Comparative analysis of cost-effectiveness of evidence-based measure to reduce smoking-attributable mortality in Switzerland

Vergleichende Analyse der Kosteneffektivität evidenzbasierter Massnahmen zur Verringerung der Tabak-bedingten Mortalität in der Schweiz

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Executive Summary deutsch

Ziel:

Empirisch belegte und bewährte Interventionen im Bereich der Tabakprävention und der Entwöhnungsbehandlung wurden auf ihre Effektivität und Kosteneffektivität bei der Reduktion Tabak-bedingter Mortalität geprüft und verglichen. Dadurch soll ermöglicht werden, Präventionsstrategien zukünftig zu bündeln und einen maximalen Effekt bei gegebenem Ressourcenaufwand zu erzielen.

Methodik:

Epidemiologische Analyse (inklusive Sensitivitätsanalysen) der durch ausgewählte Interventionen erzielbaren Effekte bei der Reduktion Tabak-bedingter Mortalität einerseits und der infolge Tabakkonsums verlorenen Lebensjahre und Krankheitslast andererseits für die erwachsene Gesamtbevölkerung der Schweiz für das Jahr 2002, jeweils getrennt nach von Aktiv- versus Passivrauchen bedingter Mortalität. Ökonomische Analyse der Kosteneffektivität der genannten Interventionen mit zwei Kriterien: Anzahl der Rauchenden und Tabak-bedingte Mortalität.

Zielkriterien:

a) Tabak-bedingte Mortalität – getrennt nach Aktiv- und Passivrauchtoten;
b) durch Tabakkonsum verlorene Lebensjahre (wiederum getrennt nach Aktiv- und Passivrauch bedingten verlorenen Lebensjahren);
c) Tabak bedingte Krankheitsbelastung in DALYs (disability-adjusted life years).

Alle Indikatoren wurden ermittelt anhand zweier Tracer-Diagnosen (Lungenkrebs (ICD 9 162; ICD 10 C33-C34) und koronare Herzkrankheit (ICD 9 410-414; ICD 10 I20-I25)) für das Jahr 2002. Zusätzlich wurden die gesamten rauchbedingten Gesundheitsschäden, d.h. die gesamte Morbiditäts- und Mortalitätslast, die durch Rauchen verursacht wurde, berechnet.

Interventionen:

Es wurden schweizerischen ExpertInnen verschiedene Interventionsstrategien zur Auswahl hinsichtlich Ihrer Anwendung in der Schweiz vorgelegt, die dann in Ihrer Wirkung speziell für die Schweiz modelliert wurden (sowohl allein für sich wie in Kombination):

a) Verhältnisprävention:
- Preiserhöhungen, zum Beispiel durch Besteuerung
- Rauchverbote auf öffentlichen Plätzen
- Arbeitsplatz-bezogene Interventionen

b) Verhaltensprävention & Therapie:
- Kurzinterventionen durch individuelle, nichtärztliche Beratung
- Substitutionstherapien (Nicotine Replacement Therapy)
- Ärztliche Beratung

Bestimmung der quantitativen Auswirkungen der verschiedenen Interventionen:
Aus den jüngst verfügbaren Meta-Analysen wurde jeweils die Effektivität jeder Massnahme bestimmt.

Datengrundlagen:
Zielkriterien: Mortalitäts- und Morbiditätsdaten wurden von der WHO bezogen; die epidemiologischen Daten zum Tabakkonsum in der Schweiz wurden der Schweizerischen Gesundheitsbefragung (SGB) entnommen und von Dr. G. Gmel (SFA) aufbereitet; die Relativen Risiken für Raucher und Ex-Raucher wurden aus epidemiologischen Meta-Analysen übernommen, und die Effekte des Passivrauchens wurden indirekt ermittelt.

Interventionen: Die Effektgrössen für die Massnahmen wurden soweit möglich der Cochrane Database entnommen, weil dadurch die aktuell höchstmögliche Präzision der Schätzungen erreicht wird.

Resultate:

Insgesamt ergaben sich für das Jahr 2002 in der Schweiz je nach Annahmen hinsichtlich Tabak-bedingten Krankheiten und den entspechenden Relativen Risiken zwischen 6'175 und 7'300 Tabak-bedingte Sterbefälle. Details sind folgender Tabelle zu entnehmen.

Schätzung rauchbedingter (inklusive Passivrauchen) Todesfälle in der Schweiz 2002 (Erwachsene 20 Jahre und älter)

	Männer	Frauen	Gesamt	% an allen Todesfällen
Aktivrauchbedingte Todesfälle (English et al.^)	4'194	1'843	6'037	9.9%
Aktivrauchbedingte Todesfälle (CPS II**)	5'339	1'663	7'002	11.5%
Passivrauchbedingte Todesfälle (English et al.*)	91	46	138	0.2%
Passivauchbedingte Todesfälle (CPS II**)	116	41	160	0.3%
Tabak-bedingte Todesfälle gesamt (English et al.*)	**4'286**	**1'888**	**6'175**	**10.1%**
Tabak-bedingte Todesfälle gesamt (CPS II)**	**5'455**	**1'704**	**7'162**	**11.8%**
Tabak-bedingte Todesfälle gesamt (indirekte Methode*)**	**5'600**	**1'800**	**7'300**	**12.0%**

Todesfälle basieren auf attributiven Fraktionen und weisen Nachkommastellen auf.
* RR aus (English et al., 1995) (siehe Text)
** RR aus der CPS II Studie (siehe Text)
*** indirekte Schätzung basierend auf Lungenkrebstodesraten; Daten aus 2000 und in der Originalveröffentlichung nur auf 100 Tote genau angegeben (Peto et al., 1992; Peto et al., 2006) siehe Text

Die beiden für Rauchen charakteristischen Diagnosen (Tracer-Diagnosen) Lungenkrebs und ischämische Herzkrankheiten machen etwas mehr als die Hälfte aller rauchbedingten Todesfälle aus. Basierend auf einer konservativen Schätzung mit den Annahmen von English und Kollegen (English et al., 1995) verloren Raucher in der Schweiz im Jahre 2002 42'902 Lebensjahre frühzeitig (12.2% der gesamten YLLs – years of life lost - in der Schweiz). Die Gesamtlast unter Einbeziehung von Passivrauchen betrug 43'871 YLLs (12.5% der gesamten YLLs). Die Tabak-bedingte Krankheitslast betrug 59'273 DALYs (disability adjusted life years; 7.4% der gesamten Krankheitslast in der Schweiz), ohne Passivrauchlast, und 60'617 DALYS insgesamt (7.6%).

Die untersuchten Interventionen resultierten in jährlichen Prävalenzminderungen an RaucherInnen zwischen 0% und 1.4% in der Allgemeinbevölkerung (Reduktionen von 0% bis 6.0% unter RaucherInnen), gleichbedeutend mit einer Reduzierung um maximal ca. 85'000 RaucherInnen in der Schweiz. Betrachtet man die Tabak-bedingten Todesfälle, so könnten diese um bis zu 85 Todesfälle jährlich ab sofort reduziert werden. Bei den genannten Zahlen ist zu bedenken, dass die gewählten Interventionsszenarien realistisch in dem Sinne waren, dass sie tatsächliche Chancen auf Durchsetzbarkeit in der Schweiz haben. Drastischere Steuererhöhungen würden in deutlich höheren Prävalenz- (z.B. 20% der RaucherInnen bei Verdoppelung des Preises) und Mortalitätsminderungen resultieren (bei Verdoppelung des Preises Reduktion der Tabak-bedingten Todesfälle um 272).

Hinsichtlich der Kosteneffektivität zeigt sich deutlich, dass die beiden verhältnispräventiven Massnahmen Steuererhöhung und Rauchverbot an öffentlichen Plätzen kosteneffektiver sind als alle individuell-basierten Interventionen wie Beratung und Therapie. Die Kosten für eine 1%-Reduktion der Raucheranzahl in der Schweiz belaufen sich dabei zwischen CHF 140'000.- (Verdoppelung des Preises via Steuererhöhung) und über CHF 80 Millionen (bei flächendeckender Anwendung von ärztlich verordneter Substitutionstherapie).

Relevanz:

Rauchbedingte Todesfälle und - Krankheitslast zählen zu den wichtigsten Public Health Problemen in der Schweiz. Es existieren effektive Interventionen, die auch in der Scheiz durchgeführt werden könnnen. Allerdings bringen diese Interventionen keine plötzlichen und durchschlagenden Erfolge hinsichtlich der RaucherInnenprävalenz und rauchbedingter Krankheitslast. Es ist zu bedenken, ob nicht drastischere Massnahmen der Tabakkontrolle angestrebt werden sollten.

Executive Summary English

Objectives:

To compare evidence-based interventions for tobacco control and treatment of tobacco dependence with respect to their cost-effectiveness. The aim of this cost-effectiveness analysis is to inform preventive strategies in Switzerland and obtain an optimal outcome with given resources.

Methods:

Economic analysis based on epidemiologic analyses of effects resulting from tobacco control interventions. Various sensitivity analyses were conducted both for the epidemiological and the economic part. All effects were calculated based on the year 2002; outcome criteria included number of smokers in Switzerland and different health indicators.

Main outcome criteria:

a) Smoking-attributable mortality – including calculation of the effect of environmental tobacco smoke (ETS);
b) Smoking-attributable years of life lost – again also including ETS;
c) Smoking-attributable burden of disease including ETS in DALYs (disability-adjusted life years).

All Indicators were also calculated for all smoking-attributable diagnoses and for two tracer diagnoses (Lung cancer (ICD 9 162; ICD 10 C33-C34) and ischaemic heart disease (ICD 9 410-414; ICD 10 I20-I25)), again for the year 2002.

Interventions:

A comprehensive set of different types of interventions were given to local experts to select the interventions to be modeled, taken into consideration especially the effectiveness and feasibility for Switzerland. The following interventions were selected for further analyses, both alone and in combination:

Public policy interventions:

- Price increase
- Interventions for preventing tobacco smoking in public places
- Workplace interventions for smoking cessation

Interventions focusing on individual behavioural change (counselling, brief advice, therapy):

- Individual behavioural counselling for smoking cessation.
- Nicotine replacement therapy for smoking cessation
- Physician advice for smoking cessation

Estimation of the effect sizes:

We used comprehensive meta-analyses to quantify the effect of different interventions.

Data sources:
All disease-specific outcome data (i.e. deaths, years of life lost, DALYs) were obtained from the WHO, the exposure data on tobacco consumption were taken from the Swiss Health Survey (data analyses from Dr. G. Gmel - SIPA). Relative Risks were taken from epidemiological meta-analyses, and the effects of ETS were estimated based on Canadian analyses.

The effect sizes for interventions were taken from the Cochrane Database whenever possible to secure comparability and high validity.

Results:

Overall, we estimate that between 6,175 and 7,300 adult Swiss were killed by tobacco in the year 2002. The details can be seen in the following overview Table:

Estimates of smoking-attributable adult deaths in Switzerland 2002 including ETS

	Men	Women	Total	% of all deaths
Total smoking-attributable deaths from own smoking (English et al., 1995 direct method)	4,194	1,843	6,037	9.9%
Total smoking-attributable deaths from own smoking (CPS II direct method)	5,339	1,663	7,002	11.5%
ETS (English et al., 1995 direct method)	91	46	138	0.2%
ETS (CPS II direct method)	116	41	160	0.3%
Total smoking-attributable deaths (English et al., 1995) - direct method	**4,286**	**1,888**	**6,175**	**10.1%**
Total smoking-attributable deaths (CPS II) – direct method	**5,455**	**1,704**	**7,162**	**11.8%**
Total smoking-attributable deaths (Peto et al., 1992; Peto et al., 2006) – indirect method	**5,600**	**1,800**	**7,300**	**12.0%**

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals); the numbers of Peto et al. (2006) were given in 100s in the original publication.

The two tracer diagnoses lung cancer and IHD comprise slightly more than 50% of the all smoking-attributable mortality. Based on the most conservative estimate (English et al., 1995) Swiss smokers accounted for 42’902 years of life lost (YLLs; 12.2% of all YLLs in Switzerland in 2002). Including ETS the smoking-attributable YLLs amounted to 43'871 YLLs (12.5% of all YLLs). Smoking-attributable burden of disease in 2002 was estimated to be 59’273 DALYs (7.4% of all DALYs) without ETS and 60’617 DALYS including ETS (7.6% of all DALYs).

The examined interventions resulted in yearly prevalence reductions between 0% and 1.4% relative to the general population and between 0% and 6% among smokers, corresponding to a reduction of up to 85,000 smokers. The interventions could reduced yearly smoking-attributable mortality by about 85 deaths per year. When evaluating this figures, it should be kept in mind, that the chosen interventions were realistic in the sense, that they could be easily implemented in Switzerland. More drastic taxation increases resulting in 50% respectively 100% increases of price for cigarettes would result in more pronounced effects. For instance, a 100% increase of prices would result in 20% reduction of smoking prevalence and 272 deaths saved per year.

With respect to cost-effectiveness, public policy measures such as even minor increases in taxation or ban of smoking in public places clearly are more cost-effective than individual counselling or therapy. The costs for reduction of smoking prevalence by 1% vary between CHF 140,000 (drastic taxation increases which double the price for cigarettes) and more than CHF 80 millions, if prevalence is reduced by prescribed nicotine replacement therapy alone.

Relevance:

Smoking-attributable mortality and burden of disease is a major public health problem in Switzerland. There are effective evidence-based interventions which could also be implemented here. However, these interventions will bring only gradual improvements in reducing prevalence of smoking and smoking-attributable burden of disease. Given this situation more drastic measures than currently contemplated should be considered.

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Table of content

Introduction

Tobacco use is responsible for high levels of mortality and morbidity. Smoking causes substantially increased risk of mortality from lung cancer, upper aerodigestive cancer, several other cancers, heart disease, stroke, chronic respiratory disease and a range of other medical causes (USDHHS: U.S.Department of Health and Human Services, 2004). In the developed world in the year 2000, smoking was reported to be the risk factor with the largest attributable mortality and attributable disability adjusted life years (DALYS) by the (WHO, 2002); overall 12.2% of all DALYS were attributed to this risk factor.

Given the extent of tobacco-attributable disease burden described above, tobacco control measures have gained more and more importance. Though there is considerable political and public for such measures (but see Cornuz et al., 1996, for Switzerland), resources are limited, even in a rich country like Switzerland. Thus, cost-effective tobacco control measures are important in further reducing the burden of tobacco smoking. Economic analyses are key to identifying and implementing such cost-effective measures (for general considerations and definitions see Drummond et al., 1997; Drummond & McGuire, 2001; for the field of substance abuse especially in German-speaking countries see Rehm, 1999; Rehm et al., 2004a; Tretter et al., 2004).

This contribution will provide epidemiologic and economic analyses of the effects of different interventions to reduce smoking-attributable burden in Switzerland. We will not restrict ourselves to the more traditional field of cost-effectiveness of different treatment options (e.g. Cornuz et al., 2006), but will include cost-effectiveness of preventive efforts, including public policy interventions such as taxation increases or a ban of smoking in public spaces (see generally Bryant et al., 1997). We can only hope that our analyses can influence decision making about tobacco control in Switzerland.

Methods

Selection of interventions

The selection of interventions was undertaken in two steps:

- Collection of evidence for most common interventions via a search of meta-analyses with special emphasis on Cochrane reviews;
- Expert consultation to select the best fitting types of interventions for Switzerland.

Collection of evidence for most common interventions

The following systematic reviews were found with respect to effectiveness of smoking-related interventions in the Cochrane database (all links accessed in February 2006; for a more general short overview on the most utilized tobacco control interventions and their coverage see Jha et al., 2006):

Acupuncture for smoking cessation	http://www.cochrane.org/reviews/en/ab000009.html
Antidepressants for smoking cessation	http://www.cochrane.org/reviews/en/ab000031.html
Anxiolytics for smoking cessation	http://www.cochrane.org/reviews/en/ab002849.html
Aversive smoking for smoking cessation	http://www.cochrane.org/reviews/en/ab000546.html
Clonidine for smoking cessation	http://www.cochrane.org/reviews/en/ab000058.html
Community interventions for preventing smoking	http://www.cochrane.org/reviews/en/ab001291.html http://www.cochrane.org/reviews/en/ab001745.html
Community pharmacy personnel interventions for smoking cessation	http://www.cochrane.org/reviews/en/ab003698.html
Competitions and incentives for smoking cessation	http://www.cochrane.org/reviews/en/ab004307.html
Enhancing partner support to improve smoking cessation	http://www.cochrane.org/reviews/en/ab002928.html

Exercise interventions for smoking cessation	http://www.cochrane.org/reviews/en/ab002295.html
Family and carer smoking control programmes for reducing children's exposure to environmental tobacco smoke	http://www.cochrane.org/reviews/en/ab001746.html
Group behaviour therapy programmes for smoking cessation	http://www.cochrane.org/reviews/en/ab001007.html
Healthcare financing systems for increasing the use of tobacco dependence treatment	http://www.cochrane.org/reviews/en/ab004305.html
Hypnotherapy for smoking cessation	http://www.cochrane.org/reviews/en/ab001008.html
Individual behavioural counselling for smoking cessation	http://www.cochrane.org/reviews/en/ab001292.html
Interventions for preoperative smoking cessation	http://www.cochrane.org/reviews/en/ab002294.html
Interventions for preventing tobacco sales to minors	http://www.cochrane.org/reviews/en/ab001497.html
Interventions for preventing tobacco smoking in public places	http://www.cochrane.org/reviews/en/ab001294.html
Interventions for smokeless tobacco use cessation	http://www.cochrane.org/reviews/en/ab004306.html
Interventions for smoking cessation in hospitalised patients	http://www.cochrane.org/reviews/en/ab001837.html
Lobeline for smoking cessation	http://www.cochrane.org/reviews/en/ab000124.html
Mass media interventions for preventing smoking in young people	http://www.cochrane.org/reviews/en/ab001006.html
Mecamylamine (a nicotine antagonist) for smoking cessation	http://www.cochrane.org/reviews/en/ab001009.html
Nicotine replacement therapy for smoking cessation	http://www.cochrane.org/reviews/en/ab000146.html
Nursing interventions for smoking cessation	http://www.cochrane.org/reviews/en/ab001188.html
Opioid antagonists for smoking cessation	http://www.cochrane.org/reviews/en/ab003086.html
Physician advice for smoking cessation	http://www.cochrane.org/reviews/en/ab000165.html
Quit and Win contests for smoking cessation	http://www.cochrane.org/reviews/en/ab004986.html
Relapse prevention interventions	http://www.cochrane.org/reviews/en/ab003999.html

for smoking cessation	
School-based programmes for preventing smoking	http://www.cochrane.org/reviews/en/ab001293.html
Self-help interventions for smoking cessation	http://www.cochrane.org/reviews/en/ab001118.html
Silver acetate for smoking cessation	http://www.cochrane.org/reviews/en/ab000191.html
Telephone counselling for smoking cessation	http://www.cochrane.org/reviews/en/ab002850.html
Training health professionals in smoking cessation	http://www.cochrane.org/reviews/en/ab000214.html
Workplace interventions for smoking cessation	http://www.cochrane.org/reviews/en/ab003440.html

Expert consultation

Five experts were contacted with a structured questionnaire to solicit answers as to which interventions would best fit for Switzerland based on importance with respect to reduce tobacco-attributable harm (see Appendix 1 for details):

- J. Cornuz, MD – Medical director (Medecin-chef), Policlinique Médicale Universitaire, Lausanne, a university affiliated outpatient clinic;
- M. Graf – Director of the Swiss Institute for the Prevention of Alcohol and Drugs Problems (SFA/ISPA/SIPA), Lausanne, one of the two internationally renowned addiction research institutes in Switzerland;
- K. Klingler, MD – Medical Director of The Hirslanden Pneumology Center, Zurich, a private hospital;
- E. Scheuer, MD – Director of „Raucherspechstunde“ (www.raucherspechstunde.ch), a private organization, which offers individually tailored behavioural smoking cessations programs;

- C. Schwendimann – Director of „Züri Rauchfrei“ („Zurich Smokefree“;

  http://www.zurismokefree.ch), a cantonal agency for tobacco control and prevention.

Interventions selected

The following interventions were selected based on the feedback of the experts:

Public policy interventions:

Price increase
http://scholar.google.com/scholar%3Fq%3Dauthor:%22Ranson%22+intitle:%22The+effectiveness+and+cost-effectiveness+of+price+...%22+%26hl%3Dde%26lr%3D%26ie%3DUTF-8%26oi%3Dscholarr
(last accessed: 12-29-06)

Interventions for preventing tobacco smoking in public places
http://www.cochrane.org/reviews/en/ab001294.html
(last accessed: 12-29-06)

Comprehensive workplace interventions for smoking cessation
http://www.cochrane.org/reviews/en/ab003440.html
(last accessed: 12-29-06)

Interventions focusing on individual behavioural change (counselling, brief advice, therapy):

Individual behavioural counselling for smoking cessation.
http://www.cochrane.org/reviews/en/ab001292.html
(last accessed: 01-03-07)

Nicotine replacement therapy for smoking cessation
http://www.cochrane.org/reviews/en/ab000146.html
(last accessed: 01-03-07)

Physician advice for smoking cessation
http://www.cochrane.org/reviews/en/ab000165.html
(last accessed: 01-03-07)

Methodological considerations for statistical modeling

Based on recent publications (Ezzati et al., 2002; Ezzati et al., 2003; Shibuya et al., 2003), we decided to model the impact of different interventions in burden of disease terms. This procedure can be justified by the fact that for tobacco abuse[1] – contrary to alcohol abuse and illicit drugs – the overwhelming majority of direct costs materializes in health care, see (Single et al., 1996; Single et al., 1998; Rehm et al., 2006).

The usual epidemiological model as defined by burden of disease studies, especially on the international level (Murray & Lopez, 1996; Murray et al., 2000; WHO, 2001; WHO, 2002), operates with one-dimensional risk factors and foresees the following steps:

- Estimation of disease-, sex- and age-specific population attributable fractions, in the case of tobacco estimation of smoking-attributable fractions (see formula below).
- Based on smoking-attributable fractions, smoking-attributable deaths and disability adjusted life years (DALYs) via years of life lost due to disability (YLDs) and years of life lost due to mortality (YLLs).

As you will see below, there is some discrepancy in the results of different methods for smoking-attributable mortality. We used three different methods to estimate overall mortality, YLLs and DALYs. In addition, we used two tracer diagnoses where there is much less variability: lung cancer and ischaemic heart disease (IHD; see Table Methods-1).

[1] The term “abuse” here is used in the economical definition and does not necessarily effect the psychiatric definition of DSM-IV.

Table Methods-1: Selected tracer diagnosis for epidemiological modeling

Disease	ICD-9	Global burden of disease study Code	ICD10 MTL 1 codes	ICD-10
Ischaemic Heart Disease (IHD)	410-414	W107	1067	I20-I25
Lung cancer	162	W067	1034	C33-C34

The contribution of a risk factor to disease or mortality relative to some alternative exposure scenario (i.e. PAF, defined as the proportional reduction in population disease or mortality that would occur if exposure to the risk factor were reduced to an alternative exposure scenario, *ceteris paribus* (Miettinen, 1974; Eide & Heuch, 2001) is given by the generalized "potential impact fraction" in Equation 1, or its discrete version when exposure variable is categorical (Eide & Heuch, 2001; Walter, 1976; Walter, 1980).

$$PIF = \frac{\int_{x=0}^{m} RR(x)P(x)\,dx - \int_{x=0}^{m} RR(x)P'(x)\,dx}{\int_{x=0}^{m} RR(x)P(x)\,dx} \qquad (1)$$

$RR(x)$: relative risk at exposure level x

$P(x)$: population distribution of exposure

$P'(x)$: counterfactual distribution of exposure (often 0 = no exposure for tobacco)

m: maximum exposure level

Because most diseases are caused by multiple risk factors, and because some risk factors act through other, more proximal, factors, population attributable fractions for multiple risk factors for the same disease can add up to more than 100% (Rothman, 1976; Rothman & Greenland, 1998). For example, some of the cardiovascular disease events may be due to combination of smoking, physical inactivity and inadequate intake of fruits and vegetables (all acting partially through obesity, cholesterol, and blood pressure). Such cases would be

attributed to all of these risk factors. While lack of additivity may seem problematic initially, multiple causality offers opportunities to tailor prevention based on availability and cost of interventions. In terms of tobacco interventions, this means that the projected mortality gains will be achieved through constellations in which some of the gains could also be achieved by other interventions; e.g. the mortality reduction of tobacco taxation on CHD could in part be achieved by improving physical fitness in the population.

To estimate smoking-attributable mortality and burden of disease attributable fractions were calculated using the discrete version of Equation 1.

Risk relations

Direct approaches based on Relative Risk and prevalence

As indicated by Equation 1, the calculation of smoking-attributable mortality was based on the combination of relative risks and prevalence of exposure. The selection of tobacco-related diseases and causes of death relied on recent comprehensive reviews by the International Agency for Research on Cancer (IARC, 2004) and the U.S. Government (USDHHS: U.S. Department of Health and Human Services, 2004). The list of these conditions is reported in Table Methods-2.

Table Methods-2: Conditions caused by tobacco smoking (English et al., 1995; IARC, 2004; USDHHS: U.S.Department of Health and Human Services, 2004)

Cause of death	ICD 9	ICD10
Lip, oral and pharyngeal cancer	140-149	C00- C14
Esophageal cancer	150	C15
Stomach cancer	151	C16
Liver cancer	155	C22
Pancreas cancer	157	C25
Laryngeal cancer	161	C32
Lung cancer	162	C33-C34
Cervical cancer	180	C53
Bladder cancer	188	C67
Kidney, other urinary cancer	189	C64-C66, C68
Leukemia	204-208	C92
Parkinson disease	332	G20-G21
Ischaemic heart disease	410-414	I20-I25
Other heart diseases	390-398, 415-417, 420-429	I00-I09, I26-I51
Cerebrovascular diseases	430-438	I60-I69
Atherosclerosis	440	I70
Other arterial diseases	441-448	I71-I78
Pneumonia	480-487	J10-J18
Bronchitis, emphysema	490-492	J40-J43
COPD	490-492, 496	J40-J44
Peptic ulcer	531-534	K25-K27
Crohn's disease	555	K50
Ulcerative colitis	556	K51
Fire injury	E890-E899	X00-X09

Two sets of relative risks were used in the analysis. The first set was derived from the Cancer Prevention Study II (CPS-II), a large prospective cohort study conducted by the

American Cancer Society (USDHHS: U.S. Department of Health and Human Services, 2004). Between 1982 and 1984 over one million healthy American volunteers were enrolled in the study; tobacco smoking was assessed at baseline. Sex-specific relative risks for current and ex-smokers are listed in Table Methods-3. For several tobacco-related conditions, no relative risks have been reported for CPS-II.

Table Methods-3: Relative Risks from Cancer Prevention Study II (CPS II)

Cause of death	ICD9 codes	Relative risk				Comments
		M-current smokers	M-Former smokers	W-current smokers	W-Former smokers	
Lip, oral and pharyngeal cancer	140-149	10.9	3.4	5.1	2.3	
Esophageal cancer	150	6.8	4.5	7.8	2.8	
Stomach cancer	151	2.0	1.5	1.4	1.3	
Liver cancer	155	NA	NA	NA	NA	
Pancreatic cancer	157	2.3	1.2	2.3	1.6	
Laryngeal cancer	161	14.6	6.3	13.0	5.2	
Lung cancer	162	23.3	8.7	12.7	4.5	
Cervical cancer	180	-	-	1.6	1.1	
Bladder cancer	188	3.3	2.1	2.2	1.9	
Kidney, other urinary cancer	189	2.7	1.7	1.3	1.1	
Leukemia	204-208	1.9	1.3	1.1	1.4	
Parkinson disease*	332	0.69	0.79	0.6	0.9	Other source
Ischaemic heart disease <65	410-414	2.8	1.6	3.1	1.3	
Ischaemic heart disease 65+	410-414	1.5	1.2	1.6	1.2	
Other heart diseases	390-398, 415-417, 420-429	1.8	1.2	1.5	1.1	
Cerebrovascular diseases <65	430-438	3.3	1.0	4.0	1.3	
Cerebrovascular diseases 65+	430-438	1.6	1.0	1.5	1.0	
Atherosclerosis	440	2.4	1.3	1.8	1.0	
Other arterial diseases**	441-448	4.15	2.05	4.65	1.6	Average of the RRs of the Aortic aneurysm and Other arterial disease
Atherosclerosis and other arterial diseases	440-448	NA	NA	NA	NA	

Pneumonia	480-487	1.8	1.4	2.2	1.1	
Bronchitis, emphysema	490-492	17.1	15.6	12.0	11.8	
Chronic airways obstruction	496	10.6	6.8	13.1	6.8	
COPD	490-492, 496	NA	NA	NA	NA	
Peptic ulcer	531-534	NA	NA	NA	NA	
Crohn's disease	555	NA	NA	NA	NA	
Ulcerative colitis	556	NA	NA	NA	NA	
Fire injury	E890-E899	NA	NA	NA	NA	

The second set of relative risks was abstracted from a comprehensive review of determinants of health prepared by the Australian Government, which contained systematic meta-analyses of health effects of tobacco smoking (English et al., 1995). These relative risks are listed in Table Methods-4: with a few exceptions, there was differentiation between risks for ex-smokers and current smokers, but relative risks were not sex-specific. The categories of diseases did not fully overlap between the two sets of relative risks, but the main tobacco-related causes of death were included in both.

Table Methods-4: Relative Risks from English et al. (1995)

Cause of death	**ICD9 codes**	**English et al., 1995**		**Comments**
		Former smokers	Current smokers	
Lip, oral and pharyngeal cancer	140-149	1.76	4.55	RRs for codes: 140-141, 143-149
Esophageal cancer	150	1.79	4.01	
Stomach cancer	151	1.11	1.41	
Liver cancer	155	1.07	1.71	
Pancreatic cancer	157	1.15	1.86	
Laryngeal cancer	161	2.86	7.48	
Lung cancer - men	162	6.75	13.0	
Lung cancer – women	162	5.07	11.4	
Cervical cancer	180	1.31	1.75	RRs for codes: 180, 233.1
Bladder cancer	188	1.66	2.72	
Kidney, other urinary cancer	189	1.61	1.64	Renal parenchymal carcinoma - 189.0
Leukemia	204-208	1.21	1.01	
Parkinson disease	332	0.57	0.57	
Ischaemic heart disease <65	410-414	1.45	3.06	
Ischaemic heart disease-m. 65+	410-414	0.93	1.67	

Ischaemic heart disease-w. 65+	410-414	1.22	1.67	
Other heart diseases	390-398, 415-417, 420-429	NA	NA	
Cerebrovascular disease <65	430-438	1.30	3.12	
Cerebrovascular disease 65+	430-438	1.15	1.65	
Atherosclerosis	440	NA	NA	
Other arterial diseases	441-448	NA	NA	
Atherosclerosis and other arterial diseases	440-448	1.82	2.54	
Pneumonia	480-487	1.29	1.47	
Bronchitis, emphysema	490-492	NA	NA	
Chronic airways obstruction	496	NA	NA	
COPD	490-492, 496	6.70	9.80	
Peptic ulcer	531-534	2.24	2.07	
Crohn's disease - men	555	1.92	1.92	
Crohn's disease - women	555	1.60	3.27	
Ulcerative colitis	556	1.71	0.63	
Fire injury	E890-E899	NA	NA	TAF = 23%

The smoking-attributable mortality fractions were calculated by combining relative risks and exposure prevalence (see below; for a summary of RR used for the tracer diagnoses only see Appendix 2).

Indirect approaches based on lung cancer mortality

In addition to the direct epidemiological method described here, a third method was used, which is usually labelled "indirect" method or Peto-method (first described in Peto et al., 1992). Basically, this method stipulates, that all smoking-related mortality burden is based on the comparison of lung cancer mortality rates from the smoking-affected society under consideration (in our case Switzerland) with lung cancer mortality rates of a societal group not at al affected by smoking (a historical cohort of females in the US), deriving a so-called Smoking Impact Ratio. In basing all estimates on lung cancer mortality as an indirect

measure of exposure, the Peto-method is able to capture a cumulative effect of exposure rather basing all calculations on a one shot cross-sectional picture of exposure.

Effects of environmental tobacco smoke (ETS)

The causal role of passive smoking for many diseases is still controversial. Thus, this analysis adopted a conservative approach and included only two diseases for which the evidence converges, which were the same as our tracer diagnoses: lung cancer and IHD. Passive smoking-attributable mortality and morbidity traditionally would be derived by combining Relative Risks (RR) for passive smoking for lung cancer and ischaemic heart disease (IHD) with the age- and sex-specific prevalence rates of the population of Swiss who have never smoked, but are exposed to environmental tobacco smoke (ETS) from spouses and other sources inside the home. However, the latter proportion was not known. Thus, we took the proportion of deaths from passive smoking to all other tobacco-related deaths from the Canadian cost study (Rehm et al., 2006), and applied this ratio to the Swiss results.

The Canadian study used the following assumptions: passive smoking-attributable mortality (PSAM) was derived by combining age- and sex-specific RRs for lung cancer and IHD and the respective prevalence rates for Canada. RR estimates were obtained from the most comprehensive meta-analyses: Taylor and colleagues (Taylor et al., 2001) derived a RR estimate of 1.21 for ETS for lung cancer; de Groh and Morrison (de Groh & Morrison, 2002); see also (Heloma & Jaakkola, 2003) used a RR estimate of 1.24 for IHD. Both estimates are consistent with the results of other meta-analyses. Zhong and colleagues (Zhong et al., 2000) cited a RR estimate of 1.2 for lung cancer from a meta-analysis of 35 case-control

and 5 cohort studies. The RR associated with exposure to environmental tobacco smoke for IHD was estimated from two recent meta-analyses. Thun and colleagues (Thun et al., 1999) noted RRs of 1.24 for males and 1.23 for females exposed to passive smoking, while He and colleagues (He et al., 1999) estimated a RR of 1.25 for both sexes. For reasons of comparability and conservatism, Baliunas and the team of the Canadian study (Baliunas et al., in press) used an RR estimate of 1.21 for lung cancer and an RR estimate of 1.24 for IHD.

Based on these assumptions the following proportions between active and passive smoking-attributable deaths could be found (Table Methods-5).

Table Methods-5: Proportions between active and passive smoking-attributable deaths in Canada 2002

	Men	Women	Total
Total smoking-attributable deaths	23,766	13,443	37,209
Total smoking-attributable deaths due to ETS	507	324	831
ETS/total deaths without ETS	2.2%	2.5%	2.3%
Smoking-attributable lung cancer deaths	9,028	4,373	13,401
Smoking-attributable lung cancer deaths due to ETS	157	95	252
ETS/total deaths without ETS (lung cancer)	1.8%	2.2%	1.9%
Smoking-attributable IHD deaths	3,837	1,506	5,343
Smoking-attributable IHD deaths due to ETS	350	228	578
ETS/total deaths without ETS (IHD)	10.0%	17.8%	12.1%

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Assumptions on natural course of smoking

For some of the epidemiological and economic calculations, current prevalence rates were not sufficient information, but additional information about the natural change of exposure was needed (i.e. when effectiveness of an intervention was given as an Odds Ratio compared to placebo or natural course). In other words, we needed information about natural change for a society like Switzerland, where the political climate increasingly highlights the risk of tobacco exposure on health, both for the smoker and for second parties (i.e. the risks of second hand or environmental tobacco smoke).

To perform these calculations, we first considered the comparison between the Swiss Health Surveys 1997 and 2002. Overall, regular smoking prevalence rates decreased during this time period by 3.8 percentage points for males and by 2.3 percentage points for females (analysis by Swiss Health Observatory: www.obsan.ch/monitoring/statistiken/3-2-1/2002/d/321.pdf).

Clearly, the comparison between 1997 and 2002 only reflects a trend of net prevalence rates, i.e. the net of the total of successful quitting efforts and the total of incidence of smoking plus the demographic changes. Moreover, it is a rough approximation, as respondents were surveyed at a specific point in time, whereas smoking behaviour is a variable behaviour with the possibility of several status changes within one year even (e.g. several quitting attempts with only the last one being successful).

Most importantly, however, the change in Switzerland between 1997 and 2002 may not reflect future changes. At least in the first years after 1997, tobacco smoking in Switzerland was still considerably more accepted compared to North America or Australia. It was also much more accepted behaviour then than it is now in Switzerland. Thus natural course

assumptions in an unfavourable socio-cultural climate had to assume higher net rates of quitting than those realized between 1997 and 2002.

As a consequence, in order to model smoking behaviour in a society with a socio-political climate exerting pressure towards reducing smoking rates, we assumed a scenario based on the literature as informed by trends observed in regions of North America and Australia featuring intense efforts to reduce tobacco related harm plus the experiences of Switzerland (e.g. www.sfa-ispa.ch ; Tillgren et al., 1995; Bondy et al., 2000). These scenarios were based on (see also Rehm et al., 2004b):

- yearly quitting rates of 10%;
- the assumption that 80% of smokers wanted to quit,
- the assumption of an annual smoking initiation rate of 3% of the never smokers in the age groups between 15 and 44 years of age. No initiation was assumed for the older age groups.

Results

Exposure

Exposure was taken from the Swiss Health Survey (S6B) 2002. Details of this survey can be obtained from the website of the Swiss Federal Office of Statistics (www.bfs.admin.ch and www.statistik.admin.ch./stat-ch/ber14/dtfr14-s.htm).

Table Results-1 and Figure-Results 1 give an overview of exposure to smoking by sex and age, Appendix 3 has more details.

Table Results-1: Smoking categories in Switzerland 2002

Smoking categories*		Overall (All ages)	15-19 years	20-44 years	45-64 years	65+ years
Never smokers	**Women**	62.2%	70.3%	57.9%	56.4%	76.3%
	Male	48.1%	68.5%	52.8%	38.8%	42.3%
Former smokers	**Women**	16.2%	4.4%	14.3%	21.9%	15.7%
	Male	23.9%	4.5%	13.5%	34.1%	42.9%
Current smokers	**Women**	21.6%	25.4%	27.8%	21.7%	8.0%
	Male	28.1%	27.0%	33.7%	27.2%	14.8%
Total	**Women**	**100%**	**100%**	**100%**	**100%**	**100%**
	Male	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Swiss Health Survey 2002, calculations by G.Gmel

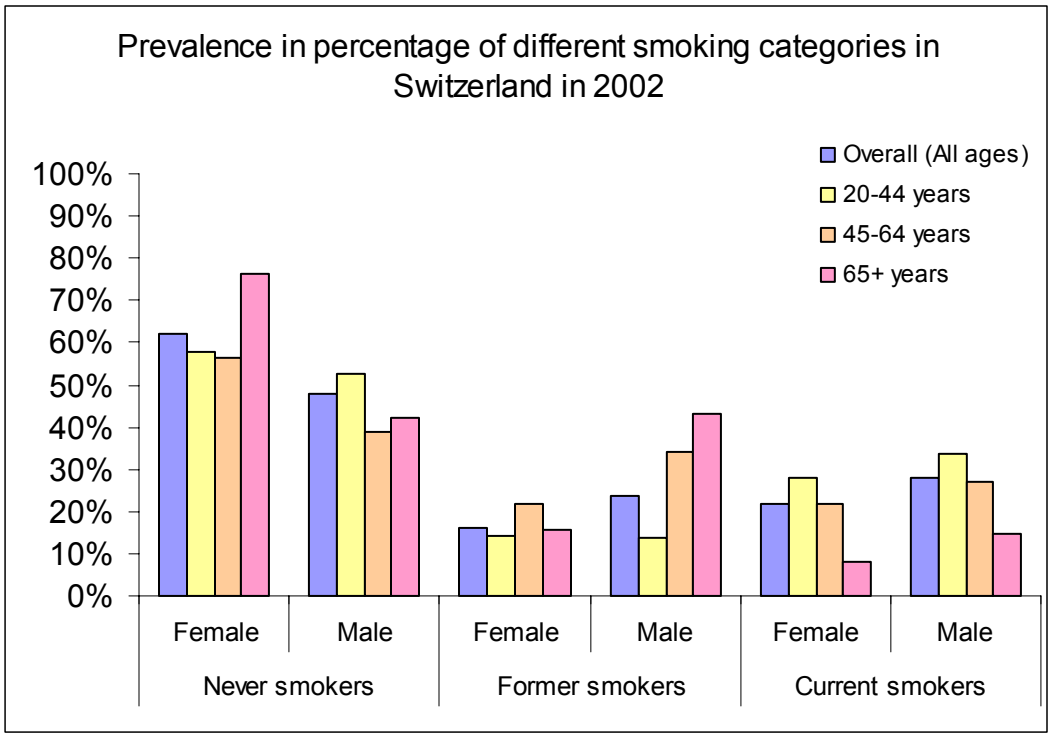
Notes: Cigars (=5), cigarillos (=2.5), and pipes (=2.5) were converted into cigarette.

Table includes smokers of other tobacco products, not only cigarette smokers.

Smokers of less than 1 (converted cigarette) a day on average were coded as never smokers.

Current smokers are those with 1 or more converted cigarettes per day on average; includes potential chippers who smoke only weekends but more than 6 cigarettes (converted) a week

Figure Results-1: Prevalence of different smoking categories by age and sex in Switzerland 2002



Source: Swiss Health Survey 2002, calculations by G.Gmel

Smoking-attributable mortality and burden of disease in Switzerland 2002

Direct estimates of mortality based on English et al. (1995) Relative Risk information

Table Results-2 gives an overview of smoking-attributable deaths in Switzerland for the year 2002 based on the RR of (English et al., 1995), without accounting for environmental tobacco smoke. Overall, 3224 male and 1482 female deaths in this year are estimated to be smoking-attributable according to this method.

Table Results-2: Smoking-attributable deaths in Switzerland 2002 – direct estimates based on English et al. (1995) RR information

Males	20-44	45-64	20-64	65+	Total 20+
Tobacco-related deaths	85	1,141	1,227	2,968	4,194
All deaths from all causes	1,498	5,094	6,592	22,750	29,342
Percentage	**5.70%**	**22.40%**	**18.61%**	**13.04%**	**14.29%**

Women	20-44	45-64	20-64	65+	Total 20+
Tobacco-related deaths	36	402	438	1,404	1,843
All deaths from all causes	734	2,906	3,640	28,137	31,777
Percentage	**4.95%**	**13.83%**	**12.04%**	**4.99%**	**5.80%**

Malignant neoplasms

Males	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from malignant neoplasms	35	709	743	1,462	2,205
(b) All deaths from malignant neoplasms	175	1,995	2,170	6,165	8,335
Percentage (a)/(b)	**19.81%**	**35.53%**	**34.26%**	**23.71%**	**26.46%**
(c) All deaths from all causes	1,498	5,094	6,592	22,750	29,342
Percentage (a)/(c)	**2.31%**	**13.91%**	**11.28%**	**6.43%**	**7.52%**

Women	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from malignant neoplasms	23	270	293	416	709
(b) All deaths from malignant neoplasms	223	1,586	1,809	5,032	6,841
Percentage (a)/(b)	**10.31%**	**17.02%**	**16.19%**	**8.26%**	**10.36%**
(c) All deaths from all causes	734	2,906	3,640	28,137	31,777
Percentage (a)/(c)	**3.13%**	**9.29%**	**8.05%**	**1.48%**	**2.23%**

Cardiovascular diseases

Males	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from cardiovascular diseases	43	331	374	488	862
(b) All deaths from cardiovascular diseases	182	1,209	1,391	9,025	10,416
Percentage (a)/(b)	**23.64%**	**27.35%**	**26.87%**	**5.41%**	**8.28%**
(c) All deaths from all causes	1,498	5,094	6,592	22,750	29,342
Percentage (a)/(c)	**2.87%**	**6.49%**	**5.67%**	**2.15%**	**2.94%**

Women	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from cardiovascular diseases	12	85	97	578	675
(b) All deaths from cardiovascular diseases	63	408	471	12,836	13,307
Percentage (a)/(b)	**18.48%**	**20.93%**	**20.60%**	**4.50%**	**5.07%**
(c) All deaths from all causes	734	2,906	3,640	28,137	31,777
Percentage (a)/(c)	**1.59%**	**2.94%**	**2.67%**	**2.05%**	**2.12%**

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Direct estimates of mortality based on CPS II Relative Risk information

Table Results-3 gives an overview of smoking-attributable deaths in Switzerland for the year 2002 based on the RR of CPS II, again without accounting for environmental tobacco smoke. Overall, 4308 male and 1663 female deaths in the year 2002 are estimated to be smoking-attributable.

Table Results-3: Smoking-attributable deaths in Switzerland 2002 – direct estimates based on CPS II RR information

Males	20-44	45-64	20-64	65+	Total 20+
Tobacco-related deaths	111	1,312	1,422	3,917	5,339
All deaths from all causes	1498	5,094	6,592	22,750	29,342
Percentage	**7.38%**	**25.75%**	**21.58%**	**17.22%**	**18.20%**

Women	20-44	45-64	20-64	65+	Total 20+
Tobacco-related deaths	43	437	480	1,586	2,066
All deaths from all causes	734	2,906	3,640	28,137	31,777
Percentage	**5.80%**	**15.04%**	**13.18%**	**5.64%**	**6.50%**

Malignant neoplasms

Males	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from malignant neoplasms	45	821	866	1,698	25,65
(b) All deaths from malignant neoplasms	175	1,995	2,170	6,165	8,335
Percentage (a)/(b)	**25.58%**	**41.17%**	**39.92%**	**27.55%**	**30.77%**
(c) All deaths from all causes	1,498	5,094	6,592	22,750	29,342
Percentage (a)/(c)	**2.99%**	**16.13%**	**13.14%**	**7.47%**	**8.74%**

Women	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from malignant neoplasms	25	286	311	469	779
(b) All deaths from malignant neoplasms	223	1,586	1,809	5,032	6,841
Percentage (a)/(b)	**11.00%**	**18.04%**	**17.17%**	**9.31%**	**11.39%**
(c) All deaths from all causes	734	2906	3640	28137	31777
Percentage (a)/(c)	**3.34%**	**9.84%**	**8.53%**	**1.67%**	**2.45%**

Cardiovascular diseases

Males	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from cardiovascular diseases	58	388	447	1,126	1,573
(b) All deaths from cardiovascular diseases	182	1,209	1,391	9,025	10,416
Percentage (a)/(b)	**32.10%**	**32.13%**	**32.13%**	**12.48%**	**15.10%**
(c) All deaths from all causes	1,498	5,094	6,592	22,750	29,342
Percentage (a)/(c)	**3.90%**	**7.63%**	**6.78%**	**4.95%**	**5.36%**

Women	20-44	45-64	20-64	65+	Total 20+
(a) Tobacco-related deaths from cardiovascular diseases	16	104	119	664	783
(b) All deaths from cardiovascular diseases	63	408	471	12,836	13,307
Percentage (a)/(b)	**25.06%**	**25.40%**	**25.35%**	**5.17%**	**5.89%**
(c) All deaths from all causes	734	2,906	3,640	28,137	31,777
Percentage (a)/(c)	**2.15%**	**3.57%**	**3.28%**	**2.36%**	**2.46%**

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Comparison of direct mortality estimates based on different RRs

In the following graphs, both methods are compared with respect to their results. Overall, the CPS II method gives higher smoking-attributable deaths, especially for men (see Figure Results-2).

Figure Results-2: Comparison of smoking-attributable deaths in Switzerland 2002 – based on English et al., 1995 versus CPS II-RR information

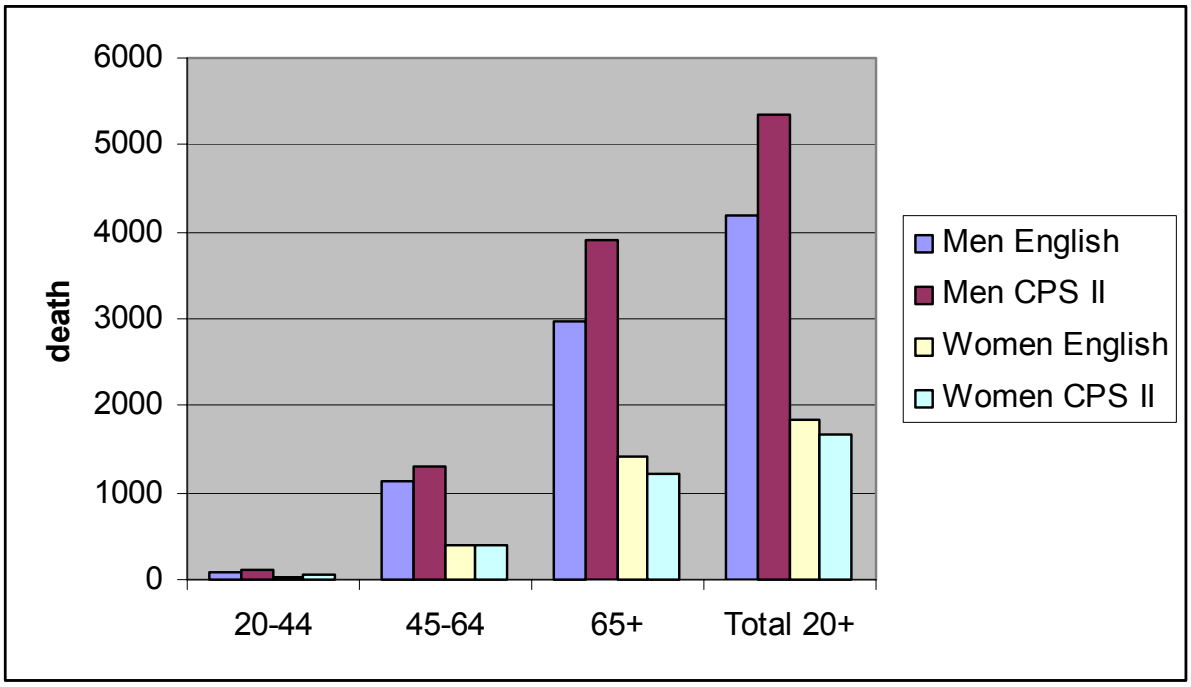
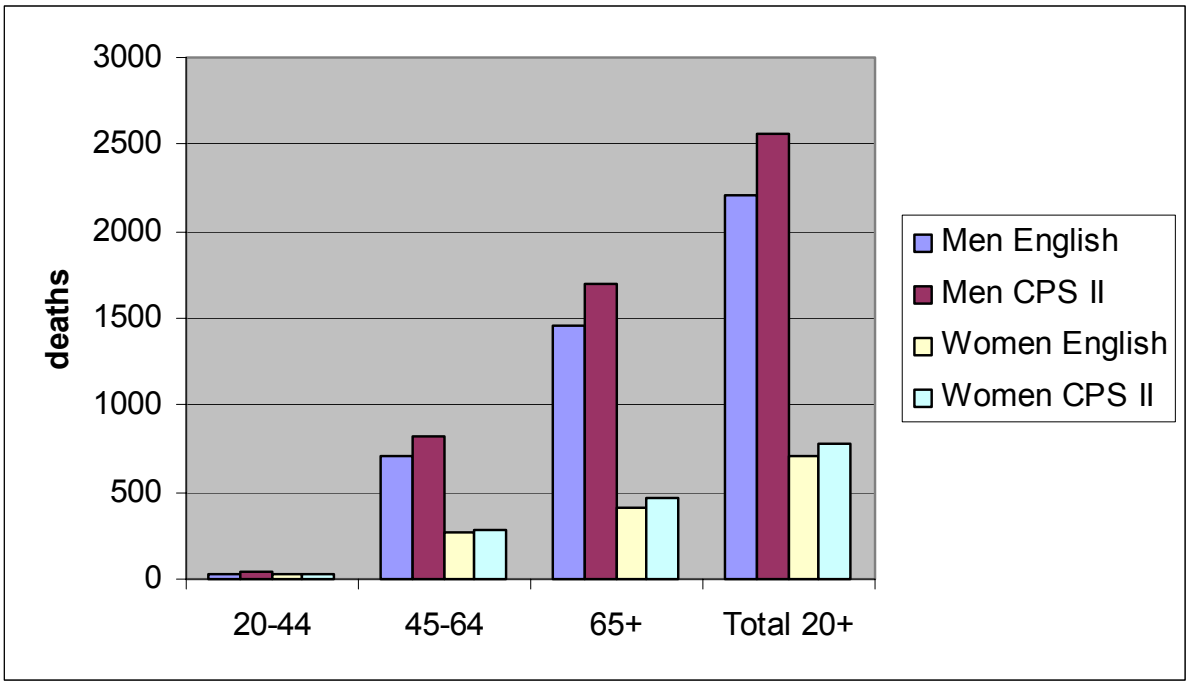


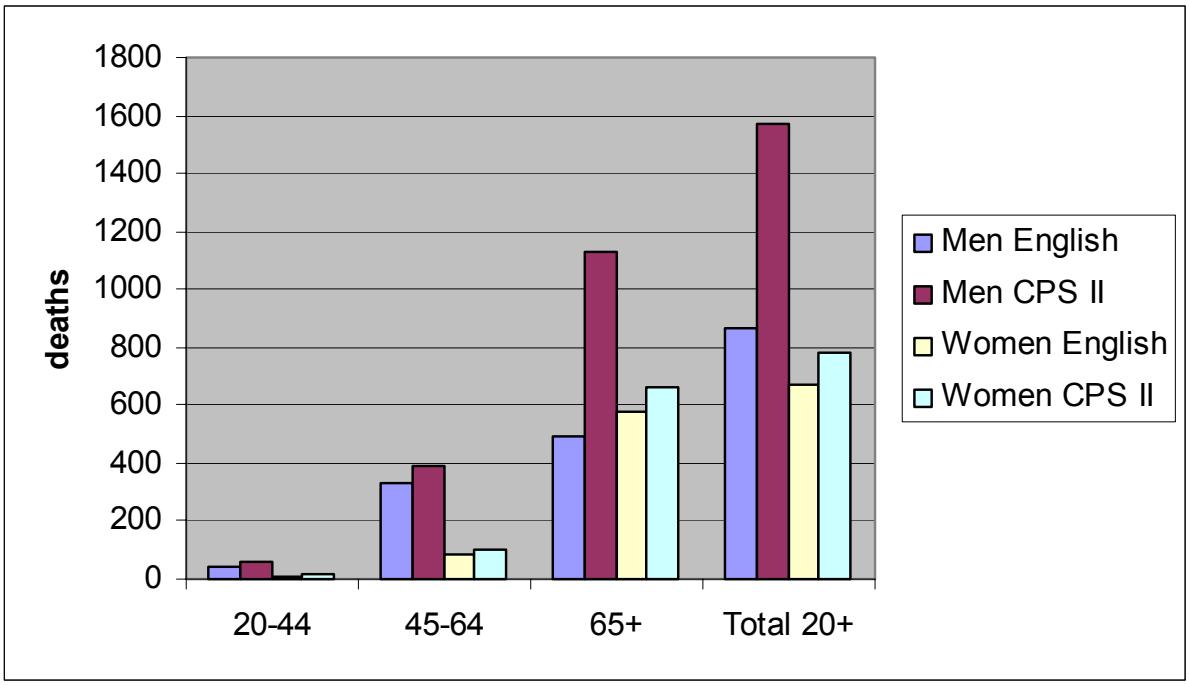
Figure Results-3: Comparison of smoking-attributable deaths of malignant neoplasms in Switzerland 2002 – (English et al., 1995) versus CPS II RR information



These differences are about the same for smoking-related neoplasms (see Figure Results-3), where the estimates of both methods are relatively close to each other, but the CPS II method was on average about 15% higher than the English et al. (1995) estimate.

For the second largest disease category, cardiovascular disease, there are significant differences (overall more than 50% greater for CPS II), mainly in the oldest age group. This difference is based to a large degree on a residual category of “other heart disease”, i.e. not in the two main categories of IHD and cerebrovascular disease.

Figure Results-4: Comparison of smoking-attributable cardiovascular deaths in Switzerland 2002 – English et al. (1995) versus CPS II RR information

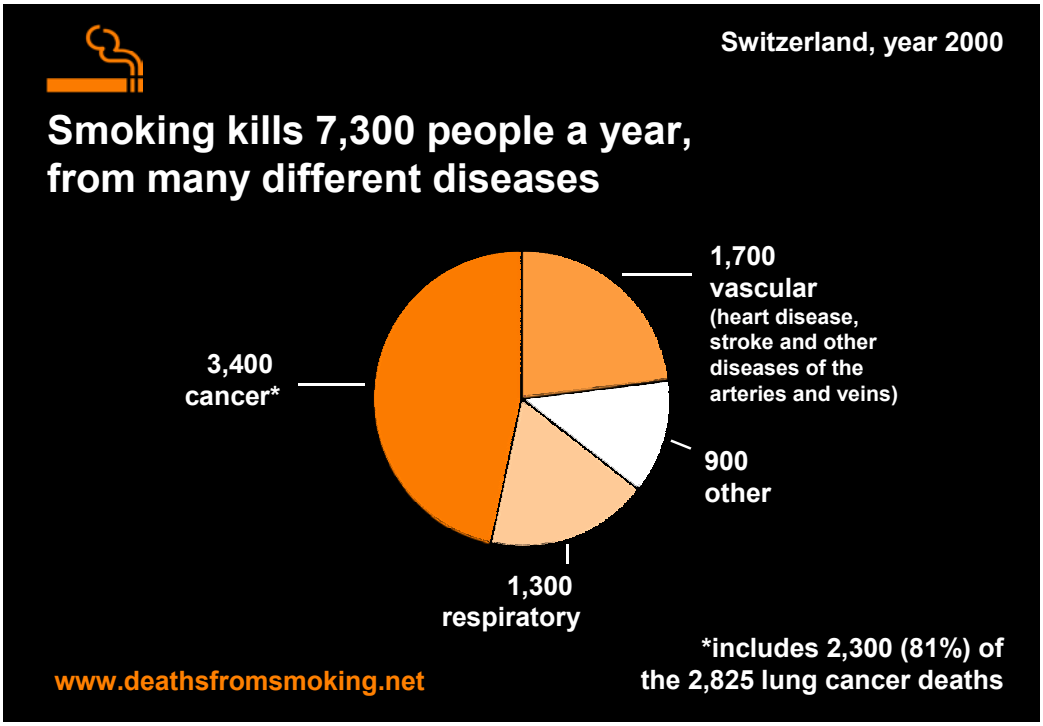


Given both estimates and the results of the comparison, we decided to use the more conservative methods of direct estimation, as it was based on a range of studies in different countries, thereby reducing potential biases. Also, it did not include residual categories such as “other heart disease”.

Indirect estimates of mortality

Based on the indirect method of Peto described above, 7,300 people were estimated to be killed in 2000 (the closest year where data with estimates from the Peto method are available). As expected in a country where the smoking rate has been declining, this method, which is based on cumulative exposure, yielded higher smoking-attributable mortality (see Figure Results-5).

Figure Results-5: Smoking-attributable mortality based on indirect method (Peto et al., 1992; Peto et al., 2006)



Tracer diagnoses

The two tracer diagnoses of IHD and lung cancer made up the majority of smoking-attributable deaths. Using (English et al., 1995) RR, we estimated that about half of the overall smoking-attributable mortality was accounted for by these two diagnoses alone, and in proportions that were approximately equal for both sexes (51.7% of smoking-attributable deaths in men, 52.7% in women, and 52.07% overall; see overview Table Results-4). Thus, the use of these two diagnoses as tracer diagnoses was valid.

Table Results-4: Smoking-attributable IHD and lung cancer deaths in Switzerland 2002 – direct estimates based on (English et al., 1995)

Cause of death	ICD10 MTL 1 codes	Smoking-attributable fraction		Smoking-attributable deaths								
		Overall (all ages)		20-44 Yrs		45-64 Yrs		65+ Yrs		Total		
		M	W	M	W	M	W	M	W	M	W	M & W
Lung cancer	1,034	81.8%	65.8%	17	16	462	207	1,102	286	1,581	510	2,091
Ischaemic heart disease	1,067	11.9%	9.0%	30	5	284	55	271	401	585	461	1,046

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Estimating all smoking-attributable deaths including the effects of environmental tobacco smoke (ETS)

So far, for direct methods we have only considered the effects of smoking for the smokers themselves. In the following, we will estimate the effects of environmental tobacco smoke in order to estimate the total number of smoking-attributable deaths. In order to do so, we would need the prevalence rates of people exposed to smoke and the respective relative risks for this. However, in the Swiss Health Survey, these rates were not available. As an alternative, we used the ratio of deaths from indirect exposure (=ETS) vs. direct exposure in Canada (Rehm et al., 2006; Baliunas et al., in press). These numbers are based on the Canadian rates of exposure to environmental tobacco smoke, and the Relative Risks for this exposure, as derived from meta-analyses (de Groh & Morrison, 2002; He et al., 1999; Taylor et al., 2001; Zhong et al., 2000; further details see above).

Using these assumptions, the following numbers of smoking-attributable deaths for Switzerland could be estimated (see Results Table-5).

Table Results-5: Estimates of smoking-attributable deaths in Switzerland 2002 including ETS

	Men	Women	Total	% of all deaths
Total smoking-attributable deaths from own smoking (English et al., 1995 – direct method)	4,194	1,843	6,037	9.9%
Total smoking-attributable deaths from own smoking (CPS II – indirect method)	5,339	1,663	7,002	11.5%
ETS/total deaths without ETS (from Canada)	2.2%	2.5%	2.3%	
ETS (English et al., 1995 – direct method)	91	46	138	0.2%
ETS (CPS II – direct method)	116	41	160	0.3%
Total smoking-attributable deaths (English et al., 1995) direct method	4,286	1,888	6,175	10.1%
Total smoking-attributable deaths (CPS II – direct method)	5,455	1,704	7,162	11.8%
Total smoking-attributable deaths (Peto et al., 1992; Peto et al., 2006) – indirect method	**5,600**	**1,800**	**7,300**	**12.0%**

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals); the numbers of Peto et al. (2006) are based on the year 2000, and were given in 100 in the original publication.

The main results shows that between 6,175 and 7,300 smoking-attributable deaths could be estimated form Switzerland for 2002. This corresponds to a rate between 10% and 12% of all of the deaths in Switzerland in this year.

Smoking-attributable years of life lost (YLLs)

Based on the methods of the CRA described above (see also Ezzati et al., 2002; Ezzati et al., 2004; Rehm & Frick, 2004), the smoking-attributable years of life lost (YLLs) for the year 2002 were calculated (see Table Results-6). These YLLs were estimated based on the most conservative estimate with the underlying RR from English and colleagues (English et al., 1995).

Table Results-6: Smoking-attributable YLLs in Switzerland 2002

Diagnosis	Gender	Total	% of all YLLs	Total including ETS	% of all YLLs
Lung cancer	M	11,812	82.7%	12,069	84.5%
	W	4,684	71.5%	4,800	73.3%
	Total	16,496	79.2%	16,869	81.0%
IHD	M	6,108	20.7%	6,241	21.2%
	W	2,486	15.4%	2,547	15.8%
	Total	8,594	18.8%	8,788	19.3%
All cause	M	31,471	15.2%	32,157	15.5%
	W	11,431	7.9%	11,714	8.1%
	Total	42,902	12.2%	43,871	12.5%

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Overall, over 40 thousand YLLs were caused by smoking in 2002 in Switzerland, corresponding to about 12.5% of all of the YLLs in this time period.

Smoking-attributable burden of disease

The smoking-attributable burden of disease from the same year is summarized in Table Results-7. Overall, slightly less than 60 thousand DALYs were caused by tobacco. This corresponds to 7.6% of the total burden of disease in Switzerland, indicating that smoking-related categories of disease are quite lethal rather than disabling.

Table Results-7: Burden of disease (DALYs) estimates of smoking-attributable in Switzerland 2002

Diagnosis	Gender	Total	%of all DALYs	Total including ETS	%of all DALYs
Lung cancer	M	12,211	82.7%	12,477	84.5%
	W	4,843	71.6%	4,963	73.4%
	Total	17,054	79.2%	17,440	81.0%
IHD	M	7,210	22.4%	7,367	22.9%
	W	2,938	16.8%	3,011	17.2%
	Total	10,148	20.4%	10,378	20.9%
All cause	M	41,439	9.8%	42,342	10.1%
	W	17,834	4.7%	18,274	4.8%
	Total	59,273	7.4%	60,617	7.6%

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)

Effectiveness of tobacco control interventions

Underlying data

The following Table Results-8 gives a summary of the effectiveness of the selected interventions.

Table Results-8: Interventions and their effectiveness

Type of intervention	Effect	Reference
Public policy interventions		
Taxation and price increases	2% prevalence reduction in smokers associated with 10% increase in price, based on meta-analysis for high income countries.	(Ranson et al., 2000)
Interventions for preventing tobacco smoking in public places	Effective policy as demonstrated by reduction of smoking in public places. However, the overall impact on prevalence of smoking is not clear.	(Serra et al., 2000)
Workplace interventions for smoking cessation.	Lack of evidence that comprehensive workplace programs reduced the prevalence of smoking. All effects were based on known effects of individual therapy and counselling, which are modeled separately here.	(Moher et al., 2003)
Interventions focusing on individual behavioural change (counselling, brief advice, therapy)		
Individual behavioural counselling for smoking cessation (non-medical)	Cessation ratio of 1.56 (95% CI: 1.32 – 1.84) compared to controls without intervention	(Lancaster & Stead, 2005) Individual behavioural counselling for smoking cessation.
Nicotine replacement therapy for smoking cessation	Cessation ratio of 1.77 (95% CI: 1.66 – 1.88) compared to controls without intervention; modeled here with and without medical advice.	(Silagy et al., 2004)
Physician advice for smoking cessation	Cessation ratio of 1.74 (95% CI: 1.48 – 2.05) compared to controls without intervention	(Lancaster & Stead, 2004)

Effectiveness with respect to prevalence rates

Table Results-9 translates these effects into the common metric of smoking prevalence in the Swiss adult population (operationalized as all inhabitants 15 years and older). More details can be found in Appendix 4.

Table Results-9: Interventions and their impact on number of smokers

	Overall (all ages >15)		Population affected		Change to baseline in reduction of numbers of smokers		
	M	W	M	W	M	W	Total
Population in thousand	2860.332	3108.618					
Natural course plus quitters plus new beginners = baseline scenario							
Current smokers	26.77%	20.79%	765.784	646.269	0	0	0
Taxation							
Current smokers	26.24%	20.37%	750.468	633.344	-15.316	-12.925	-28.241
Smoking ban at public places							
Current smokers	26.50%	20.58%	758.126	639.807	-7.658	-6.463	-14.121
Comprehensive workplace program in addition to individual measures							
Current smokers	26.77%	20.79%	765.784	646.269	0	0	0
Individual behavioural counselling (assuming 40% coverage*)							
Current smokers	26.14%	20.30%	747.745	631.194	-18.039	-15.076	-33.115
NRT (assuming 40% coverage*)							
Current smokers	25.91%	20.12%	740.980	625.541	-24.804	-20.729	-45.533
Physician's advice (assuming 40% coverage*)							
Current smokers	25.94%	20.15%	741.947	626.348	-23.837	-19.921	-43.759
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage*)							
Current smokers	25.16%	19.54%	719.688	607.558	-46.096	-38.712	-84.807

* All coverage rates are based on the overall population willing to quit (80%)

The results show that based on the situation in 2002 more than 80,000 smokers in Switzerland would quit smoking, if three interventions could be implemented:

- an increase in taxation resulting in a price increase of 10%;
- wider availability and application of nicotine replacement therapy;
- a ban of smoking in public places.

Effectiveness with respect to health outcomes

The next Tables show the effectiveness of interventions on health outcomes (Table Results-10 for all-cause smoking-attributable mortality, Table Results-11 for the two tracer diagnosis; see also Appendix 5 for details).

Table Results-10: Interventions and their impact on smoking-attributable deaths (all cause), 15+ years in Switzerland, 2002

All cause mortality	Men	Women	Total
Natural course plus quitters plus new beginners = baseline scenario	4,119	1,808	5,927

Various Intervention Scenarios				Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Taxation change to result in price increases of 10%	4,105	1,794	5,900	13	13	27	14	14	27
Smoking ban at public places	4,111	1,802	5,914	7	5	13	8	6	13
Comprehensive workplace program in addition to individual measures	4,119	1,808	5,927	0	0	0	0	0	0
Individual behavioural counselling (assuming 40% coverage based on those willing to quit)	4,099	1,796	5,896	19	11	31	20	12	31
NRT (assuming 40% coverage based on those willing to quit)	4,093	1,788	5,881	26	19	45	27	20	46
Physician's advice (assuming 40% coverage based on those willing to quit)	4,093	1,788	5,881	26	19	46	27	20	47
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)	4,067	1,776	5,844	52	31	83	53	32	85

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)
All scenarios are based on the prevalence figures displayed in Table Results-9.

Table Results-11: Interventions and their impact on smoking-attributable IHD and lung cancer deaths, 15+ years in Switzerland, 2002

Ischaemic Heart Disease (IHD)	Men	Women	Total	Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Natural course plus quitters plus new beginners = baseline scenario	543	447	991						
Various Intervention Scenarios									
Taxation change to result in price increases of 10%	535	442	977	8	5	13	9	6	15
Smoking ban at public places	539	445	984	4	2	6	4	3	7
Comprehensive workplace program in addition to individual measures	543	447	991	0	0	0	0	0	0
Individual behavioural counselling (assuming 40% coverage based on those willing to quit)	533	443	975	11	4	15	12	5	17
NRT (assuming 40% coverage based on those willing to quit)	529	440	969	15	7	22	16	9	25
Physician's advice (assuming 40% coverage based on those willing to quit)	529	440	969	15	7	22	16	9	25
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)	515	435	950	29	12	41	32	14	46

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)
All scenarios are based on the prevalence figures displayed in Table Results-9.

Table Results-11 cont:

Lung cancer	Men	Women	Total
Natural course plus quitters plus new beginners = baseline scenario	1,575	505	2,080

Various Intervention Scenarios				Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Taxation change to result in price increases of 10%	1,575	503	2,078	1	2	3	1	2	3
Smoking ban at public places	1,575	504	2,079	1	1	1	1	1	1
Comprehensive workplace program in addition to individual measures	1,575	505	2,080	0	0	0	0	0	0
Individual behavioural counselling (assuming 40% coverage based on those willing to quit)	1,574	503	2,077	1	2	3	1	2	3
NRT (assuming 40% coverage based on those willing to quit)	1,573	502	2,076	2	3	5	2	3	5
Physician's advice (assuming 40% coverage based on those willing to quit)	1,573	502	2,076	2	3	5	2	3	5
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)	1,571	501	2,072	4	4	8	4	5	8

Numbers may not add up because of rounding (all numbers are based on attributable fractions and thus have decimals)
All scenarios are based on the prevalence figures displayed in Table Results-9.

The different calculations show, that progress can be made with respect to reducing prevalence of smoking and subsequently with reducing smoking-attributable mortality. However, the burden will be continue to be substantial even after implementing more than one of the chosen interventions. Thus even if Switzerland increases taxation to result in a 10% price increase plus installs a ban of smoking in public places plus implements NRT for 40% of those wishing to quit, the overall smoking prevalence would still be around 20%, and less than 100 deaths would be saved annually, a large part in IHD. And given the long latency period between smoking and smoking-related mortality, many of the consequences of the high smoking rates of the immediate past and today will only be seen in decades from now. Thus, more drastic measures may be considered to reduce prevalence rates earlier. The following sensitivity analyses will look at the potential consequences of such more drastic strategies.

Sensitivity analysis with more marked taxation increases

Tables Results-12 and 13 show the impact of two more marked taxation changes, resulting in a 50% respectively 100% increase of price for cigarettes, both for smoking prevalence rates (Table Results-12) and health outcome (Table Results-13). Clearly these drastic taxation changes would result in more pronounced changes. For instance, a 100% increase of price would result in 20% reduction of smoking prevalence and 272 deaths saved per year (see Table Results 13).

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Table Results-12: More marked taxation increases and their impact on smoking-attributable prevalence

Sensitivity scenario1: taxation to increase price by 50%												
	All ages >15		**0-14 Yrs**		**15-19 Yrs**		**20-44 Yrs**		**45-64 Yrs**		**65+ Yrs**	
	M	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	28.89%	20.02%	0.0%	0.0%	9.4%	8.9%	19.5%	19.2%	38.7%	25.6%	45.5%	17.0%
Current smokers	24.10%	18.71%	0.0%	0.0%	24.2%	22.9%	29.3%	24.6%	22.5%	18.0%	12.3%	6.6%
Total	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Change of smoking prevalence to baseline	-2.68%	-2.08%	0.00%	0.00%	-2.69%	-2.54%	-3.26%	-2.73%	-2.50%	-2.00%	-1.36%	-0.74%
Sensitivity scenario2: taxation to increase price by 100%												
	All ages >15		**0-14 Yrs**		**15-19 Yrs**		**20-44 Yrs**		**45-64 Yrs**		**65+ Yrs**	
	M	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	31.57%	22.10%	0.0%	0.0%	12.0%	11.5%	22.8%	22.0%	41.2%	27.6%	46.8%	17.8%
Current smokers	21.42%	16.63%	0.0%	0.0%	21.5%	20.3%	26.1%	21.9%	20.0%	16.0%	10.9%	5.9%
Total	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Change of smoking prevalence to baseline	-5.35%	-4.16%	0.00%	0.00%	-5.39%	-5.09%	-6.52%	-5.46%	-5.00%	-3.99%	-2.73%	-1.48%

Table Results-13: More marked taxation increases and their impact on health outcomes

All cause	Men	Women	Total						
Natural course plus quitters plus new beginners = baseline scenario	4,119	1,808	5,927						
Tax Related Intervention Scenarios				Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Taxation change to result in price increases of 50%	4,033	1,763	5,796	86	44	131	88	45	133
Taxation change to result in price increases of 100%	3,942	1,719	5,661	177	88	265	181	91	272
Ischaemic Heart Disease (IHD)	**Men**	**Women**	**Total**						
Natural course plus quitters plus new beginners = baseline scenario	543	447	991						
Tax Related Intervention Scenarios				Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Taxation change to result in price increases of 50%	495	430	926	48	17	65	53	20	73
Taxation change to result in price increases of 100%	445	414	859	99	34	132	108	40	148
Lung cancer	**Men**	**Women**	**Total**						
Natural course plus quitters plus new beginners = baseline scenario	1,575	505	2,080						
Tax Related Intervention Scenarios				Smoking-attributable deaths saved			Smoking-attributable deaths saved including ETS		
				Men	Women	Total	Men	Women	Total
Taxation change to result in price increases of 50%	1,569	499	2,067	7	6	13	7	7	13
Taxation change to result in price increases of 100%	1,562	492	2,054	14	13	27	14	13	27

Cost-effectiveness of tobacco control interventions

Table Results-14 summarizes the main results of this study with respect to effectiveness and cost-effectiveness of the interventions analysed.

Table Results-14: Summary table on effectiveness, costs and cost-effectiveness of different interventions for reducing smoking-attributable harm

Various intervention scenarios for tobacco control	Effectiveness		Costs*	Cost-effectiveness	
	% of smokers reduced	Deaths saved	in CHF	Cost per 1% reduction of smokers	Cost per avoided death
Taxation change to result in price increases of 10%	-2.0%	27	2,791,047	1,395,526	101,700
Smoking ban at public places	-1.0%	13	5,765,358	5,765,166	436,195
Comprehensive workplace program in addition to individual measures	0.0%	0	irrelevant because of lack of effectiveness	irrelevant because of lack of effectiveness	not applicable
Individual behavioural counselling (assuming 40% coverage based on those willing to quit)	-2.3%	31	23,414,676	9,984,226	743,772
NRT (assuming 40% coverage based on those willing to quit) – baseline scenario (medication cost only)	-3.2%	46	235,707,740	73,096,836	5,083,290
NRT (assuming 40% coverage based on those willing to quit)	-3.2%	46	259,122,417	80,358,111	5,588,252
Physician's advice (assuming 40% coverage based on those willing to quit)	-3.1%	47	23,414,676	7,555,649	501,925
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)	-6.0%	85	267,678,821	44,569,043	3,158,968

Table Results-14:

Sensitivity analyses					
Taxation change to result in price increases of 50%	-10.0%	133	2,791,047	279,105	20,910
Taxation change to result in price increases of 100%	-20.0%	272	2,791,047	139,552	10,279

* Assumptions in deriving cost estimates will be given in the text.

The cost estimates were derived as follows: the costs of the public health interventions were taken from the WHO Choice Databank for Euro A, with a conversion rate of I$ (for a definition of international $ see http://www.who.int/choice/costs/ppp/en/index.html) to CHF for 2002 of 1.80 (for rate see http://www.oecd.org/dataoecd/61/56/1876133.xls; last accessed on 01-12-07; for other publications on cost-effectiveness of different interventions for tobacco control using this approach to costing see: Shibuya et al., 2003; Chisholm et al., 2006).

The costs for the individual interventions are based on the calculations summarized in Appendix 6 and the following assumptions:

- individual counselling: based on an intervention of up to 15 minutes by a trained psychologist;
- physicians' advice: based on an intervention of up to 15 minutes
- NRT: base scenario includes cost of medication only; second scenario includes costs for prescribing and medication (for the latter see Cornuz et al., 1994).
- No additional costs are assumed for more marked taxation increases compared to the base increase resulting in a price increase of 10%, even though there may be more costs for enforcement, resulting from more smuggling.

Man results indicate that with respect to cost-effectiveness, public policy measures such as even minor increases in taxation or ban of smoking in public places clearly are more cost-effective than individual counselling or therapy. Of course, the cost-effectiveness ratio becomes even more favourable for more drastic taxation increases. For instance, the costs for reduction of smoking prevalence by 1% vary between CHF 140,000 (drastic taxation increases which

double the price for cigarettes) and more than CHF 80 millions, if prevalence is reduced by prescribed nicotine replacement therapy alone. This indicates that effective public policy measures should be sought whenever feasible. Otherwise, society will pay a huge price for even moderate reductions in smoking-related harm.

Relevance

Smoking-attributable mortality and burden of disease is a major public health problem in Switzerland. There are effective evidence-based interventions which could also be implemented here. However, these interventions will bring only gradual improvements in reducing prevalence of smoking and smoking-attributable burden of disease, and individual-based interventions such as counselling and therapy will be associated with a rather high cost to society. Given this situation, more drastic public policy measures than currently contemplated should be considered. Such measures should be especially considered in light of the recent experiences, when public policy measures such as a ban in all restaurants were implemented successfully in European countries such as Italy with public support, even though critics have long warned that such measures are unthinkable in such cultures.

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Appendix 1: Cover letter and list interventions

Name Adresse

Zürich, 16.01.06

Sehr geehrte(r) ....
Im Rahmen einer vergleichenden ***Analyse der Kosteneffektivität evidenzbasierter Massnahmen zur Verringerung der Tabak-bedingten Mortalität in der Schweiz*** führt das ISGF eine Studie durch, in deren Rahmen wir die wichtigsten Methoden gegen den Tabakmissbrauch für die Schweiz identifizieren wollen, um deren Kosten-Effektivität zu prüfen. Dafür bedürfen wir Ihrer Hilfe!

Ich möchten Sie höflich bitten, sich zwei Minuten Zeit zu nehmen, um uns folgende Fragen zu beantworten:

1. ***Welche fünf der beigelegten Interventionsmethoden stellen nach Ihrer Erfahrung für die Schweiz die wichtigsten Massnahmen gegen die Tabakmissbrauch dar? Bitte ankreuzen.***
2. ***Welche Interventionsmethoden, die für die Schweiz wichtig sind, fehlen in dieser Liste?***

Für Ihre Unterstützung bedanke ich mich herzlich im Voraus und verbleibe

mit freundlichen Grüßen

Domenic Schnoz
Institut für Sucht- und Gesundheitsforschung
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Beilage:
- Liste: Methoden / Massnahmen gegen Tabakmissbrauch in der Schweiz

METHODEN/MASSNAHMEN GEGEN TABAKMISSBRAUCH IN DER SCHWEIZ

(Bitte markieren Sie die fünf wichtigsten Methoden mit einem „X")

- ___• **Akupunktur**
- ___• **Antidepressiva**
- ___• **Anxiolytikum**
- ___• **Aversives Rauchen**
- ___• **Clonidine**
- ___• **Gemeinschaftliche Intervention**
- ___• **Intervention von gemeinschaftlichem pharmazeutischem Personal**
- ___• **Wettbewerbe und Anreize**
- ___• **Förderung der Unterstützung durch den Partner**
- ___• **Übungs-Interventionen**
- ___• **Rauchen-Kontroll-Programme für Familie und Betreuer**
- ___• **Gruppenverhalten-Therapie-Programme**
- ___• **Gesundheitspflege-Finanzierungs-Systeme um die Benützung von Tabak-Abhängigkeits-Behandlungen zu erhöhen**
- ___• **Schlaftherapie**
- ___• **Individuelle Verhaltensberatungen**
- ___• **Interventionen für voroperatives Beenden des Rauchens**
- ___• **Interventionen um den Verkauf von Tabak an Minderjährige zu verhindern**
- ___• **Interventionen um das Tabakrauchen auf öffentlichen Plätzen zu verhindern**
- ___• **Interventionen um rauchlosen Tabakkonsum zu beenden**
- ___• **Interventionen um das Rauchen bei hospitalisierten Patienten zu beenden**
- ___• **Lobeline**
- ___• **Massenmediale Interventionen**
- ___• **Mecamylamine**
- ___• **Nikotin-Ersatz-Therapie**
- ___• **Krankenpflegerische Interventionen**
- ___• **Opioid-Antagonisten**
- ___• **Ärztlicher Rat**
- ___• **Aufhören-und-Gewinnnen-Wettbewerbe**

- ___ **Rückfall-Verhinderungs-Interventionen**
- ___ **Schulbasierte Programme**
- ___ **Selbsthilfe-Interventionen**
- ___ **Silberacetat**
- ___ **Telefonberatung**
- ___ **Training für Gesundheits-Spezialisten**
- ___ **Arbeitsplatz-Interventionen**
- **Andere:**_____

  _____

Appendix 2: Summary of RR used for tracer diagnoses

Relative risks and 95% confidence intervals (CI) for tracer diagnoses lung cancer and IHD

Sex	Age	Ex-smokers	Current Smokers (Cigarettes per Day)
			Any
		RR 95% CI	RR 95% CI
Lung cancer			
M	All	6.75 (6.16-7.40)	13.0 (12.2-13.7)
F	All	5.07 (4.66-5.51)	11.4 (10.5-12.3)
IHD			
Age <65 years			
M+F	All	1.45 (1.41-1.50)	3.06 (3.00-3.13)
Age 65+ years			
M+F	All	1.12 (1.07-1.16)	1.66 (1.59-1.74)
M	All	0.93 (0.87-1.00)	1.67 (1.54-1.82)
F	All	1.22 (1.16-1.29)	1.67 (1.58-1.77)

Appendix 3: Smoking in Switzerland by age and sex – Swiss Health Survey 2002

SMOKING CATEGORIES BY GENDER, SWITZERLAND 2002

	Age groups	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
MALES	Current smokers	27.04	39.20	33.87	33.14	33.38	30.65	29.85	31.91	23.98	20.97
	Ex-smokers	4.50	3.97	7.93	15.11	14.65	21.42	28.56	31.87	40.56	36.71
	Never smokers	68.46	56.83	58.20	51.75	51.97	47.94	41.58	36.22	35.46	42.33
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
WOMEN	Age groups	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
	Current smokers	25.35	31.51	24.60	25.29	27.37	30.44	25.33	23.26	21.73	15.05
	Ex-smokers	4.37	6.73	12.06	12.70	18.10	18.92	22.70	22.36	22.68	19.39
	Never smokers	70.28	61.76	63.34	62.01	54.53	50.64	51.97	54.37	55.59	65.56
	Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

	Age groups	65-69	70-74	75-79	80-84	85+	TOTAL
MALES	Current smokers	20.98	15.56	8.91	12.01	8.64	28.08
	Ex-smokers	42.00	42.00	43.28	49.47	38.60	23.87
	Never smokers	37.02	42.44	47.81	38.52	52.76	48.05
	Total	100.00	100.00	100.00	100.00	100.00	100.00
WOMEN	Age groups	65-69	70-74	75-79	80-84	85+	TOTAL
	Current smokers	14.48	8.58	5.38	5.86	2.05	21.64
	Ex-smokers	17.53	16.62	17.02	9.84	14.94	16.19
	Never smokers	67.99	74.80	77.60	84.30	83.01	62.17
	Total	100.00	100.00	100.00	100.00	100.00	100.00

Source: Swiss Health Survey 2002, calculations by G.Gmel

Notes: Cigars (=5), cigarillos (=2.5), and pipes (=2.5) were converted into cigarette.

Table includes smokers of other tobacco products, not only cigarette smokers.

Smokers of less than 1 (converted cigarette) a day on average were coded as never smokers.

Current smokers are those with 1 or more converted cigarettes per day on average; includes potential chippers who smoke only weekends but more than 6 cigarettes (converted) a week

Detailed categories of smoking in Switzerland 2002: Women (Swiss Health Survey; analyses by SFA, 2004)

Smoking category (SC)	Age groups (AG)						Total
	15-29	30-44	45-59	60-69	70-79	80+	
Nonsmoker							
Count	368,161	464,705	367,536	231,296	265,542	115,523	1,812,763
% within SC	20.3%	25.6%	20.3%	12.8%	14.6%	6.4%	100.0%
% within AG	58.8%	51.5%	50.5%	65.0%	74.9%	82.6%	58.4%
Ex-smoker							
Count	47,695	149,191	164,345	65,807	59,577	16,327	502,942
% within SC	9.5%	29.7%	32.7%	13.1%	11.8%	3.2%	100.0%
% within AG	7.6%	16.5%	22.6%	18.5%	16.8%	11.7%	16.2%
Smoking 0-14 cigarettes per day							
Count	153,348	168,725	115,733	33,498	20,720	5,947	497,971
% within SC	30.8%	33.9%	23.2%	6.7%	4.2%	1.2%	100.0%
% within AG	24.5%	18.7%	15.9%	9.4%	5.8%	4.3%	16.0%
Smoking 15 plus cigarettes per day							
Count	56,413	120,227	80,354	24,992	8,918	2,060	292,964
% within SC	19.3%	41.0%	27.4%	8.5%	3.0%	.7%	100.0%
% within AG	9.0%	13.3%	11.0%	7.0%	2.5%	1.5%	9.4%
All Women							
Count	625,617	902,848	727,968	355,593	354,757	139,857	3,106,640
% within SC	20.1%	29.1%	23.4%	11.4%	11.4%	4.5%	100.0%

Detailed categories of smoking in Switzerland 2002: Men
(Swiss Health Survey; analyses by SFA, 2004)

Smoking category (SC)	Age groups (AG)						Total
	15-29	30-44	45-59	60-69	70-79	80+	
Nonsmoker							
Count	334,048	392,857	214,896	103,637	92,420	30,290	1,168,148
% within SC	28.6%	33.6%	18.4%	8.9%	7.9%	2.6%	100.0%
% within AG	53.0%	43.1%	29.4%	32.1%	40.2%	37.4%	40.2%
Ex-smoker							
Count	34,332	154,408	244,659	125,886	97,796	37,259	694,340
% within SC	4.9%	22.2%	35.2%	18.1%	14.1%	5.4%	100.0%
% within AG	5.4%	16.9%	33.4%	39.0%	42.5%	46.0%	23.9%
Smoking 0-14 cigarettes per day							
Count	170,248	186,783	137,306	58,770	27,296	10,453	590,856
% within SC	28.8%	31.6%	23.2%	9.9%	4.6%	1.8%	100.0%
% within AG	27.0%	20.5%	18.8%	18.2%	11.9%	12.9%	20.3%
Smoking 15 plus cigarettes per day							
Count	91,853	178,507	135,089	34,116	12,327	3,003	454,895
% within SC	20.2%	39.2%	29.7%	7.5%	2.7%	.7%	100.0%
% within AG	14.6%	19.6%	18.5%	10.6%	5.4%	3.7%	15.6%
All males							
Count	630,481	912,555	731,950	322,409	229,839	81,005	2,908,239
% within SC	21.7%	31.4%	25.2%	11.1%	7.9%	2.8%	100.0%

Appendix 4: Detailed results of effectiveness of different interventions for smoking cessation on prevalence of smoking

	Overall (all ages >15)		0-14 Yrs		15-19 Yrs		20-44 Yrs		45-64 Yrs		65+ Yrs	
	M	F	M	F	M	F	M	F	M	F	M	F
Population in thousand	2860.332	3108.618	635.878	605.145	214.09	209.581	1294.448	1304.801	899.07	944.661	452.724	649.575
%	100.0%	100.0%			7.5%	6.7%	45.3%	42.0%	31.4%	30.4%	15.8%	20.9%
Never smokers	47.89%	62.14%	100.0%	100.0%	68.5%	70.3%	52.8%	57.9%	38.8%	56.4%	42.3%	76.3%
Former smokers	23.96%	16.21%	0.0%	0.0%	4.5%	4.4%	13.5%	14.3%	34.1%	21.9%	42.9%	15.7%
Current smokers	28.15%	21.65%	0.0%	0.0%	27.0%	25.4%	33.7%	27.8%	27.2%	21.7%	14.8%	8.0%
Natural course plus quitters												
Never smokers	47.88%	62.14%	100.0%	100.0%	68.5%	70.3%	52.8%	57.9%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.22%	17.94%	0.0%	0.0%	6.7%	6.4%	16.2%	16.5%	36.2%	23.6%	44.1%	16.3%
Current smokers	25.90%	19.92%	0.0%	0.0%	24.9%	23.3%	31.0%	25.6%	25.0%	20.0%	13.6%	7.4%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix 4 cont.

	Overall (all ages >15)		0-14 Yrs		15-19 Yrs		20-44 Yrs		45-64 Yrs		65+ Yrs	
	M	F	M	F	M	F	M	F	M	F	M	F
Natural course plus quitters plus new beginners = baseline scenario												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.22%	17.94%	0.0%	0.0%	6.7%	6.4%	16.2%	16.5%	36.2%	23.6%	44.1%	16.3%
Current smokers	26.77%	20.79%	0.0%	0.0%	26.9%	25.4%	32.6%	27.3%	25.0%	20.0%	13.6%	7.4%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Taxation change to result in price increases of 10%												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.75%	18.36%	0.0%	0.0%	7.2%	6.9%	16.9%	17.0%	36.7%	24.0%	44.4%	16.4%
Current smokers	26.24%	20.37%	0.0%	0.0%	26.4%	24.9%	31.9%	26.8%	24.5%	19.6%	13.4%	7.2%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Smoking ban at public places												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.48%	18.15%	0.0%	0.0%	6.9%	6.7%	16.6%	16.8%	36.5%	23.8%	44.2%	16.4%
Current smokers	26.50%	20.58%	0.0%	0.0%	26.7%	25.2%	32.3%	27.0%	24.7%	19.8%	13.5%	7.3%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix 4 cont.

	Overall (all ages >15)		0-14 Yrs		15-19 Yrs		20-44 Yrs		45-64 Yrs		65+ Yrs	
	M	F	M	F	M	F	M	F	M	F	M	F
Comprehensive workplace program in addition to individual measures												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.22%	17.94%	0.0%	0.0%	6.7%	6.4%	16.2%	16.5%	36.2%	23.6%	44.1%	16.3%
Current smokers	26.77%	20.79%	0.0%	0.0%	26.9%	25.4%	32.6%	27.3%	25.0%	20.0%	13.6%	7.4%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Individual behavioural counselling (assuming 40% coverage based on those willing to quit)												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	26.85%	18.43%	0.0%	0.0%	7.3%	7.0%	17.0%	17.1%	36.9%	24.1%	44.4%	16.5%
Current smokers	26.14%	20.30%	0.0%	0.0%	26.3%	24.9%	31.8%	26.7%	24.4%	19.5%	13.3%	7.2%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NRT (assuming 40% coverage based on those willing to quit)												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	27.08%	18.61%	0.0%	0.0%	7.5%	7.2%	17.3%	17.4%	37.1%	24.3%	44.5%	16.5%
Current smokers	25.91%	20.12%	0.0%	0.0%	26.1%	24.6%	31.5%	26.5%	24.2%	19.3%	13.2%	7.1%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix 4 cont.

	Overall (all ages >15)		0-14 Yrs		15-19 Yrs		20-44 Yrs		45-64 Yrs		65+ Yrs	
	M	F	M	F	M	F	M	F	M	F	M	F
physician's advice (assuming 40% coverage based on those willing to quit)												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	27.05%	18.58%	0.0%	0.0%	7.5%	7.1%	17.2%	17.3%	37.0%	24.3%	44.5%	16.5%
Current smokers	25.94%	20.15%	0.0%	0.0%	26.1%	24.7%	31.6%	26.5%	24.2%	19.3%	13.2%	7.1%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)												
Never smokers	47.01%	61.27%	100.0%	100.0%	66.4%	68.2%	51.2%	56.2%	38.8%	56.4%	42.3%	76.3%
Former smokers	27.83%	19.19%	0.0%	0.0%	8.2%	7.9%	18.2%	18.1%	37.8%	24.9%	44.9%	16.7%
Current smokers	25.16%	19.54%	0.0%	0.0%	25.3%	23.9%	30.6%	25.7%	23.5%	18.7%	12.8%	6.9%
	100.00%	100.00%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix 5: Detailed results of effectiveness of different interventions for smoking cessation on mortality

All cause	20-44 Yrs		45-64 Yrs		65+ Yrs		20+ Yrs			-	-	-
	Men	Women	Men	Women	Men	Women	Men	Women	Total	-	-	-
Natural course plus quitters plus new beginners = baseline scenario	85	36	1,123	395	2,911	1,376	4,119	1,808	5,927	-	-	-
Various Intervention Scenarios										**Smoking-attributable deaths saved**		
										Men	**Women**	**Total**
Taxation change to result in price increases of 10%	84	36	1,118	393	2,903	1,365	4,105	1,794	5,900	13	13	27
Smoking ban at public places	85	36	1,120		2,907	1,372	4,111	1,802	5,914	7	5	13
Comprehensive workplace program in addition to individual measures	85	36	1,123	395	2,911	1,376	4,119	1,808	5,927	0	0	0
Individual behavioural counseling (assuming 40% coverage based on those willing to quit)	84	36	1,118	393	2,898	1,367	4,099	1,796	5,896	19	11	31
NRT (assuming 40% coverage based on those willing to quit)	84	36	1,116	392	2,893	1,360	4,093	1,788	5,881	26	19	45
Physician's advice (assuming 40% coverage based on those willing to quit)	84	36	1,115	392	2,893	1,360	4,093	1,788	5,881	26	19	46
NRT plus taxation plus ban of smoking in public spaces (assuming 40% coverage based on those willing to quit)	83	36	1,109	389	2,874	1,351	4,067	1,776	5,844	52	31	83

Appendix 6: Costs in Switzerland for personal interventions

Preise von medizinischen Leistungen in der Schweiz im Jahre 2002 im Rahmen der Rauchentwöhnungstherapie

Kompiliert von Till A. Boluarte (Universität Witten Herdecke) und Domenic Schnoz (ISGF)

Eine Stunde Hausarzt CH für das Jahr 2002

Beratung zwischen 7 und 20 Uhr (bis zu einer Viertelstunde Dauer)

6 TP pro 15 Min

Pro Stunde = 24 TP

TP Wert = 4.95 CHF (seit 01.07.1992 bis 31.12.2003)

Verdienst Hausarzt pro Stunde = **118.80 CHF**

Quellen:

Ambulante Tarife Spitalleistungskatalog (1992–2003), Zentralstelle für Medizinaltarife UVG (letzte Überarbeitung 31. Januar 1997)

Aktuelle Taxpunktwerte (TPW) für UV/MV/IV-Patienten (Stand 01.01.2006), Zentralstelle für Medizinaltarife UVG

Eine Stunde Psychologe CH 2002

Leistungen durch klinische Psychologen/Psychotherapeuten (mit Hochschulabschluss und Ausbildung in Psychopathologie)

Nichtärztliche psychologische Diagnostik und Therapie in der Psychiatrie, Einzelsetting

6 TP pro 15 Min

Pro Stunde = 24 TP

TP Wert = 4.95 CHF (seit 01.07.1992 bis 31.12.2003)

Verdienst Psychologe pro Stunde = **118.80 CHF**

Quellen:
Ambulante Tarife Spitalleistungskatalog (1992–2003), Zentralstelle für Medizinaltarife UVG (letzte Überarbeitung 31. Januar 1997)
Aktuelle Taxpunktwerte (TPW) für UV/MV/IV-Patienten (Stand 01.01.2006), Zentralstelle für Medizinaltarife UVG

Eine Stunde Sozialarbeiter CH 2002

Leistungen durch nichtärztliches Personal (z.B. Psychiatrie-PflegerInnen unter ärztlicher Anordnung und Überwachung):

*„Die Behandlungen erfolgen durch von der Institution / Spitalabteilung angestelltem, nichtärztlichem Personal (Psychiatrieschwestern und Psychiatriepfleger sowie sozialtherapeutisches Personal wie Sozialpädagogen und **Sozialarbeiter** mit Zusatzausbildung, dipl. Psychologen und weiteres therapeutisch tätiges, nicht ärztliches Personal mit adäquater Ausbildung). „*
– TARMED 2006

Einzelbehandlung, pro volle oder angebrochene Viertelstunde

4 TP pro 15 Min

Pro Stunde = 16 TP

TP Wert = 4.95 CHF (seit 01.07.1992 bis 31.12.2003)

Verdienst Sozialarbeiter pro Stunde = **79,20 CHF**

Quellen:
Ambulante Tarife Spitalleistungskatalog (1992–2003), Zentralstelle für Medizinaltarife UVG (letzte Überarbeitung 31. Januar 1997)
Aktuelle Taxpunktwerte (TPW) für UV/MV/IV-Patienten (Stand 01.01.2006), Zentralstelle für Medizinaltarife UVG
TARMED-Version 1.03, TARMED Suisse

Preis für gängigsten Nikotinersatzstoff für 3 Monate (CH 2002)

Sämtliche Leitlinien der Fachgesellschaften empfehlen die Nikotinersatztherapie, die vorwiegend mit Nikotinpflaster durchgeführt wird.

Das Nikotinpflaster eignet sich sehr gut zu ökonomischen Berechnungen, da jeweils ein Pflaster pro 24 Stunden benötigt wird.

Sowohl die Leitlinien der Dt. Ges. f. Suchtforschung und Suchttherapie (DG-Sucht) und der Dt. Ges. f. Psychiatrie, Psychotherapie und Nervenheilkunde

(DGPPN), sowie die der amerikanischen Fachgesellschaften, ebenso wie Publikationen zum Thema „Rauchentwöhnung" empfehlen für die Nikotin-Ersatztherapie einen Zeitraum von bis zu drei Monaten (Cornuz et al. 2003,2006 & Fiore 2000).

Die „Arzneimittel-Fachinformation" für Nicotinell® - Pflaster empfiehlt folgendes Therapie-Schema für starke Raucher:

Wirkstärke des Pflasters	Dauer der Anwendung
Stark	Beginnend für 4 Wochen
Mittel	Für weitere 4 Wochen
Leicht	Für weitere 4 Wochen
Insgesamt:	**12 Wochen Therapie**

Der Preis für diesen Zeitraum setzt sich nun wie folgt zusammen:

Arzneimittel	Zeitraum	Packungsgröße	Preis
Nicotinell® Pflaster Stärke 1 (stark) 21 mg/24 h	4 Wochen	1 x 21 Stück + 1 x 7 Stück	129.70 CHF+ 50.25 CHF
Nicotinell® Pflaster Stärke 2 (mittel) 14 mg/24 h	4 Wochen	1 x 21 Stück + 1 x 7 Stück	119.70 CHF+ 46.35 CHF
Nicotinell® Pflaster Stärke 3 (leicht) 7 mg/24 h	4 Wochen	1 x 21 Stück + 1 x 7 Stück	109.75 CHF+ 42.55 CHF
Gesamtpreis für 3 Monate Nikotinersatztherapie im Jahr 2002:			**498,30 CHF**

Da « Compendium Suisse des Médicaments » im Internet jeweils nur die aktuellen Preise publiziert. Wurde bei Documed (www.documed.ch) telefonische nachgefragt, ob die entsprechenden Preise aus dem Jahre 2002 übermittelt werden können. Diese lieferten ein FAX, mit einer Kopie aus dem entsprechenden Datenmaterial aus dem Jahre 2002.

Quellen:

Cornuz J et al., *Cost-effectiveness of pharmacotherapies for nicotine dependence in primary care settings: a multinational comparison*, Tob. Control 2006;15;152-159

Cornuz J et al., *Cost-effectiveness analysis of the first-line therapies for nicotine dependence*, Eur J Clin Pharmacol 2003, 59: 201-206

Dt. Ges. f. Suchtforschung und Suchttherapie (DG-Sucht) und der Dt. Ges. f. Psychiatrie, Psychotherapie und Nervenheilkunde (DGPPN), *Leitlinie Tabakentwöhnung*, AWMF-Leitlinien-Register, 2004

Fiore MC, Bailey WC, Cohen SJ, et al. *Treating tobacco use and dependence, Clinical Practice Guideline. Rockville, Maryland: US Department of Health and Human Services*. Public Health Service, 2000

Documed AG, *Arzneimittelkompendium der Schweiz®,* 2002

Documed AG, *Fachinformation des Arzneimittel-Kompendium der Schweiz®*, 2006