide, other intentional injuries).

However, it should be pointed out that alcohol-attributable fractions of disease are not Swiss-specific as relative risks of a disease, which are used in computation of attributable fractions, are not available for Switzerland. Nevertheless, as they have been computed for developed countries they are assumed to be usable for Switzerland's resident population.

Binge Drinking

The criterion of 5 or more drinks on a drinking occasion as an indicator of problem drinking was the first definition of binge drinking proposed as a threshold for evaluating the negative consequences associated with drinking. In the early 1990s, the College Alcohol Study (CAS; Wechsler et al., 1994) also used the term ''binge drinking'' and introduced the gender-specific measure, which defined binge drinking for women as 4 drinks in a row during the past 2 weeks (Crandford et al., 2006).

The high prevalence of binge drinking is particularly alarming in light of the numerous alcohol-related problems associated with this behaviour. College students who binge drink are at greater risk for poor academic performance, risky sexual behaviour, driving after drinking, and physical injury (Perkins, 2002), and a recent review indicated that the number of alcohol-related deaths among college students 18 to 24 years of age increased from approximately 1,600 in 1998 to more than 1,700 in 2001 (Hingson et al., 2005). Heavy alcohol use among college students is also associated with negative consequences for other people and to the surrounding community (Perkins, 2002).

5.3. Social Costs of Alcohol Abuse in Switzerland: a snapshot

In 2000, the Swiss Federal Office of Public Health commissioned the University of Neuchâtel to assess the social costs of alcohol abuse in Switzerland. This study assessed direct, indirect and human costs of alcohol abusers and high-risk drinkers. The costs incurred by binge drinking were not assessed in the report as at the time, this drinking behaviour was not well documented in Switzerland. Below we outline the report's main findings on social costs.

Direct costs

Direct costs are composed of all human and material resources dedicated to prevention, treatment and repairing of diseases and damages caused by alcohol abuse. In this study, medical direct costs such as ambulatory care, hospital care (acute and long-term hospital stays) and pharmaceutical were assessed in relation to the diseases attributed to alcohol abuse, as well as those for road accidents caused by drunk people. In addition, the costs of material damages and police force and court expenses of alcohol-related road were included. In 2001, alcohol abuse resulted in more then 800'000 medical consultations and 500'000 hospital days (Frei, 2001). In 2003, the direct costs of alcohol abuse amounted to 700'000'000 francs. Of these, 553'600'000 francs were due to the direct medical costs of alcohol-related diseases.

Indirect costs

Indirect costs are the costs incurred by Society because of market and non-market production losses due to premature death or disability caused by alcohol drinking. The indirect costs of alcohol drinking-related mortality were based on 1'300 deaths of people aged below 74 years, representing 28'500 years of productive life lost. This alcohol-induced mortality resulted in a net production loss of 1'000'000'000 francs in 2001. Lost production due to morbidity concerns 2'800 people that had an invalidity allowance owing to alcoholism, with an average invalidity level of 90%. Thus, the production loss due to alcohol-related invalidity was 179'300'000 francs. The probability of being unemployed because of heavy alcohol drinkers was higher than those of non-heavy drinkers. The risk of being unemployed is 8.9% higher among women, and 4.2% among men. This higher unemployment level for heavy drinkers represents an ongoing annual production loss of about 250'000'000 francs. Finally, for road accidents, 1 out of 4 was caused by alcohol for men, and 1 out of 8 for women. Net production losses because of premature death and invalidity caused by alcohol-related road accidents were of 225'400'000 francs. In total, indirect costs of alcohol abuse and high drinking amounted to 1'500'000'000 francs, in 2001.

Human or intangible costs

In addition, this study also assessed the human costs of alcohol abuse. As we have explained in the section concerning the CBA method (see section 3.2), we do not take these costs into consideration.

Finally, in 2001, the economic costs, that are the direct and indirect costs, of alcohol abusers added up to 2'200 million francs. They represent 0.58% of the Swiss GDP, less than half of the direct and indirect costs of tobacco consumption in Switzerland in 1998.

The Social Costs Analysis of Alcohol Abuse focused mainly on alcohol abuse, without differentiating the impact of different patterns of alcohol consumption on health. The 2002 World Health Organisation report identifies alcohol as the third highest risk to health in developed countries (WHO, 2002). Henceforth, governments from developed countries have introduced a range of prevention measures. We now present the ones implemented in Switzerland over the last decades.

5.4. Prevention measures of alcohol consumption in Switzerland

The implementation of Swiss public health policy in the field of alcohol prevention relies on the federalist political system. The Federal Government legislates and sets the conditions for action. The Cantonal Governments are responsible for executing federal laws and policies. The non-governmental organisations complement the action of public authorities.
In the field of alcohol consumption prevention, there are two kinds of measures: some aim at controlling the supply of alcohol to protect the population's health, whereas others aim at preventing excessive alcohol consumption or decreasing it.

- **Alcohol supply side**, the federal state regulates the entrance of sellers and producers on the market. It mainly regulates the production, importation, distribution and stock of alcohol, thanks to the law on food (RS 817.0 Loi sur les denrées alimentaires (LDAI) July 1995, RS 817.02 Ordonnance sur les denrées alimentaires et les objets usuels (ODAlOUs), January 2006). It also regulates the information on alcohol composition of food and drinks on their packaging (RS 817.022.21 Etiquetage et la publicité des denrées alimentaires (OEDAI), January 2006).
- **Alcohol demand side.** In order to decrease excessive alcohol consumption, the Federal and Cantonal states also enact laws that raise taxes on alcohol (SAB, Swiss Alcohol Board), settle a legal age for buying and consuming alcohol in public place, ban advertisements on alcohol. They also operate by other ways, such as information, advertisements, targeted educational actions in schools, sport and leisure's associations, firms, administrations, etc…We present in Appendix 4 the strategies introduced by the Swiss Federal State that have targeted alcohol demand and consumption to prevent or cease excessive drinking behaviours.
  In addition to these prevention measures, the Swiss authorities have introduced regulation measures embedded in the Federal Law on Alcohol (RS 680 Loi fédérale sur l'alcool) which fixes the tax rate on alcoholic drink and limits alcohol advertisements. In May 1999, the revision of the Ordinance on Alcohol (RS 680.11 Ordonnance relative à la loi sur l'alcool et à la loi sur les distilleries domestiques (Ordonnance sur l'alcool, OLalc)) set the tax rates for domestic and imported alcoholic drinks at 29 francs per alcohol litre. The Federal law on radio and television (RS 784.40 Loi fédérale sur la radio et la télévision (LRTV) banned alcohol advertising.
  Moreover, at the end of the 1990s, a new alcoholic-sugared drink appeared on the market targeting specially the young and women. This drink, called alcopops, was subjected to the tax on alcohol, but the price increase was not sufficient enough to discourage consumers. Therefore the Swiss Federal Administration of Alcohols (RFA) modified the law on alcohol in 1997 in order to impose a higher tax rate on alcopops. However, the standardisation of the tax rate on alcohol introduced in 1999 resulted in lowering the price of alcopops. In order to prevent excessive alcopop consumption, the RFA therefore introduced in February 2004 a specific tax on alcopops of 116 francs per litre of pure alcohol. As expected, this measure of prevention had a direct impact on reducing the level of alcopop consumption (ISPA, 2005).

Given all the existing strategies and measures targeting alcohol sale and consumption, we now turn to the assessment of the impact of these measures on alcohol consumption prevalence and alcohol-related death and diseases.

5.5. Impact of prevention measures on alcohol consumption prevalence

To assess the impact of prevention measures of alcohol consumption on mortality and morbidity, we initially checked if the impact of some Swiss prevention strategies of drinking behaviour had been evaluated. Secondly, we enlarged our search to include international studies.

5.5.1. Swiss studies

The national programme “ça débouche sur quoi?” was evaluated (National Programme of Action against Alcohol, NPAA, Peters *et al.* 2002). The programme used a social marketing approach which largely depended on media campaigns targeting the population at large as well as such target groups as general practitioners. Its main objective being to reduce risky drinking behaviours in the whole population, including “binge-drinking”. The evaluation rated the programme’s outputs and short-term effects as successful. However, the long term effects have not been assessed, yet. Moreover, even when considering the short-term effects of this or any other prevention programme, given the short time period of the programme, it is unclear if any behaviour change can be partly attributed to the programme or not. As for the effects of taxation, Rhem *et al.* (2004) considered changes as a result of the 1999 tax changes when the rate of taxation on imported and domestic alcoholic drinks was standardised at 29 francs per litre of pure alcohol. Before 1999, imported heavy alcoholic drinks were taxed at a higher rate than those domestically produced. The level of consumption was measured before and after the enforcement of the new taxation rate for imported beverages. The problems linked to alcohol significantly rose after the tax changes. Among young adults and adolescents[11], the increase in consumption was higher and directly related to a rise in the consumption of heavy alcoholic drinks. However, only the short-term impact of changes in the rate of taxation was considered. Another Swiss study (ISPA ,2004) also showed that the variations in consumption of alcopops among the young are strongly linked to changes in their prices or taxation. When prices go up, because of a higher tax rate, consumption goes down. And this impact is even stronger with alcoholic beverages targeted at the young. Nevertheless, the price-elasticity of alcopops was not statistically assessed in this study. Therefore, we have no precise figures on the effects of a reduction in the level of taxation on the percentage of alcohol drinkers.

5.5.2. International studies

Impact of taxation on alcohol consumption prevalence

Usually, economists compute the price-elasticity of alcohol consumption, which is the reaction of alcohol consumption to a change in alcohol price.

- Using the most recent econometric method, Farell et al. (2003) estimated the price elasticity of alcohol dependence at –1.487 and at –1.325. for heavy drinkers. This means that when prices rise by 10%, the alcohol consumption of alcohol-dependents falls by 15%, and by 13% for heavy drinkers.
- Alcohol-related health consequences are also responsive to the price of alcoholic drinks: it is the case for traffic deaths (Chaloupka et al., 1993), drinking and driving (Kenkel, 1993), cirrhosis deaths (Cook and Tauchen, 1982), violence (Markowitz and Grossman, 2000), and frequency of drinking (Kenkel, 1993).
- The price elasticity of alcohol demand can also be computed by type of beverages. Leung and Phelps (1993) estimated that the price elasticity of alcohol demand was -0.3 for beer, -1 for wine and -1.5 for distilled spirits. There is also limited evidence in favour of substitutability between alcoholic beverages.

Concerning the impact of alcohol price variations on drinking patterns, Chaloupka (2002) argues that higher prices reduce drinking prevalence, frequency of consumption and drinks per drinking occasions. But, the impact of price increases on alcohol addictive consumption decreases over the longer term. Chisholm et al. (2004) have argued that in populations with a high prevalence of heavy drinkers (more than 5%, such as Europe and North America), the most effective and cost-effective intervention was taxation (more than 500 DALYs averted per 1 million population; CER < $500 per DALYS averted).

Impact of bans on advertising

[11] Young adults are over 18 (until 25), whereas adolescents are below 18.

Saffer and Dave (2002) studied the relationship between alcohol consumption and advertising bans across 20 developed countries over 26 years. Their results show that bans on alcohol advertisements lead to lower levels of alcohol consumption. They found that an increase of one ban, such as ban on ad on TV, could reduce alcohol consumption by 5 to 8%, and the alcohol price elasticity is about 0.2.

Impact of informational and educational measures
Many countries engage in mass media campaigns and school-based education about the risks of drinking. Studies show that such efforts do increase knowledge about and attitudes toward alcohol and its risks to health, but they have not shown sustained reductions in the rate of alcohol consumption or reductions in alcohol-related harm (Disease Control Priorities Research, "Priorities in Health" Report, 2006).

School-based education
School-based alcohol education programmes have been a widespread and popular international prevention approach. Early efforts were essentially based on a belief that education programmes increasing knowledge of alcohol related issues would result in a change in attitude toward alcohol which would consequently result in direct behaviour change ('knowledge-attitude-behaviour model'). However, evidence suggests such a strategy is not effective and it is instead necessary, in school-based education programmes, to include various sorts of social competency training and provide technical information about alcohol and the consequences of its use (Sewel, 2002). As yet it is too early to judge the effectiveness of this change in strategy.

Prevention measures targeting the young
Concerning the impact of setting a legal age for buying alcohol, it seems that few if any studies exist. The majority of studies on the young have so far focused on their consumption behaviour such as binge drinking. However, as the young are more sensitive to advertisement and the price of alcohol than older people, these structural prevention measures are recommended (Chaloupka, 2002). Young drinkers are also quite sensitive to the influences of their peers in alcoholic behaviour.

Remarks
The studies, outlined above, focus on the impact of prevention measures on alcohol demand as a whole or on groups having a specific drinking pattern (mainly heavy drinkers or the young). Determining the impact of prevention on each type of drinking pattern is not an easy task.
However, there has certainly been a downward trend in alcohol consumption in all developed countries since the end of the 1980s. Whether or not this is directly related to the impact of prevention policies is still difficult to demonstrate.

5.6. Conclusion: proposal for a cost-benefit analysis of alcohol consumption

The special issues still at stake in doing a CBA of alcohol consumption are the following:

- The report of Alcohol Abuse in Switzerland" (Jeanrenaud, 2003) took into account alcohol abuse but did not cover all patterns of alcohol consumption. Hence, binge drinking, which is an important public health issue today, was not assessed in his social costs study.
- Studies of prevention measures to date have not yet assessed the impact on all types of drinking-pattern groups; rather they have considered alcohol consumption independently of types of drinking behaviours and/or in relation to specific subgroups of the population. The drinking patterns can have a preventative or a detrimental effect on people's health: moderate level of consumption can decrease the risk of alcohol-related diseases, whereas a low or a high level of consumption increases

such risks. Henceforth, it is necessary to determine the impact of prevention measures in relation to different drinking patterns.

- Whereas Swiss data concerning alcohol consumption per habitant are available over a long time period, Swiss data about drinking patterns are only available for four years: 1992, 1997, 2002 and 2007 in the Swiss Health Survey (FOS). Henceforth it is not yet possible to analyse the changes in drinking patterns and their related diseases over the longer term.

Given the above limitations, we do not recommend proceeding with a full study on the CBA of alcohol consumption.

6. ROAD ACCIDENTS

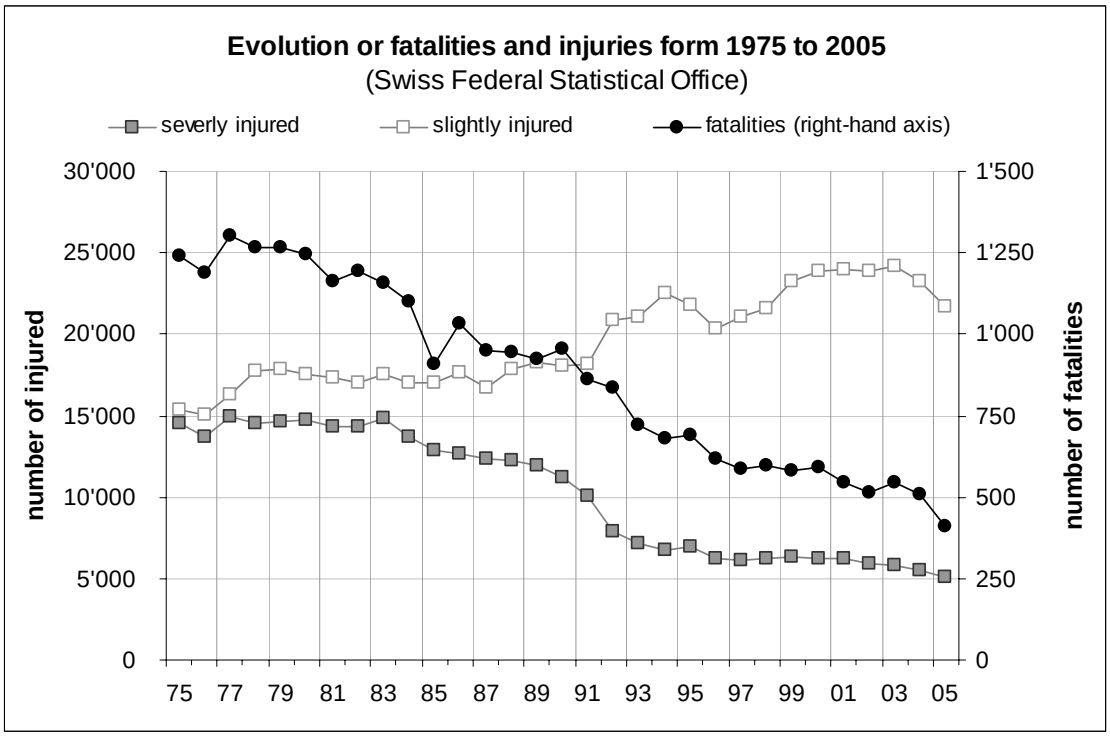
6.1. History of road accidents in Switzerland

Road accidents are one of the major public health problems in Switzerland, and in comparison to other public health issues, there is a clear-cut link between hazardous behaviour and mortality and morbidity. In 2005 road accidents caused 409 fatalities, 5'059 seriously injured and 21'685 slightly injured casualties. Most of the victims of mortal accidents were car passengers (55%), followed by motorcyclists (18%), cyclists (11%), pedestrians (8%) and moped riders (3%) (Sinus Report, 2006). Compared to other kinds of accidents and causes of mortality the cost of road accidents is particularly high because the low average age of the victims leads to a high number of years of active life lost.

In the last 35 years road accidents in Switzerland have evolved similarly to most other European countries. The number of fatalities and seriously injured individuals has continuously declined since a peak in 1971 (1'773 fatalities and 18'785 seriously injured victims) while the number of slightly injured individuals has increased (see figure 1). Severe and light accidents evolved similarly until 1983, but then the number of severely injured decreased until 1994 remaining virtually constant from then on, while the number of slightly injured individuals has experienced an increase. Interestingly, the decline of severe accidents and fatalities between 1971 and 2005 has taken place although population has increased by 20% in this period and traffic by over 100%.

We will first look at the causal mechanisms that lead to road accidents and fatalities and then see how the decrease in fatalities and serious injuries since the early 1970s has been explained in the literature. Then we will briefly outline the social costs of road accidents in Switzerland, give an overview of the most important preventive measures adopted in the last decades and of their costs and look at previous cost-benefit analyses on road accident prevention measures. In the last section we will examine viable methods and data constraints for future research and discuss the directions this research might take.

Figure 6.1: Evolution of fatalities and injuries in road accidents from 1975 to 2005 (SFSO)



This part of our report is based on a critical examination of recent Swiss and international literature on road accident analysis and prevention, our own analysis of the latest data available and on personal information obtained from organizations active in road accident prevention.

In comparison to the previous period, since the year 2000 a number of studies on road safety in Switzerland have been carried out for a number of public authorities such as the Swiss Council for Accident Prevention (bfu) and the Federal Road Agency ASTRA. Many of these studies were part of the ASTRA research project *Fundamentals of a road safety policy for Switzerland*[12] and have contributed to the *Via Sicura* project, which was launched in 2006 by the Federal Government and aims at reducing the number of road accident victims by half by 2010 with respect to the year 2000 (i.e. from 600 to 300 victims). Following the example of Sweden, with a significantly lower mortality rate, the long-term goal is the so-called *Vision Zero* with zero casualties and seriously injured. The *Via Sicura* project is a coordinated effort of the federal, cantonal and communal administrations and all economically or politically motivated associations with an interest in road safety. The objectives and strategies of Via Sicura are described in a report published in 2005 (Bundesamt für Strassen 2005).

6.2. Causal path leading to road accidents

An evaluation of public health programs requires a preliminary analysis of the factors responsible for the public health issue. Figure 2 illustrates the causal path leading to road accidents and fatalities or serious injuries. Road accidents are influenced by circumstances belonging to four domains: human behaviour, vehicle, road and environment.

1. **Human behaviour** in road traffic is influenced by a multitude of factors and is central to accident prevention. Laws define who is allowed to drive a motorised vehicle (age and health requirements for driving license, compulsory training, etc.) and the rules drivers are to follow (speed limits, safety belt wearing, limits of alcohol consumption, etc.). Police controls are a way to oblige drivers to follow these laws, but as it often is impossible to

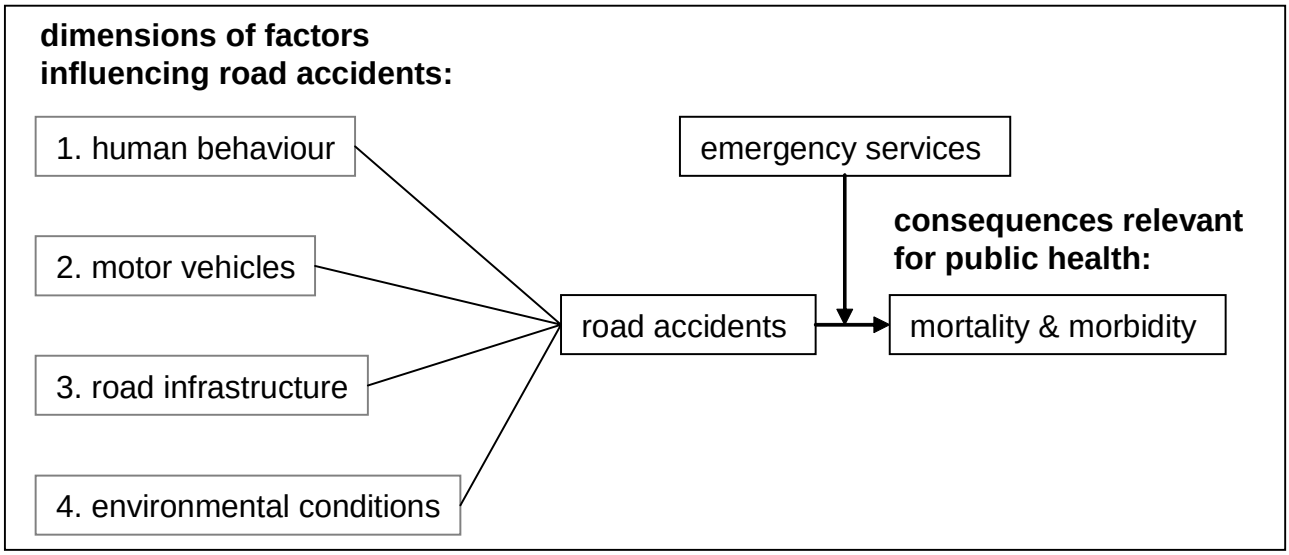
control if the drivers follow the law and not every possible action can be regulated by the law the free will of drivers to adopt a safe driving style is of vital importance (e.g. abiding to the law, adopting voluntary safety measures such as wearing a bicycle helmet, driving carefully, etc.). Human behaviour is also influenced by factors as traffic density and demography.[13] The government, insurance companies, the media and private interest groups (e.g. touring clubs, traffic associations, etc.) can try to influence people's driving behaviour.

2. **Motor vehicles** influence road accidents and the gravity of their consequences in two ways: On one side, the protection of passengers has been continuously improved in the past decades (e.g. the crush zone, safety equipment, ABS, the quality of tires and brakes, etc.), reducing both the frequency and the gravity of accidents. Laws can influence this aspect of vehicle safety through the definition of technical standards. On the other side, however, the development and supply of certain vehicle models may lead to more severe consequences, as when people tend to buy heavier and faster cars (e.g. sport utility vehicles). Paradoxically the improvement of vehicle safety can also have a negative effect on road safety, if drivers reduce their attention level or drive more aggressively as they feel safer and are less afraid of the consequences of an accident.
   Improvements in **road construction** also play an important role in the reduction of accidents. Nowadays, the costs of safety-specific features amount to 5-10% of total construction costs of a new road. In addition, substantial efforts have been made in the past years to improve the safety of the existing infrastructure, by improving safety in tunnels and eliminating so called black accident spots, mainly by the construction of roundabouts and structural modifications at intersections and crossroads.
3. The **environmental conditions** due to weather (rain, snow, ice, fog) daytime and season often also play an important role in the causal path leading to an accident but are beyond human control. The characteristics of vehicles and roads have been improved to increase the safety in difficult environmental conditions. However, the most important factor in dealing with difficult environmental conditions remains the human behaviour, as the driving style has to be adapted to environmental conditions.

Once a major road accident has taken place the speed and efficiency of rescue efforts may play a crucial role in increasing the survival rate of severely injured victims and in minimising the long-term consequences of the injuries (invalidities). As figure 6.2 shows, improving emergency services influences the consequences of an accident for the public health sector; they contribute to reducing the rate of mortality and morbidity due to road accidents.

[12] The project VESIPO „Grundlagen der Strassenverkehrspolitik der Schweiz" was commissioned to the bfu, which commissioned specific research projects to external researchers.
[13] An example: One of the possible reasons for the reduction of road accidents respect to the 1970s might be the diminution of the number young drivers responsible for a high number of accidents respect to total population of drivers. As the baby-boom generation grew older and people started having less children, the number of young drivers decreased contributing to a decrease in the number of road accidents.

Figure 6.2: Dimensions of causal path leading to road accidents and fatalities or serious injuries



6.3. Evaluating the influence of single factors on the reduction of severe accidents since 1971

As fatalities and severe injuries represent the main public health issue of road accidents from now on, we will focus on the factors leading to a reduction of severe accidents. Understanding the role of single causal factors in the reduction of the number of fatalities and seriously injured victims in the last 35 years is of crucial importance for the development of strategies aiming at further abatement. Safety improvements of vehicles and roads have played an important role in the reduction of accidents since 1971. In the case of Australia these improvements are estimated to account for about half of the reduction in the number of fatalities and severe injuries (Abelson et al. 2003). Additional safety improvements are possible, especially new electronic safety devices on cars such as automatic stopping procedures (active safety), but given the already high safety level of vehicles and roads, additional improvements are unlikely to deliver similar reductions of fatalities and severe injuries as they have in the past. Changes in demography have also contributed to the decrease of serious accidents as the fraction of young drivers on the total population has decreased significantly with respect to the 1970s. The decisive factor for further reductions of road accident fatalities and serious injuries is thus mainly the human behaviour dimension – which can aptly be influenced by public health programs.

A series of detailed analyses of the human factors responsible for accidents commissioned by the bfu reach a similar conclusion. The following factors are crucial for a further reduction of severe accidents and their consequences (bfu 2006b):

- Alcohol abuse was the main cause of 79 fatalities and 655 severely injured in 2005 (19 and 13%). The number of victims was especially high in accidents caused by young drivers (age between 18 and 24 years) and most of the accidents occurred at night and on weekends. Alcohol abuse is often combined with speeding. As only about half of the drivers involved in an accident are tested for blood alcohol, the actual contribution of alcohol abuse to accidents might be substantially higher.
- Speeding was a major cause in 25% of the seriously injured victims and in 44% of the fatalities in 2005. The proportion of young drivers responsible for accidents caused by speeding is even higher than of those caused by alcohol abuse.

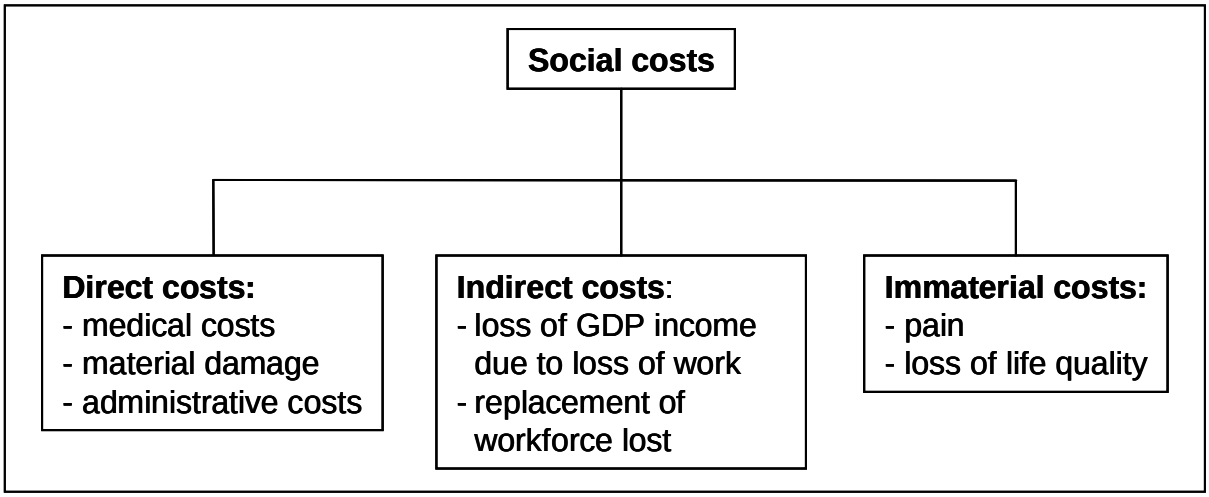
- While motorcyclists always wear helmets, the number of moped riders not wearing the compulsory helmet is still substantial. In 2005 10 moped and 26 bicycle riders died because they did not wear a helmet (133 moped riders and motorcyclists and 650 bicycle riders were seriously injured). If all riders of two-wheeled vehicles were wearing a helmet, 60% of mortal accidents and 20% of serious injuries could be avoided.
- Safety belts are the most important safety device on cars and other vehicles. Although wearing a safety belt is mandatory since 1981, the wearing quota in 2005 was 85% in the German speaking part of Switzerland, 77% in the French speaking part and only 55% in the Italian speaking part. An increase of the safety belt wearing quota to a maximum level could save approximately 40 lives and 150 serious injuries. The number of lives potentially saved is probably even higher, as the information on whether the victims were wearing a safety belt or not is missing for a number of accidents.

An investigation carried out in 2002 by Ernst Basler & Partner for the bfu made a forecast of road accidents and their consequences for the years 2010 (Merz and Schlatter 2002). The forecast is based on accident data from 1970 to 1999 and on the assumption that prevention efforts will follow the same trend as in the past. The results show that prevention efforts have to be intensified in order to reach the goal of the federal government to reduce the number of traffic victims to 300 by 2010. The result of the forecast, which is based on a simple extrapolation of the past trends, is of 400 casualties for the year 2010. This result has probably contributed to the considerable intensification of prevention efforts in the last years.

6.4. Social costs of road accidents

A vast number of measures have been proposed for the reduction of road accidents and a cost-benefit analysis is necessary to identify the most cost effective measures if we want to reach the goals proposed by Vision Zero and other plans. A first step in the cost-benefit analysis of public health prevention programs for the prevention of road accidents is to evaluate the social costs of road accidents. The main reference in this regard is a study carried out by Ecoplan for the Federal Office for Spatial Development on the social costs of road and rail traffic accidents in 1998 (Bundesamt für Raumentwicklung 2002). The authors built a set of quantities (number of casualties, of invalidities, of severely and slightly injured persons) and a set of corresponding costs. Total costs are calculated multiplying the quantities with the costs. The number of officially recorded accidents is adjusted significantly from 28'150 to 78'700 injuries on the grounds that a high number of accidents is not reported to the police and thus does not appear in the data of the Federal Office of Statistics. However, an adjustment of the number of fatalities is not necessary.

Figure 6.3: Types of costs road accidents assessed in the study for 1998



The following costs are considered:

1. Medical costs (in a range from 945 Fr. for slight injuries up to 69'678 Fr. for cases of invalidity)
2. Net loss of GDP production at factor costs (mean income minus consumption per person is 18'995 Fr. and corresponds to the average cost of a life year lost in 1998. The social cost is the accumulation of these yearly costs discounted at a 3% rate for the period of the average working years lost by the average traffic victim, while also accounting for a productivity growth rate of 1.5%).[14]
3. Costs for the replacement of lost workforce for the firms (50% of a medium yearly labour income)
4. Immaterial costs based on a willingness-to-pay approach (2.87 Mio. Fr. based on a 1.5 Mio. € estimate of a study for the EU)
5. Material damage (based on payments of car insurance companies)
6. Administrative costs (660 Fr. per accident)

Total costs for the year 1998 thus amounted to 12'300 Mio. Fr., of which 68% are immaterial costs.

The study by Jeanrenaud et al. (2003), on the social costs of alcohol abuse in Switzerland, includes a section on road accidents caused by alcohol abuse, and estimates the resulting human costs to amount to 1'182 Mio Fr.

The social costs of road accidents differ substantially between single studies and these differences are mainly due to differences in the methodological approaches, in particular if a lost life is valued according to the human capital approach (lost GDP) or the willingness-to-pay approach. A comparison between the social costs of different public health issues is thus only possible, if these costs are measured according to the same approach.

6.5. Road accident prevention programs and their costs

An analysis of costs and efficient accident prevention programs is a necessary stage of cost-benefit analysis. The "Report on road safety in Switzerland – Estimation of the yearly employed means" (bfu 2001) written by Ernst Basler + Partner for the bfu is currently the most detailed work describing the multitude of efforts aimed at increasing road safety by

[14] This is a reasonable way to measure the production lost due to accidents if immaterial costs are considered. However, if immaterial costs are not considered, it would better to consider total gross income lost per working person.

public authorities and private organizations involved in traffic policies. The report distinguishes between direct and indirect expenses for road safety. The direct expenses comprise:

1. New laws and law-enforcement
2. Improvement of existing road infrastructure
3. Safety equipment directly purchased by households (e.g. helmets)
4. Safety education and safety campaigns
5. Research

The indirect expenses are the costs for standard safety features of new roads and standard safety equipment in new motor vehicles.

For the year 2000 the direct costs are estimated to be 500 Mil. Fr., of which the law enforcement efforts by the cantonal and communal police constitute the most important part with 420 Mio. Fr. (3'100 full time police officers). Approximately 10 Mio. Fr. are spent on the safety improvement on existing roads. The expenses for safety education and safety campaigns amount to 50 Mio. Fr. and are mainly financed by the federal government, the city communes and the traffic associations (bfu, TCS …). The direct expenditures for safety equipment by households amount to 200 Mio. Fr.

The indirect costs are estimated to be between 1'300 and 1'800 Mio. Fr. and consist of the costs for the implementation of safety features in road construction (520 to 1'040 Mio. Fr., corresponding to 5 to 10% of total road construction costs), standard safety equipment on commercial vehicles (360 Mio Fr., equalling 5% of purchasing costs) and on private vehicles (400 Mio. Fr., equalling 5% of total production costs of new cars).

In their conclusion, Basler *et al* stress the relatively low share of expenses used for safety education and safety campaigns. They affirm that higher expenses in this area would improve safety awareness of drivers and have a multiplying effect on the efficiency of other road safety measures.

In 2003 a more recent study on road accidents and measures to improve road safety with a focus on the Canton of Zurich was carried out by the Institute for Transport Planning and Systems (IVT/ETH), the Swiss Council for Accident Prevention (bfu) and the Canton Zurich Police's Department for Traffic Engineering (VTA) for the Department of the Environment, Transport, Energy and Communications (Lindenmann et al. 2003). The organisations participating in this study dispose of a vast and detailed knowledge on road safety measures. Conclusively, they propose the main measures to be intensified police controls combined with public information campaigns and measures to improve the safety at accident black spots (mainly at crossroads). The study also highlights how safety audits, which are about to become a standard part of all new road projects, contribute importantly to the improvement of road safety and that the cantonal police and the municipal police forces of the city of Winterthur and Zurich conduct a number of periodic traffic safety campaigns.

The report of the bfu (Ewert and Fitz 2004) examines the reasons why drivers do not use safety belts and measures to increase the safety belt wearing quota. The current public-information campaign planned by the bfu for the years 2005 to 2008 ("Ein Band fürs Leben") might well have been influenced by the conclusions of the report that estimates an increase of the safety belt wearing quota by one percentage point to save the lives of five people each year.

Appendix 5 lists the most important programs that have been implemented, as well as the laws and regulations enacted over the last 35 years to reduce the level of road accidents in Switzerland. Given the vast number of measures undertaken by the public administration and private organizations with an interest in improving road safety, it is impossible to list them all. Therefore, the list is restricted to significant changes in traffic regulations and to campaigns

at a national level financed through public resources. If a measure was taken in the month of December, it is accounted for the following year.
Prevention efforts by private organisations and a quantitative estimation of their expenses are addressed in the report by Basler & Hofmann (2002) on the economic evaluation of road safety measures, which will be discussed in the next section.
All these studies agree that a combination of law and regulation, police enforcement and information campaigns is particularly effective in the reduction of road accidents.

6.6. Review of Cost-benefit analysis of road accident prevention programs

Given the multitude of possible measures for road accident prevention, the most cost effective measures have to be identified with a cost-benefit analysis.
The report "Economic evaluation of road safety measures" by Basler & Hofmann (2002) contains a cost-benefit analysis of 92 single measures proposed in 2001 in the context of the new road safety policy (VESIPO) by the Department of the Environment, Transport, Energy and Communications (UVEK). For simplification, only the costs that can easily be expressed in money value were considered in their analysis (e.g. the costs to people under the age of 18 of not being allowed to drive a motorcycle were not accounted for). The assumptions for costs and benefit values are based on data evaluations and judgements by experts consulted for this purpose (e.g. cost of a new law 250'000 Fr., cost of a campaign 1 Mio. Fr.). The cost-benefit analysis is based on a time horizon of 10 years and a relatively high discount rate of 5% p.a. for costs. Benefits are valued at a negative discount rate of 5%, as the goal of road prevention policies is to reduce accidents in the future. The following measures are shown to have the highest benefit-cost ratios: road improvements in accident black spots, changes in traffic law (e.g. 0.5 per mil blood-alcohol limit), mechanism leading to automatic use of daytime light, changes in the driving-license regime, speed limit 50/30 on urban roads, proposal of compulsory bicycle helmet, bicycle helmet campaign. Thus compulsory measures and measures aiming at changing drivers habits appear to be particularly cost-effective.

These conclusions are similar to those of the report *Cost-benefit analysis of road safety improvements* (ICF Consulting 2003) compiled for the EU, which concludes that the enforcement of laws regarding speeding, drunk driving and non-use of safety belts should have a priority in road safety policies. Cost-benefit analysis shows that policies improving the performance of all EU countries to the level of the best performing countries (UK for speeding, Sweden for drunk driving and safety-belt use) could deliver substantial benefits between 0.22 and 0.40% of GDP over a period of 15 years (a reduction from 10'000 to 6'000 fatalities and from 500'000 to 170'000 injuries). Improving the enforcement of laws relating to commercial road transport would also lead to substantial benefits.
A very simple approach to measure the benefits of prevention measures is the one proposed in the Australian study (Abelson et al. 2003) on the return of public health interventions. Based on information contained in other studies, the authors calculate the difference between the actual fatalities and the fatalities that would have occurred without any prevention programmes (1'768 instead 2'783 of fatalities in the year 1997). As the value of the 1015 lives saved vastly exceeds the costs of prevention this is a very convincing argument in favour of prevention, and it is even more convincing if the other costs of road accidents (injured victims, medical costs etc.) are also considered. While this calculation shows the total benefit of prevention we can also try to value any additional prevention measure with a simple computation of this kind: If we believe that an additional million francs spent on a new prevention campaign saves one life, then the prevention campaign is effective, considering a statistical value of life between 1.5 and 3 Mio. Fr.

6.7. Measuring the cost-effectiveness and cost-benefit of road-safety measures

Based on the previous analysis we will now propose several strategies for the economic evaluation of road accident prevention programmes. Up to now, we don't know how social costs of road accidents have been computed, because no clear explanation of the formula used for this calculation is given in the Swiss Report. However, a crude estimate of social costs of road accident is quite possible even so not fully satisfying.

However, other domain of road accident prevention can be investigated from the Swiss data. Statistical investigations of the effects of public health measures on the occurrence of road accidents and their consequences in terms of mortality and morbidity are constrained to the data available for the explained variable (e.g. number of accidents, fatalities, seriously injured) and the explanatory variables (public health measures and all factors potentially influencing the event of road accidents and their consequences). Given the multitude of explanatory variables the analysis must be carried out with multivariate statistical techniques, which are able to isolate the effects of single variables. As the type of data at hand and the number of data points available for estimation represent fundamental constraints for the statistical analysis, it is useful to give a brief overview of the data available for Switzerland.

- ***Data on road accidents and consequent mortality and morbidity:***
  - The road accident data of the Swiss Federal Statistical Office data is based on accident reports of the police and covers several aspects of the accidents (vehicles/pedestrians involved, time, environmental conditions, characteristics of driver, severity and kind of injuries etc.). Data are published on a yearly basis since 1927 but detailed data are available since 1992. They can be disaggregated to cantonal level, which might be very useful the explanatory variable can also be disaggregated on cantonal level. (Accidents data for 2006 will be available by May/June 2007; yearly, cantonal)
  - Data on the medical cost of the injuries, the grade of invalidities and the characteristics of traffic victims are available from accident insurance companies on a yearly basis.

- ***Data on prevention programs and measures and other factors potentially influencing road accidents:***
  - Changes in traffic laws and regulations and prevention programs (see table 1 above for major programs). (yearly)
  - Number of fines and other administrative measures (ASTRA) (yearly, cantonal) (might be used as a proxy for control intensity)
  - Number and types of vehicles registered (ASTRA) (yearly, cantonal)
  - Average distances travelled (ARE) (yearly)
  - Travel speed measurements (ETH) (yearly)
  - Attitudes of drivers concerning road safety measures (bfu)
  - Safety-belt and helmet wearing quota (bfu) (yearly, language regions)
  - Black accident spot program (bfu) (yearly)
  - The costs of prevention programmes can be valued extrapolating the numbers proposed in Basler & Hofmann (2002) or updated by consulting the annual reports of the main prevention agencies.

- There is no statistical information quantifying the changes in road and vehicle security. It should be possible to use the results of studies in other developed countries to construct a time trend capturing the combined effect of these factors.

Using yearly data on road accidents from 1970 to 2005 we have a times series of 35 data points, which is quite a small number of dependent variables considering the high number of explanatory variables. We can increase the number of dependent variables by using data disaggregated at a Cantonal level, but this is only useful if there is a variation in the explanatory variables between the Cantons. This variation does clearly not exist for national laws, but might exist for single prevention measures if they were conducted with a different intensity in different parts of the country. This might be the case of media campaigns concentrated in the French and Italian speaking cantons, or of particularly intense police controls in a certain Canton.

A particularly interesting aspect of the evolution of road accidents is the strong decrease of fatalities (-20%) and seriously injured (-8%) in the year 2005. This trend has continued in the first half of the year 2006 with a further reduction of fatalities (17%) and severely injured (-15%) respect to the same period of the previous year (the complete data for the 2006 will be available in May 2007). If the severe accidents continue to decrease with this rate the goal of the federal government to half the number of fatalities between 2000 and 2010 to 300 fatalities may be achieved. According to the bfu (2006b; 2006a) the factors responsible for this strong decrease have not yet been fully understood. As changes in the safety of road infrastructure and cars occur progressively in time, the sharp decline of accidents with severe consequences cannot be attributed to these factors. An explanation might be found in the stricter blood alcohol limits introduced in 2005, but an analysis of the causes of accidents shows that not only the accidents caused by alcohol abuse but also accidents caused by other factors have decreased. According to the bfu the intensification of police controls and the increased public attention towards road safety might also be responsible for this drastic decline. A detailed study of the reasons for this decrease of severe accidents might be an important illustration of how a combined prevention efforts on different levels (law & regulation, enforcement, information campaigns) can lead to a major reduction of public health problems.

Even if a quantification of the effects of many road accident prevention programmes is impossible due to the statistical problems and the limitation of the data, the study of the effects of some prevention campaigns might still be possible. If there is an apparent connection between the kind of injuries caused by an accident and change in behaviour the public health campaign is trying to encourage a causal connection between campaign and reduction of fatalities and severe injuries can be demonstrated. This could be the case of a reduction of severe head injuries due to bicycle helmet campaigns or of the proportion of fatal accidents of drivers without safety belt on total fatalities. If the campaigns or law enforcement measures are conducted with different intensity in different cantons or different language regions of Switzerland, this could also facilitate the exposure of a causal link between prevention measure and reduction of severe road accidents.
Given the necessary time and funding this approach could be highly promising.

7. CONCLUSION

This feasibility study presents an overview of how an economic evaluation of Swiss prevention measures could be done. The method of cost-benefit analysis is doubly well fitted for evaluating prevention as it links the benefit and costs effects of prevention projects in a single measure. It enables us to assess the impact of prevention measures on the quantity and quality of life in a monetary value. This value could then be used to compute the "returns on investment" of prevention strategies.

Having considered the three prevention areas posing the highest social costs as feasible for CBA analysis, we conclude the following:

- For **alcohol,** it is not appropriate at this stage to conduct a CBA on Swiss data. The impact of prevention on the full range of alcohol consumption patterns is not fully documented at national and international levels. For Switzerland in particular, for the purposes of econometric analysis, there is no suitable data available over a long enough time period.
- For **tobacco,** a CBA is possible. However, due to availability of the dataset and beginning of prevention in Switzerland, the analysis would be limited to observations of tobacco consumption behaviour over a very short time period (since 1998). This could, however be supported by international studies.
- For **road accidents,** the causal chain between the detrimental health behaviour and the injuries is clearer, and Swiss data are available over a longer time span as well as prevention measures. Henceforth CBA is feasible and less controversial.

To assess the cost/benefits of each of these two risk factors (tobacco and road-accidents), we propose evaluating the "packet of prevention measures" as a whole with respect to each. This strategy allows us to circumvent some issues in evaluating prevention, such as mixed impact of prevention measures. For both risk factors, we will compare a baseline year, the one of the first study on social costs (respectively: 1994 for road accidents and 1998 for smoking) with the following years. Thus for the subsequent year, we will update the social costs according to the variation in prevalence of the risk factor. The new social costs are expected to be the decreased social costs (thanks to prevention) plus the costs of prevention measures. The benefits expected are the decrease in prevalence of the risk factor and its related diseases, under a conservative assumption of same attributed fraction. These benefits are then transformed into DALYs and monetary value. However, given that we don't have social costs before the beginning of prevention strategies in Switzerland, it may be that the benefits of new prevention measures could be less significant by comparison with the baseline year. The other limits of our approach are the following. For tobacco, it is unlikely that we could disentangle the impact of cantonal prevention from Federal prevention. For road accidents, we can only crudely update social costs, and not finely as in the case of smoking. We would largely depend on the international literature for discerning the contextual effects on prevalence. And finally, given that morbidity statistics come from the Swiss hospitals statistics and from the SHS, any study using morbidity as a health outcome will be surrounded to available data. However, as the FOPH wish to launch a project called "Indicateurs de la Prévention: poids corporel sain, santé psychique et stress"[15] in collaboration with the IEMS, more reliable morbidity and related treatments data would be available for conducting CBA of prevention of overweight, mental health and stress, in the near future (3 to 4 years).

[15] A collaboration of the IEMS (Dr. Yves Eggli) and the FOPH (Till Bandi).

Our proposal offers two important additional advantages:

1. To our knowledge, this would be the first time that the prevention of two health risk factors would be assessed in the same way: cost-benefit analysis.
2. We also propose to extend our analysis in order to make a general framework for the future CBA of the prevention of new public health issue such as obesity.

Nowadays, curbing health expenditures of National Health Systems is a challenge for all developed countries. Cost-benefit analysis is then the most relevant method to compare health services or policies targeting different diseases at different levels, i.e. curative or preventive care. Henceforth, assessing cost-benefit of all health services whereas for curative or preventive care should be one of the major aims of policy-makers in order to invest efficiently state revenues.

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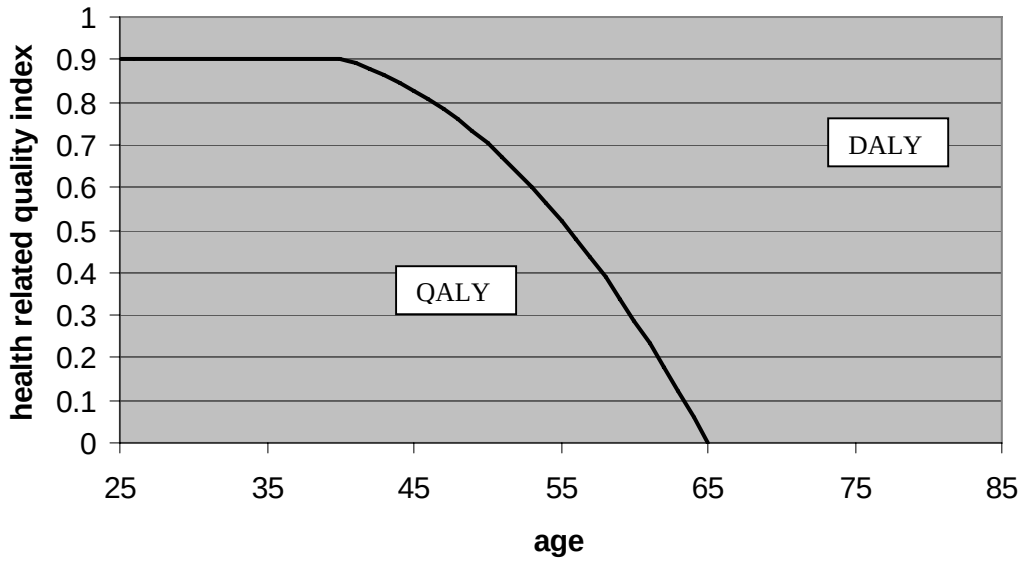
APPENDIX 1: A COMPARISON OF QALYS AND DALYS

Introduction

Quality adjusted life years (QALYS) and disability adjusted life years (DALYS) both belong to the group of health adjusted life years (HALY)[16]. The common purpose of the two measures is combining both, mortality and morbidity, in one index number. Basically, this is achieved by multiplying the number of life years with an adjustment factor that reflects the health state of a person or a group of people.

QALYS and DALYS each have their own history of origins, which can explain at least part of their difference. The QALYS concept was developed in the late 1960s by health economists with the goal to be applied in cost effectiveness analysis. By contrast, the DALYS concept originates in a collaboration of the World Bank and the World Health Organization in 1993 and aims to measure the global burden of disease, particularly in developing countries[17].

Figure 1: Illustration of QALYS and DALYS



The first and often confusing difference between QALYS and DALYS is mathematical issue. QALYS depict life years still to come or life years won and, therefore, represent a good to be maximized. DALYS, on the other hand, measures life years foregone or life years lost and, consequently, should be minimized. To illustrate, take a person at age 25 with a minor health problem that is assumed to aggravate at age 40 and a life expectancy (at age 25) of 65. The number of QALYs of this person, i.e. the number of quality adjusted life years still to come, can be depicted as the area below the curved frontier in figure 1. The number of DALYs, on the other hand, corresponds to the area above the frontier and describes the health adjusted life years lost. Note that in order to calculate DALYs, a reference with respect to health condition and life expectancy must be chosen. While perfect health is the natural reference for the quality dimension, the choice of a specific life expectancy is less obvious. The founders of the DALYS concept solved the problem by choosing a model life table that depicts the highest national life expectancy observed, which is in Japan[18].

[16] The hierarchical structure of the notions HALY, QALYS and DALYS is not always presented in the same way. Interestingly, Murray, although being a co-founder of the DALYS approach, denominates DALYs a variant of QALYs. However described, the discussion shows how close the two concepts actually are.

[17] Gold, M. R. et al., HALYs and QALYs and DALYs, Oh My: Similarities and Differences in Summary Measures of Population Health, Annual Review Public Health, 23, 2002.

[18] Murray, C. J. L., Quantifying the burden of disease: the technical basis for disability-adjusted life years, Bulletin of the World Health Organization, 72(3), 1994.

From this mathematical difference, it is obvious that the absolute measures of QALYS and DALYS vary. However, the more interesting question is, how strong these measures are affected by health interventions, i.e. how far the frontier in figure 1 shifts outward due to public health policy. Up to now, for simplicity reasons, it was assumed that the frontier in figure 1 is identical for both, the QALYS and the DALYS measure. However, this is not the case. In fact, the important difference between QALYS and DALYS is rooted in the specific construction of the frontier. We now turn to this distinction.

QALYS

In assessing quality weights to different health conditions, the QALYS concept is based on individual preferences. People are asked which health state they prefer to other conditions or which health states they consider equivalent. Typically this is done with rating scales, standard gambles or time tradeoffs. The approach is consistent with modern welfare economics where value judgments always are derived from affected individuals. The procedure also explains the use of the expression cost utility analysis, since, with such questionnaires, it is aimed to depict individual utilities, at least as far as health is concerned. However, there is an ongoing discussion on the topic which individuals should be questioned, e. g. patients that benefit from a health program or taxpayers that finance the program. Furthermore, there is no consensus on which questionnaire should be used to construct a weighting scale. Consequently, several scales are in use and they do not produce identical results.

One widely used scale is the EuroQol EQ-5D. Box 1 below, which is copied from Phillips and Thompson[19], present the five dimensions that are considered when describing individual health states with EQ-5D. The following table 1, also taken from Phillips and Thompson, gives examples of how different health conditions are quality weighted. Note that in this application negative weights are possible, expressing a condition that is considered worse than death.

[19] Phillips, C. and G. Thompson, What is a QALYS?, www.evidence-based-medicine.co.uk

Table A1: Using the EQ-5D

Scores for the EQ-5D are generated from the ability of the individual to function in five dimensions. These are: • **Mobility** 1. No problems walking about. 2. Some problems walking about. 3. Confined to bed. • **Pain/discomfort** 1. No pain or discomfort. 2. Moderate pain or discomfort. 3. Extreme pain or discomfort. • **Self-care** 1. No problems with self-care. 2. Some problems washing or dressing. 3. Unable to wash or dress self.	• **Anxiety/depression** 1. Not anxious or depressed. 2. Moderately anxious or depressed. 3. Extremely anxious or depressed. • **Usual activities** (work, study, housework, leisure activities) 1. No problems in performing usual activities. 2. Some problems in performing usual activities. 3. Unable to perform usual activities. Each of the five dimensions used has three levels – no problem, some problems and major problems – making a total of 243 possible health states, to which 'unconscious' and 'dead' are added to make 245 in total.
www.evidence-based-medicine.co.uk	

Table A2: Quality weights for selected health states according to EQ-5D

Health state	Description	Valuation
11111	No problems	1.000
11221	No problems walking about; no problems with self-care; some problems with performing usual activities; some pain or discomfort; not anxious or depressed	0.760
22222	Some problems walking about; some problems washing or dressing self; some problems with performing usual activities; moderate pain or discomfort; moderately anxious or depressed	0.516
12321	No problems walking about; some problems washing or dressing self; unable to perform usual activities; some pain or discomfort; not anxious or depressed	0.329
21123	Some problems walking about; no problems with self-care; no problems with performing usual activities; moderate pain or discomfort; extremely anxious or depressed	0.222
23322	Some problems walking about, unable to wash or dress self, unable to perform usual activities, moderate pain or discomfort, moderately anxious or depressed	0.079
33332	Confined to bed; unable to wash or dress self; unable to perform usual activities; extreme pain or discomfort; moderately anxious or depressed	-0.429
www.evidence-based-medicine.co.uk		

DALYS

The DALYS concept bases its quality weighting on the judgment of health experts. For this purpose, an elaborate Delphi method procedure has been applied with the goal to establish social preferences on different health conditions.

Also, in its effort to describe health states, the DALYS approach focuses on specific diseases, as opposed to generic health conditions of the QALYS concept. The following table 2 taken from Murray and Acharya[20] shows seven disability classes and their respective weight as well as 22 indicator conditions that have been assigned to the respective classes. Note that due to the definition of a DALYS as a life year lost, perfect health is assigned a weight of zero.

Table 2: DALYS disabilities classes and its weighting

Revised disability classes for the Global Burden Disease Study based on the results of the PTO protocol used at the Geneva meeting on disability weights

Disability class	Severity weight	Indicator conditions
1	0.00–0.02	Vitiligio on face, weight-for-height less than 2 SDs
2	0.02–0.12	Watery diarrhea, severe sore throat, sever anemia
3	0.12–0.24	Radius fracture in a stiff cast, infertility, erectile dysfunction, rheumatoid arthritis, angina
4	0.24–0.36	Below-the-knee amputation, deafness
5	0.36–0.50	Rectovaginal fistula, mild mental retardation, Down-syndrome
6	0.50–0.70	Unipolar major depression, blindness, paraplegia
7	0.70–1.00	Active psychosis, dementia, sever migraine, quadriplegia

A further distinct feature of DALYS is the inclusion of age weights independently from age specific health states. A life year of a young or an old person is weighted less than a life year of a middle aged person, not because their health is impaired, but because other family members do not depend on them. The precise age weighting scheme is depicted in figure 2, which is taken over from Murray's original technical description of the DALYS concept[21]. It shows that years in the middle of the age spectrum are assigned weights greater than one. The curve is constructed such that the average weight over the life cycle equals one. The maximum weight occurs at age 25, which indicates that the focus of DALYS is on developing countries. In industrialized countries, the average age of people that keep a family is higher than 25.

Finally, the DALYS concept applies an explicit discount rate of 3 percent. However, QALYS calculations do not exclude the discounting of future utilities a priori. Therefore, with respect to discounting, both approaches can be applied equivalently.

[20] Murray, C.J.L. and A. K. Acharya, Understanding DALYs, Journal of Health Economics, 16 (1997), 703-730

[21] For simplicity, in the illustrative example of figure 1 age weights are not considered.

Figure 2: Health unrelated age weights in the DALYS concept

Conclusion

The following table 3 gives an overview of the relevant differences between the two concepts.

Table 3: Differences between QALYS and DALYS

QALYS	DALYS
life years won	life years lost
based on individual preferences	based on expert judgment (social preferences)
generic health description	disease specific health description
various health quality weight scales	specific health quality weight scale
no health independent age weights	health independent age weights

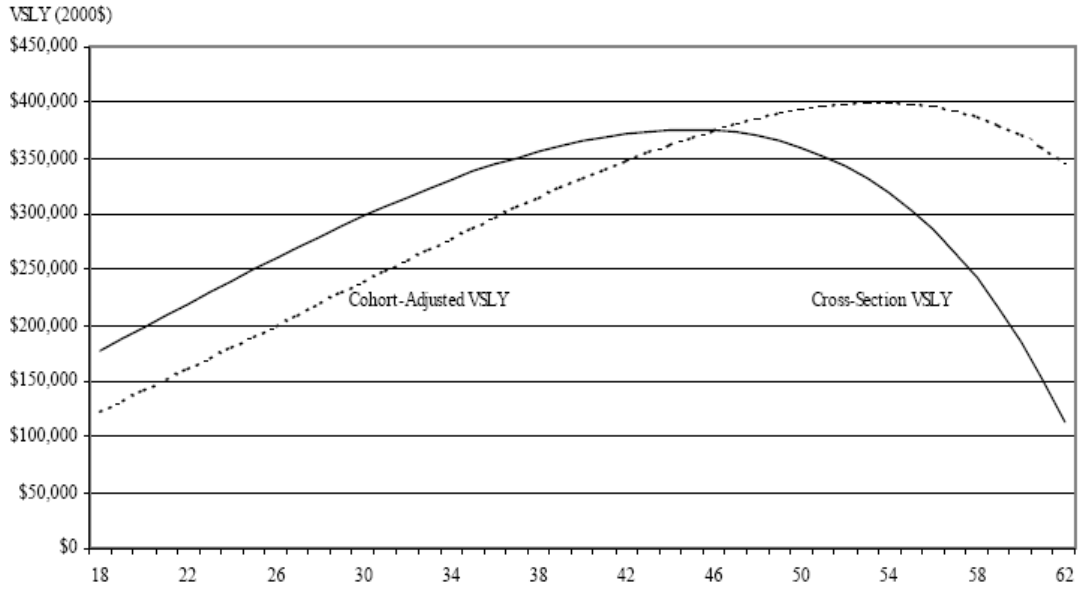
The first difference, i.e. measuring years won or lost, is an issue of definition, and does not influence the result of cost effectiveness analysis. In its application, effectiveness is measured either as years won (with QALYS) or as years not lost (with DALYS), which obviously is the same.

The next difference between individual and social preferences is, at least in theory, of more significance. With value judgments based on experts, it is explicitly aimed to include interpersonal tradeoffs and, therefore, equity issues. Individual values, on the other hand, do not consider interpersonal tradeoffs and, therefore, are confined to the efficiency criterion. The inclusion of equity aspects in the DALYS concept can be regarded as an advantage over the QALYS approach. However, it must be noted, that equity judgments itself are based on individual preferences and, consequently, are far from indisputable.

With respect to generic or disease specific health description, it has been criticized that co-morbidity is not considered enough in the DALYS concept. Murray and Archaya, however, posit that the problem can be solved by simply adding up the weights of different disabilities. The example shows that the DALYS disability scale is rather a concrete application of many conceivable health quality scales and does not principally differ from the various scales

applied within the QALYS concept. In this sense, DALYS is in fact a variant of QALYS, as Murray himself puts it.
Finally, the different age weighting seems to be the most important difference that systematically influences the results of cost effectiveness or cost utility analysis. Everything else equal, the DALYS application would allocate substantially more resources to the health improvement of the middle aged than the QALYS approach. With this allocation, the DALYS concept again applies equity judgments on interpersonal distribution.
The QALYS approach, on the other hand, refrains from fairness issues. However, different age weights on the basis of individual preferences could be included when assigning a money value to QALYs. Aldy and Viscusi[22] have estimated these values as a function of age for the U. S. and also find an inverted U-shape as depicted in figure 3. In comparison to the age weighting in DALYs, the maximum value occurs at a much higher age.

Figure 3: Value of a statistical life year as a function of age



From the presented comparison between QALYS and DALYS it can be concluded that both concepts aim to combine the duration and the quality of life in one measure. A number of differences of the two concepts are more technically than principally caused. This is predominantly the case with assigning different health condition a quality weight.
A more basic difference stems from the task to incorporate fairness issues in the DALYS approach. As a consequence, DALYs comprise more normative judgments and therefore might foreclose decisions that are left for the policy makers with the QALYS approach. In practice, the difference will certainly show in the different treatment of various age groups.

[22] Aldy, Joseph E., Viscusi, W. Kip, Adjusting the Value of a Statistical Life for Age and Cohort Effects, Washington, DC: Resources for the Future, 2006

APPENDIX 2: METHODOLOGY TO SEARCH DATA, REFERENCES AND INFORMATION

To collect data and information on our field of interest, we have proceeded as follows:

- For prevention and promotion measures, we have done:
  - Interviews of
    - People involved in primary and secondary prevention,
    - People from the BAG-OFSP,
    - People from Cantonal governments in five Cantons: Geneva, Vaud, Valais, Bern and Zurich,
    - People from non-governmental organization that implement prevention measures in collaboration with Cantonal or Federal Authorities or on their own.
  - Internet research on websites of BAG-OFSP, Cantons and associations doing prevention or promotion, on websites of Régie Fédérale des Alcools, Fonds Tabac, of the Confederations (for laws).
- For social costs of a risk factor and epidemiology of it: Swiss reports on Social Costs of Alcohol Abuse, Tobacco Consumption and Road Accidents, as well as international reports on the burden of tobacco or alcohol consumption.
- For the risk factor and its related diseases:
  - Causal path: Swiss and international reports on Alcohol and tobacco Consumption.
  - Prevalence: contacts (interview and websites) with OFS, IMS.
  - Mortality: OFS
- For impact of prevention on prevalence of the risk factor: Swiss and international literature search on Medline, Econlit and internet.
- For the costs of medical care: OFS, IMS, Interpharma.

The search on prevention strategies or measures is not exhaustive as we have only joined 5 cantons over 26.However, if for some of them, the information on prevention measures is easily accessible, for others it is more difficult to access to it as it is not well documented or it is spread between different associations or groups.
The other data searches have been done with the idea of: firstly, recovering all the relevant data sources of the reports on Social Costs in Switzerland; secondly, collecting the prevalence and mortality of the risk factor and its related diseases over time; thirdly, updating the Social Costs in taking into account the variation in prevalence and mortality.

APPENDIX 3: LIST OF FEDERAL PREVENTION MEASURES OF SMOKING

Year	Prevention measure	Type	Public	Cost
01.01.-31.08.2006	"schlau-du au?" FPT (Smoking Prevention Fund)	Campaign	16-24 years	167'000. CHF -
Who?	-Antenna for Prevention of toxicomania (drugs addiction) FDI -League against Cancer (Central Swiss) -Lung (pulmonary) League of Lucerne			
12.2005 - 04.2006	Introduction of smoking ban in train (CFF) and other public transport FPT (Smoking Prevention Fund)	Regulation	All travellers by public transports	CHF 1'000'000
Who ?	Union des Transports Publics (UTP)			
01.06.2005-31.1.2007	Smoke Free Galaxy (Galaxy Jump) FPT (Smoking Prevention Fund)	Information – Game software	15-19 years	CHF 85'000
Who?	Black Pencil Entertainment AG			
1.1.-31.12.2005	Cool&clean (for the spirit of the sport)	Campaign	Sportmen/women aged 10-20	CHF 5'000'000.-
Who?	-Swiss Olympic, Sport Federal Office (OFSPO) -OFSP (Federal Office of Public Health)			
01.07.2005-31.07.2007	Experience non-smoking FPT (Smoking Prevention Fund)	Campaign	60'000-80'000 pupils 6-9th years of compulsory school	CHF 2'016'976.-
Who?	OFSP – Federal Office of Public Health			
01.09.2005-31.12.2006	www.ciao.ch FPT (Smoking Prevention Fund)	Internet information	Young aged 13-18	CHF 189'081
Who?	OFSP – Federal Office of Public Health			
01.10.2005-30.06.2007	Smokeless Job[23] FPT (Smoking prevention Fund)	Campaign	Small and Medium size Swiss companies (PME)	CHF 607'940.-
Who?	-Santésuisse/SwissHealth, -SECO, -OFSP			
01.12.2005-31.12.2007	BRAVO FPT (Smoking Prevention Fund) PNPT[24] –	Campaign: TV spots, bill-sticking	Whole population – smokers and passive smokers	2005: CHF 4'050'000 2006: CHF 3'100'000
Who?	OFSP			
2004-2005	« Smoking is harmful »…De l'air FPT (Smoking Prevention Fund) PNPT[25]	Campaign: TV spots, bill-sticking	Whole population – smokers	2004: CHF 3'000'000 2005: CHF 4'050'000
Who?	OFSP			
01.07.2004-30.06.2005	Experience non-smoking FPT (Smoking Prevention Fund)	Campaign	pupils 6-9th years of compulsory school	CHF 938'500.-
Who?	OFSP – Federal Office of Public Health			
01.10.2004	641.310 "Ordonnance du 24 septembre 2004 modifiant les tarifs d'impôt pour le tabac coupé ainsi que pour les cigarettes et le papier à cigarettes"	Legal: Taxes on cigarettes	Whole population - smokers	
Who?	OFSP			

[23] «lieu de travail. sans fumée»
[24] Programme National de Prévention du Tabagisme (National Program of Smoking Prevention)
[25] Programme National de Prévention du Tabagisme (National Program of Smoking Prevention)

01.10.2004	641.316 "Ordonnance sur le Fonds de Prévention du Tabagisme" Tobacco Prevention Funds	Legal	Whole population - smokers	Linked to cigarettes taxation (sells).
Who?	OFSP			
01.11.2004	RS 817.06 Ordonnance sur le tabac (OTab) : Advertisements for minors Health warnings on pack	Legal	Whole population - smokers	
Who?	OFSP			
01.03.-31.12.2004	LaOla	Campaign	Sports clubs (sportmen/women)	CHF 1'300'000.-
Who?	-Swiss Olympic Association, -OFSPO, -OFSP			
1.12.2004-30.06.2005	Un sport sans fumée	Campaign	People involved in sport activities.	CHF 400'000.-
Who?	-Swiss Olympic Association, -OFSPO, -OFSP			
01.01.2004-31.12.2005	Smoking is harmful - let it be FPT (Smoking Prevention Fund) PNPT[26]	Campaign	People that want to stop smoking	CHF 1'100'000.-
Who?	-Swiss League against cancer -Swiss Pulmonary League -Swiss Association for smoking prevention AT - OFSP			
01.01.2004-31.07.2004	Experience non-smoking FPT (Smoking Prevention Fund)	Campaign	pupils 6-9th years of compulsory school	CHF 250'000.-
Who?	OFSP – Federal Office of Public Health			
May 2003-Sept. 2005	Area without smoke[27] FPT (Smoking Prevention Fund)	Information Education	Restaurants, bars and workplaces	CHF 870'000
Who?	AT (Swiss Association for Smoking Prevention)			
2001-2007	Smoking is harmful[28] FPT (Smoking Prevention Fund)	Campaign: TV spots, bill-sticking	Whole population - smokers	2001: CHF 2'865'400 2002: CHF 2'700'000 2003: CHF 2'750'000
2000/2001	Experience non-smoking – 1st part	Campaign	pupils 6-9th years of compulsory school	NC
Who?	OFSP – Federal Office of Public Health			
01.01.1998	RS 784.401 Ordonnance sur la radio et la télévision (ORTV)	Legal: Ban on ad	Whole population	
Who?	OFCOM			
1996-1999	Programme Global Tabac (TPG:) 25 intervention projects 6 research projects	Campaign	Whole population	10'000'000CHF ~2.5 millions/year
Who?	OFSP			
01.04.1992	RS 784.40 Loi fédérale sur la radio et la télévision (LRTV)	Legal: Ban on ad	Whole population	
Who?	OFCOM			
01.01.1970	641.31 Loi fédérale du 21 mars 1969 sur l'imposition du tabac	Legal - Taxes	Whole population - smokers	
Who?	OFSP			

[26] Programme National de Prévention du Tabagisme (National Program of Smoking Prevention)
[27] "Espace sans fumée"
[28] From the PNPT, campaign « Fumer ça fait du mal…- De l'air ! » against passive smoking

APPENDIX 4: LIST OF FEDERAL PREVENTION MEASURES OF ALCOHOL CONSUMPTION

Year	Prevention measure	Type	Public	Cost
10.2006-01.2007	Go4Points; celebrate with pleasure	Campaign	16-24 years out at week-end	
Who?	ISPA			
2000-2006	Programme- – Several measures Les communes bougent! PNAA & PCAA[29]	Campaign	Population in the towns concerned	
Who?	Radix, towns' authorities			
	-			
1999-2007	Ça débouche sur quoi? PNAA[30]	Campaign Mass Media	All population + young regular consumers	1999 CHF 3'379'116.40 2000 CHF 3'100'000.00 2001 CHF 3'400'000.00 2002 CHF 3'565'000.00 2003 CHF 2'998'000.00 2004 CHF 2'940'000.00 2005 CHF 625'000.00 2006 CHF 625'000.00 2007 CHF 480'000.00
Who?	OFSP, RFA			
Dice play: 1993-expo 2002	Café Saigon	Education Exposition, Game	Adolescents aged 13-18	
Who ?	-Suchtpräventionsstelle der Stadt Zürich -GREAT Groupement Romand d'Etudes sur l'Alcoolisme et les Toxicomanies			

[29] PCAA = Cantonal Programme of Action against Alcohol consumption, launched by the Federal Commission of alcohol consumption problems to support the PNAA at cantonal and communal levels.

[30] PNAA = National Programme of Action against Alcohol consumption, launched by the Federal Commission of alcohol consumption problems.

APPENDIX 5: LIST OF PREVENTION MEASURES OF ROAD ACCIDENTS

Programs, laws and regulation aiming at the reduction of road accidents (based on information by bfu, Internet research and personal communication)

year	to year	measure	kind of measure	territory
1971		compulsory safety belts on front seats of cars	law	CH
1973	1975	temporary introduction of speed limit 100 on rural roads	law	CH
1973		introduction of speed limit 130 on highways	law	CH
1976		compulsory triangular safety belts on front seats of cars	law	CH
1976	1977	compulsory safety belt wearing on all seats (temporary measure)	law	CH
1977		compulsory daytime running lights for motorcycles and mopeds	law	CH
1978		compulsory equipment with laminated safety glass	law	CH
1980		compulsory safety belts on back seats of cars	law	CH
1980		blood alcohol limit of 0.8 per mil and police allowed to test without signs that the driver may be intoxicated	law	CH
1981		compulsory safety belt wearing on front seats	law	CH
1981		compulsory helmet on motorcycles	law	CH
1984		introduction of speed limit 50 on urban roads	law	CH
1984		introduction of speed limit 80 on rural roads and 120 on highways	law	CH
1986	2005	beginning of new school year	bfu campaign	CH
1986	1991	light motorcycle helmet	bfu campaign	CH
1986		young drivers / disco	bfu campaign	CH
1987		safety belt	bfu campaign	CH
1987		visible at night	bfu campaign	CH
1988		only authorised helmets may be used	law	CH
1989		no medicine when driving	bfu campaign	CH
1990		compulsory helmet on mopeds	law	CH
1990		young drivers / disco	bfu campaign	CH
1990		visible at night	bfu campaign	9 communes
1991		new regulation of driving instruction	law	CH
1992		compulsory rear-view mirrors on mopeds	law	CH
1992		bicycle and light motorcycle helmet	bfu and SUVA campaign	CH
1993	2000	bicycle helmet	bfu campaign	CH
1993		young drivers / disco	bfu campaign	CH
1994		compulsory safety belt wearing on all seats	law	CH
1994		compulsory safety seats for young children on front seats	law	CH
1994		compulsory lateral safety bar on heavy trucks	law	CH
1994		precedence of pedestrians at crosswalks	law	CH
1995		obligation to carry an accident warning sign in a car	law	CH
1995		general adoption of European norms on technical standards	law	CH
1996	1997	pedestrian safety	bfu campaign	CH
1997		young drivers / disco	bfu campaign	CH

1998		compulsory trip recorder on trucks in order to control work and rest times of drivers	law	CH
1998		compulsory head rests on front seats of cars	law	CH
1998	2001	young drivers - young sportsmen [???]	bfu campaign	CH
1999	2007	general alcohol prevention campaigns (not specific to road accidents)	BAG campaign	CH
1999		pedestrian safety	bfu campaign	CH
2001	2006	bicycle helmet	bfu and SUVA campaign	CH
2001	2003	use of daytime running lights	bfu campaign	CH
2002		children have to be secured on all car seats	law	CH
2002		recommended use of daytime running lights (compulsory but no penalties)	law but no penalty	CH
2003		speed limiter on busses	law	CH
2003		speed limiter on vehicles > 3.5 t	law	CH
2004		0.5 per mil alcohol blood content	bfu campaign	CH
2005		introduction of a new vehicle revision plan	law	CH
2005		the use of a number of additional lights is authorises	law	CH
2005		blood alcohol limit of 0.8 per mill for divers of all vehicles	law	CH
2005	2008	safety belt	bfu campaign	CH
2006		driving licence on trial	law	CH
2007		changes in the regime of fines and sanctions on traffic rules	law	CH