THE PEP Transport, Health and Environment Pan-European Programme

WHO / Europe UNECE

Transport-related Health Effects with a Particular Focus on Children

Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions

PHYSICAL ACTIVITY

Transnational Project and Workshop Series of Austria, France, Malta, the Netherlands, Sweden and Switzerland

Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW)

Agency for Environment and Energy Management

Ministry of Health, Elderly & Community Care

National Institute of Public Health and Environment

Swedish Institute for Transport and Communications Analysis

Federal Office of Public Health

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The project "Transport Related Health Effects with a Particular Focus on Children - Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions" is a contribution to the UNECE - WHO Transport, Health and Environment Pan-European Programme - THE PEP and to the Children´s Environment and Health Action Plan for Europe - CEHAPE.

Specific topics have been elaborated under the responsibility of one leading country:

- **Air Pollution - by France**
- **Noise - by the Netherlands**
- **Physical Activity - by Switzerland**
- **Psychological and Social Effects - by Austria**
- **Economic Valuation - by Sweden**

Within this project the topics Climate Change and Road Safety were covered by contributions from WHO Europe.

This project was developed through a series of reviews and workshops:

Workshop I: "Transport Related Health Impacts - Review of Exposures, Epidemiological Status", Vienna 24-25 April 2003

Workshop II: "Economic Valuation of Health Effects due to Transport", Stockholm 12-13 June 2003

Workshop III: "Health Impacts of Transport on Children", The Hague 16-17 October 2003

Workshop IV: "Synthesis and Policy Recommendations", Malta 19-20 February 2004

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Switzerland : Federal Office of Sports, Federal Office of Public Health

This Synthesis Report covers the main outcome and conclusions of the project. Additionally, detailed results and outcomes of the various topics are published in specific topic reports on:

Topic Report 1: Air Pollution, Agency for Environment and Energy Management (ADEME), France

Topic Report 2: Noise, National Institute of Public Health and Environment (RIVM), the Netherlands

Topic Report 3: Physical Activity, Institute of Sport Sciences, Federal Office of Sports, Magglingen, Switzerland

Topic Report 4: Psychological and Social Effects, Institute of Environmental Health, Medical University Vienna, Austria

Topic Report 5: Economic Valuation, Swedish Institute for Transport and Communications Analysis (SIKA)

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EXECUTIVE SUMMARY

Background and Objectives

Motorized road transport has increased rapidly in the European Region in the last decades. Forecasts for 2020 in the EU show a further rise in passenger and freight transport and similar trends are also expected in the eastern part of the European Region. There is an increasing awareness of the environmental and health effects of transport. The health risks posed suggest an increased urgency for action to reduce these effects and related risks. The integration of environmental and health dimensions into transport policies is necessary for achieving sustainability and reducing the disease burden. This is a challenging task but necessary for providing a viable future for our children.

To this end, Austria, France, Malta, the Netherlands, Sweden and Switzerland launched a joint project and series of workshops on "Transport-related Health Effects with a Particular Focus on Children" in 2003. With this joint initiative the participating countries intend to make an active contribution to the UNECE - WHO Transport Health and Environment Pan-European Programme - THE PEP as well as to the development of the CEHAPE - Children's Environment and Health Action Plan for Europe.

The aim of this project which, focused particularly on road transport, was to make progress towards an integrated assessment of major transport related health effects by:

1) Focusing on children

2) Bringing together state of the art of knowledge about these health effects

3) Highlighting their costs and benefits.

4) Focusing on methodological aspects

5) Identifying policy directions to address transport-related health effects on children

One of the outcomes of this joint project is a set of "Key Messages". These 'messages' were developed after reviewing the evidence and a comprehensive list of policies addressing different aspects of transport-related effects on environment and health. This was undertaken by experts and was developed further at the Workshop on "Synthesis and Policy Recommendations" (Malta, 19-20 February 2004) by an panel of decision makers and external experts.

Experts from the six participating countries shared tasks, experiences and resources. Austria focussed on the psychological issues, France on air pollution, Malta on road safety, the Netherlands on noise, Sweden on economic valuation and Switzerland on physical activity. The project was supported by expert input from the WHO on road safety and climate change. A series of reviewing workshops in Vienna, Stockholm, The Hague and Malta complemented these studies involving also external experts and stakeholders. The results and conclusions of this joint project are summarized and published in a synthesis report complemented by five topic reports. It has to be stressed that due to limited time and resources, some effects of transport, such as the contamination of water and soil, as well as more comprehensive economic calculations could not be sufficiently undertaken. Follow-up activities would be advisable.

Air Pollution related Health Effects

Many epidemiological studies have assessed and shown the association between ambient air pollution and health effects on adults using different indicators such as particulate matter (PM expressed as PM10, PM2.5, Total Suspended Particles - TSP, Black Smoke - BS) or gaseous pollutants (nitrogen dioxide (NO_2), sulphur dioxide (SO_2) and ozone (O_3)).

Although fewer studies have focused on the effects of air pollution on European children, their results suggest that there is a relationship between air pollution in Europe and numerous adverse health outcomes in children, in particular, respiratory disease.

Children, in particular those under two years of age and adolescents, are considered to be more susceptible than adults to the effects of air pollution, partly because of their immature metabolism and their physiology.

Even at relatively low levels, ambient air pollution has been shown to affect children with asthma and other conditions. Living along busy streets in urban areas, particularly with heavy motor traffic, has been associated to several respiratory diseases (exacerbation of asthma, chronic respiratory symptoms, allergic symptoms, increased prevalence of a topic sensitization, reduction in lung function).

Results from different study consistently indicate that neonatal or early post-neonatal exposure to air pollution results in mortality; these effects seem to be stronger in the post-neonatal (1-12 months) period and due to respiratory causes. Brazil suggest that there is a positive relationship between exposure to air pollution and respiratory mortality in young children (< 5 years). There are no European studies using this health outcome.

Technical and legal measures implemented since 1990 (e.g. ban of lead in petrol, decrease in sulphur content of fuels, emission standards for vehicles) have led to a reduction of some vehicles exhaust emissions. In contrast, the effects of road transport-related particulate emissions and their continued increase in many countries are at the fore of today's health concerns. Models which forecast traffic growth and factor in both, the implementation of regulations and improved technical measures, suggest that any improvements archived by the latter measures, will be offset by the increased emissions due to traffic growth. As a result, if emission ceilings and air quality objectives are to be met, technical measures will have to be complemented by economic and structural actions, which act to restrict emissions from road transport and other mobile sources.

Several studies have produced estimates of the health benefits that could be attained by decreasing ambient

air pollution levels in European cities, using particulate matter with a diameter smaller than 10 μm (PM10) as an indicator. Other important indicators for transport related air pollution are PM2,5, NO_2 and black smoke. To put this in perspective, it has been estimated by the Air Pollution and Health: A European Information System (APHEIS) study that a decrease of 5 $\mu g/m^3$ in ambient PM10 levels (other factors unchanged) in nine French cities would prevent 1,561 anticipated deaths. The same scenario if applied to 19 European cities estimates that 5,547 deaths would be prevented. If the PM10 air quality guide value of 20 $\mu g/m^3$, which must be implemented in 2010 in Europe, had to be implemented in the 19 European cities, this would prevent 11,855 deaths.

Climate Change and Health

The transport sector is the second largest energy consumer in Europe. Over the period 1990 to 2000, transport greenhouse gas emissions in the EU-15 increased by 19 %, whereas emissions from Central and Eastern Europe had a smaller increase of 4 %. Projected trends forecast that CO_2 emissions will further increase in the future due to the growth in passenger and freight transport.

The health impacts of climate change have a unique set of features, (a) they are global, (b) they affect future generations even more than current ones, (c) they are unevenly distributed, and (d) they can be worsened through coexistent environmental changes. The effects will undoubtedly have a greater impact on societies or individuals with scarce resources, where technologies are lacking, and where infrastructure and institutions are least able to adapt. The Burden of Disease assessment of the WHO estimated, that, in the year 2000 there were an excess of 160,000 deaths due to climate change worldwide. The African and Asian continents face the biggest risk with children being the most vulnerable. In Europe, there is increasing evidence to show that extreme weather and climate events are becoming more frequent and intense and are associated with increases in hospital admissions in children during hot periods. The elderly, disabled, children, women, ethnic minorities and rescue workers may be at greater risk of exposure to the effects of flooding than others.

The analysis of the time series of climate patterns and laboratory confirmed cases of indigenous salmonella infections from ten European countries found that increases in temperature contributed to an estimated 30 % of cases of salmonellosis in most countries investigated. In relation to climate and ecosystem changes preliminary results show that Lyme borreliosis (LB) has spread into both higher latitudes and altitudes, and in some areas is associated with an extended and more intense LB transmission season. Among children, Borrelia burgdorferi is now the most common bacterial cause of encephalitis and facial palsy.

The health impacts of climate change are difficult to quantify and surrounded by a high degree of uncertainty with regard to the long time-scale involved, the extent of the impacts, and the pattern of future world development. However what has become clearer is that international efforts are needed to achieve a world-wide reduction in greenhouse gases emissions, if climate change is to be slowed.

Noise Exposure and Health Effects

In Europe, transport (road, rail and air traffic) is the most important source of community noise. Approximately 30 % of the European Union's population (EU-15) is exposed to levels of road traffic noise of more than 55 dB(A). Exposure to high noise levels has decreased in some countries since 1980 due to technological measures, noise barriers and spatial planning. Due to the expected growth in traffic, extra measures will be needed. At current noise levels many people are annoyed and disturbed in their sleep. A small effect on cardiovascular risk is highly plausible.

The limited number of epidemiological studies in children indicates that noise exposure affects children's learning (cognition), motivation and annoyance. In addition, there is some evidence that noise is associated with impacts on the cardiovascular and endocrine system of children. A few intervention studies show the benefits that could be attained by decreasing noise levels: reduction of railway and aircraft noise improved the long-term memory and reading ability of school children. To avoid such effects, protection of children against noise exposure during the night and during learning activities is recommended. Recent estimations of the noise-related health impacts in the Netherlands suggest that current noise levels may be associated with annoyance in 1.5 - 2 million people (out of a population of 16 million) disturbed sleep in 550,000 - 1 million and about 220,000 cases of hypertension. In total, 1-2 % of the total disease burden could be attributed to traffic noise. Impacts in children cannot be estimated yet. The results of noise and HIA studies in different countries are difficult to compare due to methodological differences. The new EU directive on environmental noise provides a basis for further harmonisation.

The benefits of implementing several source-measures for noise abatement on cars and trains will exceed the costs of these measures, as cost-benefit analyses clearly indicate. For example, it has been estimated in the Netherlands that the implementation of several source-measures on cars and trains will cost about 2 billion Euros. The benefits in terms of reduced annoyance are estimated to be about 4-6 billion Euros . Estimations are that in the EU-15 the overall external (abatement) costs of road and rail traffic noise amount 0.4 % of the total GDP, some 36 billion Euros.

Transport-related Physical Activity and Health

The importance of regular physical activity for health is well established. Positive health effects have been demonstrated for life expectancy, cardiovascular disease, stroke, type II diabetes, obesity, some forms of cancer, osteoporosis, depression and independence at old age.

International minimum recommendations for health-enhancing physical activity refer to 30 minutes of moderately-intense activities. Moderate intensity is characterised by getting somewhat out of breath but not necessarily sweating, typical examples being walking and cycling. Further activities will convey further health benefits and in many countries the minimum recommendations for children are set at one hour per day.

However, levels of physical inactivity are alarmingly high not only in industrialized countries, and this poses a major public health problem. Studies indicate high levels of inactivity omong young people and a tendency towards declining activity levels from childhood to adolescence, which starts at puberty and continues until the young adulthood. Transport-related physical activity can make an important contribution to overall physical activity in children. A wealth of data exists on overweight and obesity which are strongly influenced by physical activity behaviour. Direct health impacts of physical activity in children have been shown for major diseases. Short-term effects of physical activity are most easily demonstrated and impressive in size for weight control, while the associations with type II diabetes and cardiovascular disease could become very important if current trends of inactivity continue. There is a greater likelihood that physically active young people, compared with those inactive, will be more active in later life as well, so it is perceivable that all health effects of physical activity in adults may be influenced by increasing and maintaining active behaviour in young people.

There is a clear need to develop more interventions to increase physical activity and more specifically transport-related physical activity and to assess their effectiveness. In particular, traffic interventions should be identified, such as awareness programmes relating to taking children to school, that are most likely to increase health-enhancing physical activity and to reach physically inactive population groups.

In Switzerland, a country with 7 million inhabitants, current estimates suggest that between 1.4 and 1.9 million cases of disease, between 2,000 and 2,700 deaths and direct treatment costs of 1.1 to 1.5 billion Euros are caused by physical inactivity.

Psychological and Social Impacts

Psychological and social impacts of transport are often ignored or underestimated despite the fact that they can influence mobility behaviour. For instance fear from traffic dangers has led to an increased number of parents who drive their children to school.

Furthermore health effects of noise and air pollutants also have a psychosocial component and therefore cannot be properly studied nor understood if psychology is neglected. Psychological and social mechanisms triggered by the perceived impact of transport alone can lead to disease. Every disease can also have consequences on the mental and social status of a person or an affected group of people. In addition, mental and social conditions can directly modify the impact of environmental stressors on humans.

In the long run high traffic density in human settlements may also lead to social effects by hindering the development of independence and social interaction in children.

Psychological and social effects of transport should be seen as an integral part of transport-related health impacts. One example is that walking to school instead of being taken by car has a direct positive effect on psychological and physical well-being in children, in terms of lower scores of depression, anxiety, aggression and hostility, fewer psychosomatic symptoms, and improved motor skills. Conversely, fear of road traffic injuries acts as a barrier which prevents children from more walking and cycling.

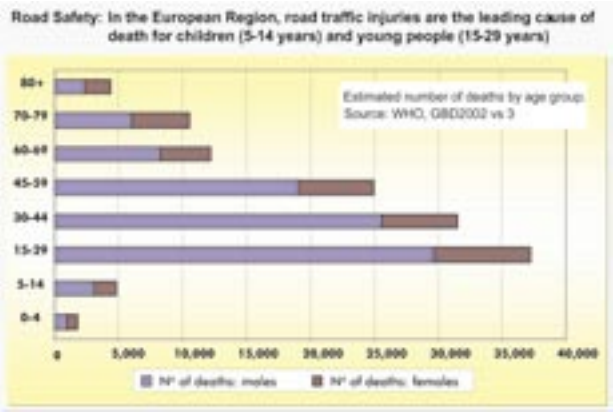
Addressing our true needs, including those of children, requires us to address physiological, safety, security, social, intellectual and aesthetic dimensions. Moreover, children have very definite ideas as to what they need and what they want. These ideas are surprisingly consistent and coherent and even younger school children are able to express their wishes if they get the proper opportunity. Children's needs and aspirations should be taken as an important reference point in the planning of human settlements and mobility management. This would improve planning processes, children's self esteem and their social competence.

Road Traffic Injuries

Ten percent of the 1.2 million deaths estimated worldwide from road traffic injuries (RTIs) in 2002 occurred in the European Region. Road traffic injuries are the leading cause of death of children and young people (age of 5-29 years). 6,500 deaths/year are reported among children aged 0-14 years. Nearly 67 % of crashes occurred in built-up areas. Cyclists and pedestrians pay a disproportionate price, representing one third of the deaths from road traffic injuries. For the EU, the cost of RTIs are estimated to be 180 billion Euro per year. Children are particularly vulnerable because their ability to cope with traffic is limited until 10 years of age. They are more at risk in conditions with heavy or fast traffic, limited visibility, or when drivers' attention is focused elsewhere rather than on pedestrians or cyclists. A study reported that 33 % of children involved in road traffic crashes had post-traumatic stress disorder.

Real and perceived safety concerns are quoted as the most important barrier preventing many people from

choosing walking and cycling as means of transport. Reducing road danger requires control of this threat and reducing casualties. Of particular concern is the issue of speed at the moment of collision, which is a key determinant for the severity of road traffic injuries. In pursuit of reducing road danger, studies using a Willingness to Pay approach suggest that the public may be willing to have more rigorous road safety controls and greater accountability by governments, as in the rail and air sectors. These studies serve as a pragmatic basis for assessing the value and appeal of safety programmes. More generally, road safety, including danger reduction, should become a governing parameter of road transport, and not a tradable variable. This requires strong political commitment and leadership. The adoption of a comprehensive approach to road safety, should address all components of the transport system, namely road users, vehicles and infrastructure, and should take into account the human body's vulnerability to excess kinetic energy and that imperfect road user behaviour is likely.



Lessons Learned: Assessment of Health Impacts and Economic Valuation

Assessments of transport related health impacts should be important tools to guide policy decisions in transport and land use policies. Health Impact Assessment (HIA) studies can also provide relevant information for policy makers on the effects of interventions on public health. Cost-benefit analyses can be derived from these estimates. There are challenges to the estimation of transport related health impacts in children, their costs and their benefits in particular:

- How to select pertinent health effects in children and how to estimate the quantitative relationships between exposure and health effect (exposure response function)
- How to accurately estimate the fraction of exposure coming from transport
- How to measure and express in monetary terms effects of physical, mental and social health and well-being and how to achieve comparability

There are different concepts to evaluate mortality or the risk of mortality and it is important to consider the context in which they are to be used.

For transport related air pollution and the related external costs two main methodologies have been used. These have been designed to answer different questions. The tri-national European project of Austria, France and Switzerland for the London Conference of WHO 1999 and the APHEIS study have led to a more global understanding of the overall impact of air pollution and is more appropriate for general transport policy planning at a national level. The ExternE study, which follows an impact-pathway approach, offers a better methodology to understand and assess the effects of specific interventions, such as minimum standards on fuel quality and engine or exhaust technology.

For noise assessments the mapping of noise exposure of the population and therein of children is crucial. Annoyance and sleep disturbance are recommendable end-points for health impact assessments. For these indicators generalized exposure response functions are available which can be used for impact assessment of transport noise.

Road safety impact assessments should focus in particular on vulnerable road users (e.g. children, bicyclists and pedestrians) and the decisive role of speed. They should be included into impact assessments of transport and land use programs and strategies.

Areas that require further investigation are the quantification and monetary valuation of psychological and social effects and the benefits of physical activity. A number of selected Swiss projects have begun to assess the effectiveness of interventions to promote physical activity. Studies to incorporate the health benefits of cycling into the cost benefit analysis of infrastructure development are also underway in Norway and Sweden. The result of a recent cost-benefit-analysis of cycling infrastructure in three Norwegian cities show that when the positive health aspects of physical activity are considered, the benefits for society of investing in cycle networks, significantly outweigh the cost.

Economic analyses and tools like cost-benefit analysis are often used in decision making regarding transport investments. These economic valuations have not to date taken sufficiently into account the transport related environmental health effects. Another major challenge when undertaking economic valuations is the issue of monetarization. Although not all health effects can be monetized as yet, there is a need to find ways of taking these fully into account when undertaking assessments and evaluations.

The Willingness To Pay (WTP) methodology of monetarization satisfies the condition of economic welfare theory by evaluating people's preferences. So far there have been no economic valuations that have applied this approach to children, but only to their parents as relevant studies of the US Environmental Protection Agency have shown. Economic valuations of transport-related health effects in children should apply at least the same costs as for adults, until child-specific values become available.

Often incomparability is a major obstacle. Different studies may give different results. The reasons for the differences should be made transparent. Harmonization of the methodology is strongly desirable.

Further research and work on traffic-related health effects on children and their economic evaluation is recommended.

KEY MESSAGES AND POLICY DIRECTIONS

Children are vulnerable and their needs should be taken first.

- Children are vulnerable from a physiological, psychological and economic point of view.
- Experience of a "healthy" environment as a child will influence future choices towards a healthy environment as an adult.
- Investments to improve health and environmental conditions for children benefit the entire society and avoid future costs.
- The UN Convention on the Rights of the Child (1989) specifically addresses children's rights to express views freely and be given due weight in accordance with age and maturity (Article 12).

There is an increasing dependence on private car use leading to severe restrictions for children's choice of mobility and physical activity.

- This is the result of the large investments in road infrastructure, the significant growth in road traffic and the rising car ownership and use among families.
- Urban sprawl is inter-related with car-dependent mobility and impediments to short distance trips on foot or bicycle.
- Children are the main losers of car dominated patterns of mobility as they have less opportunities for physical exercise and choice in modes of mobility.
- Consumers' behaviour (bigger/faster/more cars) offsets progress in cleaner technologies.
- Lack of investment and modernization of infrastructure and rolling stock has resulted in a stagnation or even a sharp decline of public transport and rail, particularly in the countries of Eastern Europe, the Caucasus, Central Asia (EECCA).

Present transport patterns and future trends pose a significant threat to children's health and development.

- Children's health is at risk due to traffic related accidents, air pollution, greenhouse gas emissions, noise, and restricted opportunities for safe walking, cycling and other outdoor activities.
- Present transport patterns are major contributors to ill health in children, for example through road traffic injuries and respiratory illness, and have contributed to the epidemic of childhood obesity and adult illnesses such as heart disease and osteoporosis.

Healthy mobility makes a difference.

- A minimum of 30 minutes a day of moderately intense physical activity significantly reduces the risks of important diseases such as cardiovascular disease, hypertension, Type II diabetes and some forms of cancer and enhances psychological wellbeing.
- Moderate physical activity will bring the biggest benefits to the sedentary.
- Safety concerns need to be addressed, by providing appropriate infrastructures in order to make walking and cycling realistic options (rather than being an excuse for a lack of action).
- Substituting car trips by journeys undertaken on foot, by bicycle and other forms of human powered mobility as well as public transport will also contribute to reducing congestion, exhaust emissions and noise.

Prioritising health and environment considerations as part of transport decision making, (particularly those addressing children's needs), would increase the efficiency and sustainability of transport systems. Policy makers should focus on implementing measures, which are highly beneficial to children, as they would also bring benefit to everyone.

Integrated policies for making transport children friendlier:

- Integrate a „children friendly mobility" vision into transport and transport related policies as well as infrastructure and human settlement planning. This could be facilitated by developing environment and health targets specific to children i.e. reductions in road traffic injuries, increase in physical activity.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- Implement sustainable mobility management plans in schools including kindergarten and pre-schools. These plans should be developed and implemented in cooperation with pupils, teachers, parents organisations, local authorities and transport operators, with a view to promoting walking, cycling and public transport and less car use on the way to and from school.
- Give priority to speed reduction and control, for example by establishing 30 km/h as maximum speed limit in urban residential areas, implementing traffic calming, reducing car traffic and restricting access for motorised vehicles particularly around schools, playgrounds and kindergarten.
- Develop policies facilitating the reduction of car dependence and promote car-free settlements, housing and shopping, leisure activities and tourism.

Tools to support the integration of health concerns and children's needs into transport policies and decision-making

- Make use of tools for decision making such as Environmental Impact Assessments (EIA), Health Impact Assessment (HIA) and Strategic Environmental Assessments (SEA) in bringing health and environmental considerations at the core of decisions related to transport and land use planning.
- Children Impact Assessment (CIA) should be one of the tools used to measure effects of planned interventions at national/regional/local levels in order to identify areas of high concern for children. This approach can be used to assess health impacts, costs and benefits, and support the identification of recommended policy actions and implementation tools.
- Undertake and use economic studies and valuation methods for valuing and prioritising road safety and health benefits of walking and cycling in the development of transport policies.

Awareness raising, education and communication strategies:

- Launch national awareness-raising programmes on child friendly mobility, highlighting in particular the benefits of human powered mobility.
- Use communication strategies, which are action-oriented and tailored for different target groups.
- Promote more ecological and safer driving behaviour, such as "eco-driving", by implementing eco-driving measures including training of the drivers in safe and children-friendly driving styles.

Infrastructural measures and planning

- Extend and improve safe and attractive infra-structure for bicycles and pedestrians.
- Improve and extend public transport infrastructure and services, increase service quality and the use of fleets with child friendly low floor vehicles, and prioritize public transport in road traffic schemes.
- Reform design-standards and planning guidelines for infrastructure, transport codes, and zoning regulations according to children's needs.
- Implement noise abatement plans and measures, tighter noise requirements for sensitive areas such as schools and residential areas to minimize harmful educational and psychological effects.

Technical measures and standards

- Substantially reduce particle emissions by advocating the installation of particle filters or other appropriate technologies in cars and further tighten the particle emission standards for motorized vehicles in particular passenger cars.
- Implement safety measures, which are known to save children's lives such as child car safety seats, seat belt use, improving visibility, helmet use.

Research programmes should focus more on children specific concerns.

- Give more priority and support to assessments and monitoring of the transport related environment and health threats posed on children including epidemiological research on air pollution and noise, research on cumulative effects and inter-linkages with psychological and social issues as well as the positive impacts of mobility patterns relying on physical exercise.

Children's health can also be promoted by general policy using economic instruments and normative interventions.

- Implement mobility management in communities including parking fee schemes, car traffic restrictions and prioritization of walking, cycling and public transport.
- Enforce speed limits and speed control.
- Enforce maximum permissible alcohol blood level for drivers of less than 0.05 g/dl.
- Reduce traffic emissions by restricting traffic and improving vehicle technologies to meet the requirements set by the EU National Emission Ceilings of air pollutants.
- Further tighten emission standards (air pollutants as well as noise) for all motorized vehicles and improve safety for both their occupants and other road users (e.g. pedestrians, cyclists).
- Enforce periodic maintenance checks and improve emission remote control systems.
- Use CO_2 / energy taxes and incentives for introducing energy-saving technologies.
- Establish fiscal incentives for public transport and cycling.
- Consider pricing of road infrastructure - road pricing, parking fees, charging of car purchase and ownership.
- Provide incentives for zero or ultra-low emission vehicles (noise, pollution).

KEY MESSAGES AND POLICY DIRECTIONS

Individual costs of mobility do not reflect the full costs to society. In particular children's specific costs and needs for mobility are not yet accounted for: it is necessary to improve economic assessments and internalisation of costs and benefits, correct pricing-signals and include children specific costs in economic valuations.

- Promote and improve economic valuation of the transport related health impacts on children, including negative health effects of transport such as exhaust emissions and noise, as well as the positive health effects of walking and cycling.
- Integrate transport related health impacts on children and their costs and benefits into policy instruments e.g. when conducting cost-benefit-analysis of infrastructure and when considering internalisation of the external costs of transport.

There is a need to redesign human settlements and infrastructure to provide more space for physical, mental and social development of children. Integration of children's needs in planning and decision-making would help overcoming segregation effects and social deficits.

- Consider needs of children in the decision making process of transport, human settlements, land use and infrastructure planning, etc.
- Make children's needs and aspirations an important reference point in the creative planning process of human settlements and mobility management and follow a participative approach by involving children.
- Bring all relevant partners together for implementation; build new partnerships with children's interest groups.

Incorporating children's needs requires a shared responsibility of families, the educational, health, environment, transport and urban planning sectors as well as of the private sector, industry and civil society.

- Enforce better integration of children's needs and the related specific requirements into relevant policies at all political levels (international, national, local).
- Intensify pan-European co-operations and use the implementation of international agreements such as the WHO-CEHAPE, WHO/UNECE THE PEP, the EU-Environment & Health Strategy as driving forces for child friendly adaptation of existing policies and the formulation of new policies and actions.
- Strengthen the role of the health as well as of the education sector e.g. extending the concept of "healthy schools" by encompassing the journey to school.
- Promote the notion of liability for children´s health and the environment in industry (vehicle manufacturers, public transport companies) and amongst transport providers and infrastructure planners.

There is a world to win: Start to act now!!

- Collect and disseminate examples of best practices and assessments, establish new partnerships and co-operation among sectors.
- Develop and implement children friendly mobility plans and monitor their achievements.
- Design a "package" of integrative measures with a timeframe for implementation. These could start with pilot projects.
- Assess the transferability of different strategies across different cultural, political, economic and social settings.
- Start assessments of transport related health effects which include their costs and benefits with a particular focus on children.


Federal Office of Sports; CH

Front Cover: HERRY Consult; Puzzle: based on WHO publication „Preventing road traffic injury: a public health perspective for Europe"

Links for further information

Children' Environment and Health Action Plan for Europe
www.euro.who.int/budapest2004
THE PEP - Transport Health and Environment Trans-European Programme
http://unece.unog.ch/the-pep/en/welcome.htm
"Transport-related Health Effects with a Particular Focus on Children" (Transnational study and workshop series by Austria, France, Malta, the Netherlands, Sweden and Switzerland, 2004)
www.herry.at/the-pep
"Health Costs due to Road Traffic-related Air Pollution" (Tri-lateral study by Austria, France and Switzerland, 1999)
www.euro.who.int/transport/HIA/20021107_3
World Health Organization
www.euro.who.int/transport
ADEME – Agency for Environment and Energy Management, France
www.ademe.fr
bmgf - Austrian Federal Ministry of Health and Women
www.bmgf.gv.at
BMLFUW - Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management
www.lebensministerium.at
bm:vit - Austrian Federal Ministry of Traffic, Innovation and Technology
www.bmvit.gv.at
Federal Office of Public Health, Switzerland
www.bag.admin.ch
FOSPO - Federal Office of Sports, Switzerland
www.baspo.admin.ch
Medical University Vienna, Environmental Health Institute, Austria
www.univie.ac.at/umwelthygiene/
Ministry of Health, Elderly & Community Care, Malta
www.health.gov.mt
Ministry of Housing, Spatial Planning and the Environment of the Netherlands (VROM)
www.vrom.nl
Ministry of Transport, Public Works and Water Management of the Netherlands (VenW)
www.minvenw.nl
RIVM - National Institute of Public Health and Environment, the Netherlands
www.rivm.nl
Swedish Institute for Transport and Communications Analysis (SIKA)
www.sika-institute.se

Transnational Project and Workshop Series of
Austria, France, Malta, the Netherlands, Sweden and Switzerland

Transport-related Health Effects with a Particular Focus on Children

Towards an Integrated Assessment of their Costs and Benefits State of the Art Knowledge, Methodological Aspects and Policy Directions

Topic Report

PHYSICAL ACTIVITY

Federal Office of Sports, Magglingen
Federal Office of Public Health, Bern

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Commissioned by

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Transport-related Health Effects with a Particular Focus on Children

Transnational Project and Workshop Series of Austria, France, Malta, Sweden, Switzerland and The Netherlands

TOPIC PAPER ON PHYSICAL ACTIVITY

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THE PEP – Topic Paper on Physical Activity

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1. Introduction and Summaries

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1.1. The Topic Paper on Physical Activity within THE PEP

This topic paper has been developed in the project "Transport Related Health Impacts, Costs and Benefits with a Particular Focus on Children" within the context of the UNECE- WHO Pan-European Programme for Transport, Health and Environment - THE PEP. The aim of the project is to provide a review on the state of the art on transport related health impacts, costs and benefits as well as to develop recommendations on political implementation strategies and also to contribute to the development of WHO-Guidelines for the economic valuation of transport related health effects.

The topic paper intends to review the state of the art with respect to methods for assessing the exposures, epidemiologial status, effects and health impacts of transport-related physical activity and to identify the respective research gaps. A first version of the paper has been produced before the Vienna Workshop in April 2003 mainly from the national perspective of Switzerland. For the second version the introductory part has been adapted following the discussions in Vienna and the third and final version is planned to include more international experiences and perspectives from other country experts in the THE PEP project and also from the "WHO Working Group on Guidelines Assessing the Health Impact of Policies that Increase Walking and Cycling".

Aspects specific to children will be treated in a separate document, as will be the implications, recommendations and examples of good practice for the political process.

1.2. Overview of the health impacts of transport related physical activity

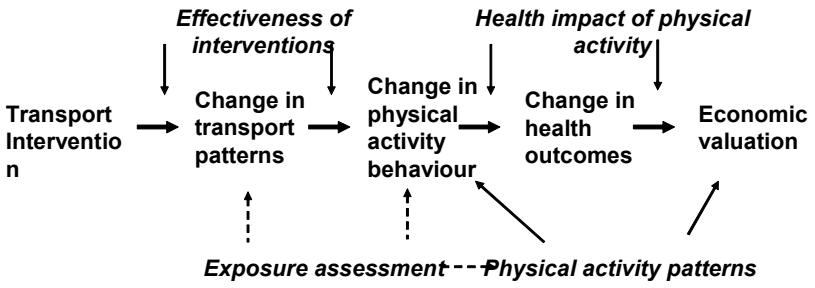

Figure 1. Overview of the chain from trans-port intervention to economic valuation of the health effects of transport-related physical activity. While the overall causal relationship (indicated by the bold arrows) is well accepted, quantifica-tion and modelling represent several challenges due to a number of issues discussed in the respective chapters of this topic paper.

The importance of regular physical activity for health is well established. There is evidence for the effectiveness of a growing number of interventions in increasing physical activity among the inactive, and transport-related physical activity has a great potential in the promotion of overall physical activity. Though this overall rationale is well accepted (figure 1), the quantification of the relationships and effects remains difficult, mainly due to the need for an internationally agreed definition and measure of physical activity on the population level, the lack of data for the contribution of transport related physical activity to overall physical activity and therefore to health. The need for realistic estimations of effects of transport interventions on transport patterns (modal shift) is essential for quantifying not only the health effects of physical activity, but also for other transport related factors like air pollution or noise.

The following summaries address the specific issues indicated in figure 1, they are explored in more detail in the following chapters of the topic paper. In order to advance the modelling, quantification and monetarisation approaches in transport-related physical activity, intensified inter-disciplinary exchange within the THE PEP could be very fruitful.

1.3. Sources and methods of exposure assessment - summary

The measurement of physical activity represents several challenges, in particular with respect to transport and health. First of all, there exists no internationally agreed definition or measure of physical activity on the population level. Then, while associations between overall physical activity and health are very clear, the contribution of transport related physical activity to overall physical activity is difficult to assess, not least because of the different methods and data sources for those two aspects.

Though a whole range of possibilities exist (table 1), self-completed or interviewer-administered questionnaires are most commonly used to assess physical activity.

For the measurement of travel behaviour and also transport related physical activity, methods used are diaries, questionnaires, manned or automated counting stations and as a new approach in some studies also GPS.

• **Surveying**	- **Task specific diary**
	- **Recall questionnaire**
	- **Quantitative history**
	- **Global self-report**
• **Monitoring**	- **Behavioral observation**
	- **Job classification**
	- **Heart rate monitor**
	- **Motion sensors**
	- **Calorimetry**
	- **GPS**
	- **Doubly labeled water**

TABLE 1. PHYSICAL ACTIVITY ASSESSMENT METHODS

The fact that physical activity assessment systems on the national and international level rely solely on questionnaire data imposes limitations on inter-cultural comparisons both within countries and between them. The development of internationally standardised instruments and the use of objective measurements like accerelometry might open up new possibilities in this regard.

1.4. Physical activity patterns - summary

The World Health Report 2002 reports summary statistics for physical activity, though indicating that they are derived from a number of direct and indirect data sources and a range of survey instruments and methodologies: "The global estimate for prevalence of physical inactivity among adults is 17%, ranging from 11% to 24% across subregions. Estimates for prevalence of some but insufficient activity (<2.5 hours per week of moderate activity) ranged from 31% to 51%, with a global average of 41% across the 14 subregions."

Physical inactivity is a worldwide public health problem. Though methodological issues still restrict the possibilities to quantify this problem in absolute terms and to carry out intercultural and international comparisons, subgroups with particularly low activity levels and changes over time can be documented. A systematic integration of data from the health and from the transport sector has not yet taken place.

The availability of epidemiological data is an important element in the political process leading to a better recognition of the importance of health-enhancing physical activity (HEPA) on the national and international level and the current attempts for standardised measurement procedures will play an important role in this process.

1.5. Health Impacts of Physical Activity - summary

⇧ Life expectancy
⇩ Cardiovascular disease
⇩ Diabetes II
⇩ Obesity
⇩ Colon cancer
⇩ Breast cancer
⇩ (Prostate cancer)
⇩ (Pancreatic cancer)
⇩ Osteoporosis
⇩ Symptomatic gallstone disease
⇩ Depression
⇧ Stress tolerance
⇧ Independence in old age

Table 2. Overview of health effects of physical activity

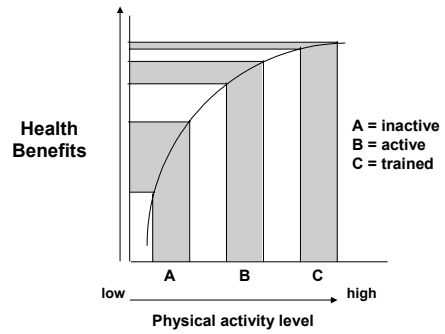

Figure 2. Dose-response relationship for physical activity and health

The importance of physical activity has been well established over the last decades and a wealth of different endpoints has been identified (table 2).

A dose-response-relationship could be demonstrated for most of these endpoints, most clearly for overall mortality and cardiovascular morbidity (figure 2). While most of the studies have studied the associations with overall physical activity, only very few have been able to study the independent effects of transport related physical activity.

1.6. The effectiveness of interventions to increase physical activity - summary

In general, most experience regarding design and feasibility of intervention studies and the effects of these programs is available for interventions at the individual and group level. There is good evidence that interventions at these levels can increase physical activity among the

inactive. There is also good evidence that interventions in the worksite setting are effective to increase physical activity.

There seem to be virtually no studies assessing the impact of interventions targeting transport policies and environmental changes on physical activity – neither on their effect to increase individual physical activity behaviour in general, and particularly not regarding their potential to reach the inactive segment of a population. An observed increase in bicycle use for example is far less relevant for public health if it occurs in individuals already physically active in other ways than if the same increase could be observed in a previously inactive group.

It is difficult to quantify and compare intervention effects because of different measures for physical activity and the respective outcomes of the studies.

2. Sources and methods of exposure assessment

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2.1. Introduction

The measurement of physical activity represents several challenges, in particular with respect to transport and health. First of all, there exists no internationally agreed definition or measure of physical activity on the population level [1]. Then, while associations between overall physical activity and health are very clear (chapter 3 of this paper), the contribution of transport related physical activity to overall physical activity is difficult to assess, not least because of the different methods and data sources for those two aspects.

2.2. Methods and sources of physical activity assessment

The ideal instrument for the assessment of physical activity should give a global assessment of physical activity, be easily applicable, comparable between population groups, result in good distinction between more and less active individuals or groups and should provide information that is relevant for interventions. Obviously, such an instrument does not exist. The different possibilities for the assessment of physical activity have already been outlined in the US Surgeon General's Report on Physical Activity and Health (table 1) [2]. Since then, only GPS (global positioning system) has been added to the list, though this device is not yet in routine use.

• **Surveying**	- **Task specific diary**
	- **Recall questionnaire**
	- **Quantitative history**
	- **Global self-report**
• **Monitoring**	- **Behavioral observation**
	- **Job classification**
	- **Heart rate monitor**
	- **Motion sensors**
	- **Calorimetry**
	- **GPS**
	- **Doubly labeled water**

Table 1. Physical activity assessment methods (adapted after [2])

[1] WHO. The World Health Report: 2002: Reducing risks, promoting healthy life. Geneva: World Health Organisation WHO, 2002.

[2] Department of Health and Human Services: Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.

Except for job classifications which only give a very rough estimate of physical activity, most possibilities in the "monitoring" group are methodologically rather demanding. Laboratory methods such as direct and indirect calorimetry or doubly labelled water technique are generally considered as accurate in measuring energy expenditure of physical activity. Nevertheless, both methods have limitations. While the doubly labelled water technique cannot be used to examine short-term physical activity [3], indirect calorimetry is not suitable to measure energy expenditure in free-living humans during longer periods. In addition, these methods are expensive and not suitable for epidemiological studies. The only method in this group that has already been used in representative studies are accelerometers as a particular kind of motion sensors [4].

Self-completed or interviewer-administered questionnaires are often used to assess physical activity. These instruments record information on duration, intensity and type of activities performed over a certain period of time. Detailed physical activity recall questionnaires show the best results in validity studies and also allow the identification of the contribution of different forms of activity to overall activity usually expressed as energy expenditure [5], but their utilisation in large representative surveys is limited by their sheer size. Therefore, short physical activity questionnaires are most widely used, though their validity is poorer [6, 7]. Even by respecting the necessary procedures for trans-cultural adaptation, questionnaires in general are prone to differential use not only between countries, but also between different cultural groups within the same country [8].

A standardised and internationally comparable physical activity questionnaire (IPAQ) is under development, but has not yet been used in representative surveys (www.ipaq.ki.se).

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[3] Starling R.D., Matthews D.E., Ades P.A., Poehlman E.T.: Assessment of physical activity in older individuals: a doubly labeled water study. J Appl Physiol 1999: 86: 2090-2096.

[4] Sjöström M. Level and pattern of physical activity in the population. Abstract. In Miilunpalo S, Tulimäki (ed.). International Symposium on Health-Enhancing Physical Activity (HEPA). Evidence-based Promotion of Physical Activity. Helsinki, Finland, September 1-2, 2002. Book of Abstracts. Tampere: UKK Institute, 2002: 67.

[5] Bernstein M, Sloutskis D, Kumanyika S, Sparti A, Schutz Y, and Morabia A. Databased Approach for Developing a Physical Activity Frequency Questionnaire. Am J Epidemiol 1998;147:147-54.

[6] Sequeira MM; Rickenbach M; Wietlisbach V; Tullen B; Schutz Y. Physical activity assessment using a pedometer and its comparison with a questionnaire in a large population survey. Am J Epidemiol 1995 Nov 1;142(9):989-99.

[7] Mäder U, Martin B, Schutz Y, Bernstein M, Marti B. Physiological validation study of five widely-used epidemiological physical activity short questionnaires, based on heart rate monitoring, accelerometry and indirect calorimetry. Research report. Magglingen: Federal Office of Sports, Institute of Sport Sciences, 2002.

[8] Martin BW, Mäder Urs. Körperliches Aktivitätsverhalten in der Schweiz. In: Samitz G, Mensink G (Hrsg). Körperliche Aktivität in Prävention und Therapie. Evidenzbasierter Leitfaden für Klinik und Praxis. München: Marseille Verlag GmbH, 2002.

2.3. Data sources for health-related physical activity assessment in Switzerland

The Swiss Health Survey is a large (nearly 20'000 participants in 2002) representative population survey conducted by the Swiss Federal Statistical Office every five years and is also the most reliable and the most important data source for health-related physical activity in Switzerland on a national scale. It has used an item on sweat episodes in physical activities during leisure time – that has been shown to correlate well with overall physical activity measured by pedometers [6] - since 1992, and a secondary analysis of the respective data was published in 1997 [9]. The Swiss Health Survey 1997 included several more items on physical activity and has given the opportunity to study the associations between physical activity behaviour and several health variables in more detail [10]. Among others, it contained an item on daily transport by bicycle or by foot. The Swiss Health Survey 2002 encompassed additional questions on activities of moderate intensity, its results will be available in early 2004.

In a supplementary smaller study, the Swiss HEPA survey 1999, activities of moderate intensity and intention for behavioural change were assessed for the first time [10]. The Swiss HEPA survey 2001, again carried out in 1500 participants, has allowed comparison of the prevalence data with two years before and has also used a new set of less suggestive items [11].

The Swiss Household Panel (www.swisspanel.ch) carried out annually since 1999 in more than 5000 households also contains some items on physical activity and allows the observation of spontaneous change in activity patterns in the same individuals as well as the cross-sectional and longitudinal associations with potentials predictors on the individual and on the household level.

2.4. Methods of walking and cycling assessment

For the measurement of travel behaviour and also transport related physical activity, methods used are diaries, questionnaires, manned or automated counting stations and as a new approach in some studies, but not yet in routine use for monitoring also GPS. While diaries, questionnaires and devices like GPS provide data on individuals, counting stations can only provide aggregated information.

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[9] Calmonte R., Kälin W.: Körperliche Aktivität und Gesundheit in der Schweizer Bevölkerung. Eine Sekundäranalyse der Daten aus der Schweizerischen Gesundheitsbefragung 1992. Berne, Institute for Social and Preventive Medicine, 1997.

[10] Martin BW, Lamprecht M, Calmonte R, Raeber PA, Marti B. Körperliche Aktivität in der Schweizer Bevölkerung: Niveau und Zusammenhänge mit der Gesundheit. Gemeinsame wissenschaftliche Stellungnahme von Bundesamt für Sport (BASPO), Bundesamt für Gesundheit (BAG), Bundesamt für Statistik (BFS) und Netzwerk Gesundheit und Bewegung Schweiz. Schweiz Z Sportmed Sporttraumatol 2000; 48 (2): 87-88 und BAG-Bulletin 2000; 47: 921-923.

[11] Martin BW. Physical activity related attitudes, knowledge and behaviour in the Swiss population: comparison of the HEPA Surveys 2001 and 1999. Schweiz. Schweiz Z Sportmed Sporttraumatol 2002: 50 (4): 164-168.

2.5. Data sources for walking and cycling assessment in Switzerland

The most important data source on the national level is the scientific survey of the population's travel behaviour conducted by the Swiss Federal Office for Spatial Development and the Swiss Federal Statistical Office (travel behaviour microcensus [12]) carried out every five years since 1974.

In 1974 and 1979, the survey used diaries, in 1984 and 1989 written questionnaires, and in 1994 and 2000 it was conducted as a whole year telephone survey (http://www.are.admin.ch/are/en/verkehr/mobilitaetskennziffern/index.html).

The 2000 microcensus included nearly 30'000 participants selected in a random-random-procedure (randomisation first at the household, and then at the individual level) who were asked about every travel distance of more than 25 meters during the preceding day with respect to distance and time travelled, transport mode and purpose.

Similar surveys are carried out by the Federal Statistical Office for transport and tourism and by the University of St. Gallen for the travel market Switzerland, but an integration of the respective results has not yet taken place. None of the surveys mentioned includes information on overall physical activity.

Systematic counting station networks on a national level exist only for motorised transport. Some counting on cycling is carried out by the foundation "Cycling in Switzerland" (www.cycling-in-switzerland.ch) and used for modelling, but an actual national cycling counting network is only in the planning stage. Some of the bigger cities in Switzerland like for example Berne or Zurich use systematic counting for walking and cycling, but a national counting station network for walking does not yet exist.

An integration of data from surveys and counting stations has not yet taken place on a larger scale.

2.6. Conclusions and comments

Elements of a longitudinal monitoring system based on surveys have been established in Switzerland for both overall physical activity and walking and cycling as transport-related physical activity. An integration of the data from both sources has not yet taken place.

The fact that these monitoring systems rely solely on questionnaire data imposes limitations on inter-cultural comparisons both within the country and with other countries. The use of objective measurements like accerelometry might open up new possibilities in this aspect.

[12] Bundesamt für Raumentwicklung, Bundesamt für Statistik: Mobilität in der Schweiz, Ergebnisse des Mikrozensus 2000 zum Verkehrsverhalten. Bern und Neuenburg: Bundesamt für Raumentwicklung, Bundesamt für Statistik, 2001.

3. Physical activity patterns

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[2]Federal Office for Spatial Development, Switzerland

3.1. Introduction

Though the importance of regular physical activity for health is beyond any doubt on the individual as well as on the public health level, there is only a limited number of countries like Finland and Canada that have had a well-established monitoring system in place for many years. A number of countries have begun to establish national representative surveys on physical activity since the 1990s, but intercultural and international comparisons remain difficult due to the methodological issues mentioned in chapter 1.

Nevertheless, the public health importance of regular physical activity is such that estimates of patterns of physical activity are needed, though there does not yet exist any internationally agreed definition or measure of physical activity on the population level [13].

3.2. Physical activity patterns in Switzerland

Since the Swiss Health Survey 1992, systematic information about physical activity patterns of the Swiss population has been available. The Surveys 1992 and 1997 did not include any items relating directly to the current activity recommendations which were only issued in 1999 (chapter 4), but a question on sweating induced by leisure time physical activity has been included since 1992. A distinction was thus made between inactive (less than one sweating episode per week), moderately active (1 or 2 sweating episodes per week) and active (more than 3 leisure time sweating episodes) individuals [14].

Although the interval between the first and second health surveys was just five years, changes in physical activity have occurred over this short period [15]. Whereas the proportion of those sweating several times a week as a result of physical activity remained almost constant between 1992 and 1997, striking shifts had occurred in the percentages for the moderately active and inactive groups: the proportion of inactive individuals rose by about four percentage points between 1992 and 1997

[13] WHO. The World Health Report: 2002: Reducing risks, promoting healthy life. Geneva: World Health Organisation WHO, 2002.

[14] Calmonte R., Kälin W.: Körperliche Aktivität und Gesundheit in der Schweizer Bevölkerung. Eine Sekundäranalyse der Daten aus der Schweizerischen Gesundheitsbefragung 1992. Berne, Institute for Social and Preventive Medicine, 1997.

[15] Lamprecht M, Stamm HP. Bewegung, Sport und Gesundheit in der Schweizer Bevölkerung. Eine Sekundäranalyse der Daten aus der Schweizerischen Gesundheitsbefragung 1997 im Auftrag des Bundesamtes für Sport. Forschungsbericht. Zurich, L&S Sozialforschung und Beratung AG, 1999 (Short version available in German, French, Italian and English).

(table 1). In other words: physical inactivity in the Swiss population has increased by over a tenth in just five years.

Leisure time sweating	1992 (n=14'676)	1997 (n=12'727)
3 days/week and more	26.3%	26.9%
1 to 2 days/week	37.8%	33.7%
less than 1 day/week	35.7%	39.4%
Total	100.0%	100.0%

Table 1. Proportion of inactive, moderately active and active individuals in the Swiss health Surveys 1992 and 1997, based on the number of days with sweating episodes during leisure time (adapted from [3]).

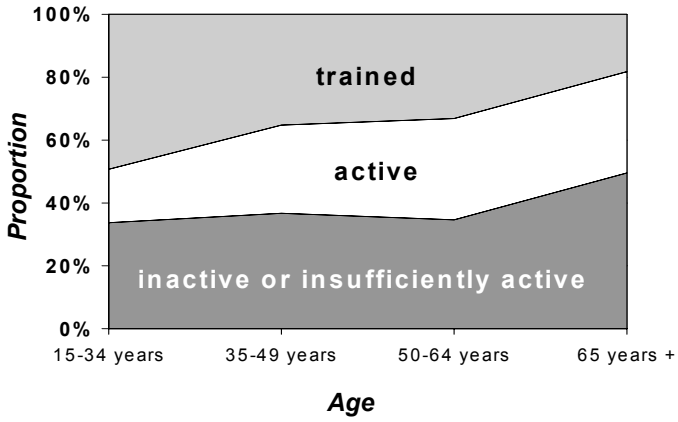
An accentuation of social differences was also observed in physical activity between 1992 and 1997. Specifically, inactivity showed a particularly sharp rise in those population groups that had already been characterized by little physical activity. The differences in activity level in respect to gender, age, linguistic region, education and household income have increased - dramatically for some indicators - between 1992 and 1997. The principal findings can be summarized as follows:

- Whereas the proportion of inactive men only increased by about two percent, inactivity rose in women - who were already less active in 1992 - by around six percent. This gender-specific difference in leisure time physical activity, which is often attributed to historical inequalities in basic conditions, has therefore not declined – as is often assumed – but rather increased. As regards the proportion of active individuals, a serious gender difference is already apparent in the 15 to 24 year age group.
- The same applies to the differences relating to age and region. Here too, inactivity rose particularly in those groups that were already fairly inactive. Although a slight increase in physical activity was noted in the 15 to 24 and 25 to 34 year age groups, inactivity has increased dramatically among those aged over 55.
- In German-speaking Switzerland, the groups of both active and inactive individuals increased slightly at the expense of the moderately active group. In the French- and Italian-speaking areas of Switzerland, on the other hand, growth was only observed in the inactive group.
- Regardless of age, sex or region, inactivity increased primarily among the least educated and those with lower household incomes, while minor changes only were apparent among the better educated and higher income groups.

The 1999 HEPA survey with about 1500 participants has produced the first activity prevalences that could be correlated directly to the new recommendations for health-enhancing physical activity (HEPA) (chapter 3): 37% of the Swiss interviewees were not active at the level of the minimum recommendations and could therefore be classed as inactive. 26% reported half an hour of moderate intensity activities on most days of the week (but without any endurance type training), while a further 37% reported at least twenty minutes of vigorous intensity on three days of the week (figure 1)[16].

[16] Martin BW, Lamprecht M, Calmonte R, Raeber PA, Marti B. Körperliche Aktivität in der Schweizer Bevölkerung: Niveau und Zusammenhänge mit der Gesundheit. Gemeinsame

Figure 1. Physical activity by age group in the Swiss HEPA survey 1999. Trained individuals report at least 3 activity sessions of 20 minutes of vigorous intensity weekly; active individuals report at least half an hour of moderate intensity activity daily; inactive individuals report less or no activity at all.



These results were derived from algorithms assessing the stages of change of the transtheoretical model [17]. Target behaviours were half an hour physical activity daily with at least moderate intensity and three times twenty minutes of activities of vigorous intensity respectively. The HEPA survey 2001 has shown no difference in the prevalence of inactivity in comparison to 1999 when using the same items [18], but a considerably higher percentage of inactive individuals (58%) when using an alternative set of items to assess activities of both moderate and vigorous activity in a two-step-procedure (on how many days per week; with what average duration) and providing a continuous measure of physical activity.

The Swiss Health survey 1997 contained an item on daily transport by bicycle or foot. According to the data, 40.3% of the Swiss population spends 20 minutes or more per day using these forms of transport, 16.0% less than twenty minutes and 43.7% neither walk nor cycle regularly [3].

Transport mode	Daily distance	Time spent	Number of trips
Walking	4.6%	34.3%	40.1%
Cycling	2.5%	5.6%	6.0%
Mot. individual transport	69.5%	43.6%	41.6%
Public transport	17.7%	11.4%	10.3%

wissenschaftliche Stellungnahme von Bundesamt für Sport (BASPO), Bundesamt für Gesundheit (BAG), Bundesamt für Statistik (BFS) und Netzwerk Gesundheit und Bewegung Schweiz. Schweiz Z Sportmed Sporttraumatol 2000; 48 (2): 87-88 und BAG-Bulletin 2000; 47: 921-923.

[17] Marcus BH, Selby VC, Niaura RS, Rossi JS.Self-efficacy and the stages of exercise behaviour change. Research Quarterly for Exercise and Sport 1992; 63: 60-66.

[18] Martin BW. Physical activity related attitudes, knowledge and behaviour in the Swiss population: comparison of the HEPA Surveys 2001 and 1999. Schweiz. Schweiz Z Sportmed Sporttraumatol 2002: 50 (4): 164-168.

Total	100%	100%	100%

Table 2. Modal split in Switzerland according to the travel behaviour in the microcensus 2000 [7]

According to the Swiss scientific survey of the population's travel behaviour (travel behaviour microcensus [19]) 2000, walking and cycling are important transport modes in Switzerland. 46 % of trips (journey stages) per day and 40% of the time spent for travel purposes (average travelling time per day: 85 minutes) can be attributed to forms of non-motorised transport, 42% and 44% to motorised individual transport (table 2). In 80% of all travel episodes, only one transport mode is used, in 10% of all journeys non-motorised transport is used jointly with car use, in 9% jointly with public transport. Modal split differs according to the purpose of travel (table 2)

Purpose	Walking	Cycling	Total
Commuting	33%	6%	39%
Education	55%	13%	68%
Shopping	45%	6%	51%
Business transport	23%	3%	26%
Service and accompanying transport	24%	2%	26%
Leisure time	42%	6%	48%
All purposes	40%	6%	46%

Table 3. Contribution of non-motorised forms of transport to the modal split according to the purpose of travel in the microcensus 2000 [7]

According to the survey results, the contribution of non-motorised transport to the modal split is more important in the age groups below 17 years and above 65 years than in the age groups between, more important in women than in men and more important in the German speaking than in the French or in the Italian speaking parts of Switzerland.

3.3. International physical activity patterns

The World Health Report 2002 reports summary statistics for physical activity, though indicating that they are derived from a number of direct and indirect data sources and a range of survey instruments and methodologies [1]: "The global estimate for prevalence of physical inactivity among adults is 17%, ranging from 11% to 24% across subregions. Estimates for prevalence of some but insufficient activity (<2.5 hours per week of moderate activity) ranged from 31% to 51%, with a global average of 41% across the 14 subregions."

[19] Bundesamt für Raumentwicklung, Bundesamt für Statistik: Mobilität in der Schweiz, Ergebnisse des Mikrozensus 2000 zum Verkehrsverhalten. Bern und Neuenburg: Bundesamt für Raumentwicklung, Bundesamt für Statistik, 2001.

In 1999 a report was published on a study carried out in 15 member states of the European Union [20]. This survey contained items on physical activities of moderate intensity. The proportion of individuals reporting no more than 3 hours per week of such activities was 57% in the EU average, with the lowest values being 32% and 33% in Sweden and Finland. Switzerland's neighbouring countries had the following prevalences: Germany 56%, Austria 38%, France 63%, Italy 66%.

3.4. Conclusions and Perspectives

Physical inactivity is a worldwide public health problem. Though methodological issues still restrict the possibilities to quantify this problem in absolute terms and to carry out intercultural and international comparisons, subgroups with particularly low activity levels and changes over time can be documented. A systematic integration of data from the health and from the transport sector has not yet taken place.

The availability of epidemiological data is an important element in the political process leading to a better recognition of the importance of HEPA on the national and international level and the current attempts for standardised measurement procedures will play an important role in this process.

[20] European Commission, Directorate-General for Employment, Industrial Relations and Social Affairs. A pan-EU survey on consumer attitudes to physical activity, body-weight and health. Luxembourg: Office for Official Publications of the European Communities, 1999.

4. Health Impacts of Physical Activity

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4.1. Diversity of effects

The importance of physical activity has been well established over the last decades and a wealth of different endpoints has been identified (table 1). The World Health Report 2002 cites reductions in the risk of cardiovascular disease, colon and breast cancer as well as type 2 diabetes as the most important effects [21], but other effects like improvements in musculoskeletal health (osteoarthritis, low back pain, osteoporosis, falls), control of body weight, reductions in symptoms of depression, anxiety and stress, and risk reduction for prostate cancer are mentioned as well.

⇧	Life expectancy
⇩	Cardiovascular disease
⇩	Diabetes II
⇩	Obesity
⇩	Colon cancer
⇩	Breast cancer
⇩	(Prostate cancer)
⇩	(Pancreatic cancer)
⇩	Osteoporosis
⇩	Symptomatic gallstone disease
⇩	Depression
⇧	Well being
⇧	Stress tolerance
⇧	Independence in old age

Table 1. Overview of health effects of physical activity

These relationships and the association with overall mortality have already been shown and commented upon in the US Surgeon General's Report on Physical Activity and Health [22] and other encyclopaedic reviews [23], more recent publications have indicated further effects on the risk of cholecystectomy [24] or on pancreatic cancer [25].

[21] WHO. The World Health Report: 2002: Reducing risks, promoting healthy life. Geneva: World Health Organisation WHO, 2002.
[22] Department of Health and Human Services: Physical Activity and Health: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
[23] Marti B, Hättich A. Bewegung – Sport – Gesundheit: epidemiologisches Kompendium. Bern; Stuttgart; Wien: Haupt, 1999.
[24] Leitzmann MF, Rimm E, Willet WC et al. Recreational physical activity and the risk of cholecystectomy in women. N Engl J Med 1999; 341: 777-84.
[25] Michaud DS, Giovannucci E, Willett WC, Colditz GA, Stampfer MJ, Fuchs CS. Physical Activity, Obesity, Height, and the Risk of Pancreatic Cancer. JAMA. 2001; 286: 921-929.

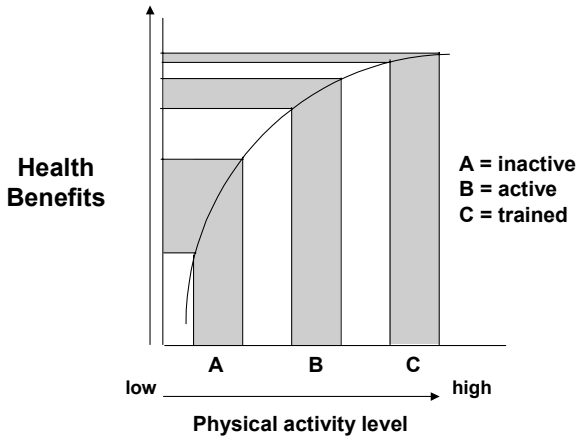

Figure 1. Dose-response relationship for physical activity and health (adapted from [26])

While most of the earlier studies included only male participants, more recent research has shown that the effect size and the dose-response relationship are comparable for both genders [27]. A dose-response-relationship could be demonstrated for most of the endpoints mentioned above, most clearly for overall mortality and cardiovascular morbidity (figure 1)[2, 3, 6].

While most of the studies have studied the associations with overall physical activity, only very few have been able to study the independent effects of transport related physical activity [28, 29].

4.2. Recommendations for health-enhancing physical activity

The first applications of this evidence to public health were the 1995 recommendations of the US-American Centers for Disease Control (CDC) and the American College of Sports Medicine (ACSM). They were the first recommendations to focus on activities of so called moderate intensity [30] that included many activities of everyday life like brisk walking. These recommendations were also the first acknowledging the contribution of shorter “bouts of activity” by allowing the accumulation of activity episodes of about 10 minutes or more. An attempt to include not only minimal recommendations, but also the additional effects of further or more intensive activity [1,2] is the physical activity pyramid of the recommendations for health-enhancing physical activity currently in use in Switzerland (figure 2).

[26] Haskell W.L.: Health consequences of physical activity: understanding and challenges regarding dose-response. Med Sci Sports Exerc 1994; 26: 649-660.
[27] Oguma Y, Sesso HD, Paffenbarger RS Jr, Lee IM. Physical activity and all cause mortality in women: a review of the evidence. Br J Sports Med 2002 Jun;36(3):162-72.
[28] Andersen LB, Schnohr P, Schroll M, Hein HO. All-cause mortality associated with physical activity during leisure time, work, sports, and cycling to work. Arch Intern Med 2000 Jun 12;160(11):1621-8.
[29] Wagner A, Simon C, Ducimetiere P, Montaye M, Bongard V, Yarnell J, Bingham A, Hedelin G, Amouyel P, Ferrieres J, Evans A, Arveiler D. Leisure-time physical activity and regular walking or cycling to work are associated with adiposity and 5 y weight gain in middle-aged men: the PRIME Study. Int J Obes 2001; 25: 940-948.
[30] Pate R.R., Pratt M., Blair S.N., Haskell W.L., Macera C.A., Bouchard C., et al.: Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. JAMA 1995; 273: 402–407.

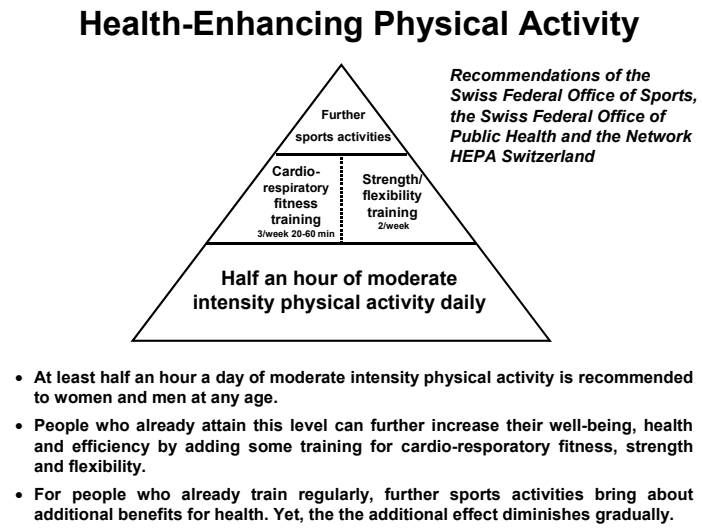

Figure 2. The recommendations for health-enhancing physical activity currently in use in Switzerland

4.3. First estimations of health effects on the population level

Even though the differences in health outcomes between more active and less active subgroups in observational studies and the effect sizes in the more recent randomised interventional studies [31] are impressive, the exact quantification of the relationship remains a challenge due to the measurement issues discussed in the chapter 2. Just physiologically, physical activity is characterised by intensity, duration and frequency [32], and there exists no internationally agreed definition or measure of it [1]. Therefore some arbitrary assumptions have to be made in order to apply the effect sizes obtained from the literature in effect estimations on the population level.

	Relative risk for the disease	Relative risk for mortality	Direct treatment costs	Indirect costs
Cardiovascular disorders	1.84	1.43	2239	2556
Type II diabetes	1.88	3.00	3508	636
Colon cancer	1.90	1.68	52165	0
Osteoporosis	2.00	-	630	0
Breast cancer	1.39	1.00	28490	0
Depression	3.15	-	1983	0
Back pain	1.36	-	739	1126
Hypertension	1.47	1.00	693	0

Table 2. Assumptions for effect sizes in a Swiss study on the health effects of physical activity [33]. Estimates for costs are in Swiss francs.

[31] Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM; Diabetes Prevention Program Research Group. Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin. N Engl J Med 2002;346(6):393-403.

[32] Marti B, Martin BW: Sportliches Training oder Bewegung im Alltag zur Optimierung von Gesundheit und Lebensqualität? Therapeutische Umschau 2001; 58: 189-195.

[33] Martin BW, Beeler I, Szucs T, Smala AM, Brügger O, Casparis C, Allenbach R, Raeber PA, Marti B. Economic benefits of the health-enhancing effects of physical activity: first estimates for Switzerland. Scientific position statement of th Swiss Federal Office of Sports, Swiss Federal Office of Public Heal, Swiss Council for Accident Prevention, Swiss National Accident Insurance Organisation (SUVA) , Department of Medical Economics of the Institute of Social and Preventive Medicine and the University Hospital of Zurich and the Network HEPA Switzerland. Schweiz. Schweiz Z Sportmed Sporttraumatol 2001; 49 (3): 131-133.

An example of the assumptions to be made for effect sizes is shown in table 2. By assuming a proportion of physically inactive individuals of 37%, this study has estimated that a number 1.4 million cases of disease, almost 2'000 deaths and direct treatment costs of 1.6 billion Swiss francs (1.1 billion Euro) are caused by physical inactivity in Switzerland each year. Using exactly the same assumptions except for a proportion of inactive individuals of 58% (identical with the WHO global estimate [1] and according to most recent findings also more likely for Switzerland [34]), the respective estimates would be 1.9 million cases of disease, 2'700 deaths and direct treatment costs of 2.2 billion Swiss francs (1.5 billion Euro).

'It is estimated that about 36% of deaths from CHD in men and 38% of deaths from CHD in women are due to lack of physical activity and that 9% of deaths from CHD in the UK could be avoided if people who are currently sedentary or have a light level of physical activity increased their level of physical activity to a moderate level.'[35]

The global estimations of WHO indicate that physical inactivity causes about 10–16% of cases each of breast cancer, colon and rectal cancers and diabetes mellitus, and about 22% of ischaemic heart disease, resulting in 1.9 million deaths and 19 million DALYs (disability-adjusted life years)[1].

[34] Martin BW. Physical activity related attitudes, knowledge and behaviour in the Swiss population: comparison of the HEPA Surveys 2001 and 1999. Schweiz. Schweiz Z Sportmed Sporttraumatol 2002: 50 (4): 164-168.

[35] National Heart Forum. Coronary heart disease: Estimating the impact of changes in risk factors. London The Stationery Office, 2002.

5. The effectiveness of interventions to increase physical activity

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5.1. Introduction

The outstanding importance of physical activity as a health resource and for the prevention of various chronic diseases has been extensively been documented (U.S. Department of Health and Human Services, 1996). In the last decade, the recommendations for health enhancing physical activity (HEPA) have focussed on moderate intensity physical activity as part of an active lifestyle. In Switzerland, national authorities have adapted the international recommendations for health enhancing physical activity, which are defined as the accumulation of 30 minutes or more of moderate intensity activities on most, preferably all days of the week, or alternatively at least 20 minutes of vigorous exercise on three or more days of the week (Bundesamt für Sport (BASPO) et al., 2002). Nevertheless, one third of the Swiss adult population does not meet either of these two recommendations (Martin et al., 1999; Martin 2002), which causes 1.4 million cases of disease annually, almost 2'000 deaths and direct treatment costs of 1.6 billion Swiss francs (Martin et al., 2001). In Switzerland, the need for interventions to promote physical activity has been recognized and has influenced the political agenda-setting (BASPO, 2000). From the public health point of view, it is most important to reach individuals and sub-groups with the lowest baseline activity.

Four levels of interventions to increase physical activity have been described (King, 1994):

Level 1: **legislative / policy**

Examples: Bike paths, compulsory school PE, countryside access, road pricing

Level 2: **organisational / environmental**

Examples: Workplace, local council initiatives, mass media approaches, environmental prompts, speed bumps for cars

Level 3: **inter-personal**

Examples: Teaching approaches, provision of classes, peer led groups

Level 4: **individual**

Examples: Consultations, fitness assessment, written materials

Interventions such as transport policies and environmental changes which promote or facilitate lifestyle activities like walking and cycling are of particular interest. They are located mainly on level 1, to some degree on level 2. There is consensus among physical activity promotion experts (e.g. King, 1998, Sallis & Owen, 1999, Sallis, Bauman & Pratt, 1998), that there is a great potential in these type of interventions to have an impact on public health, because entire populations of inactive people can be influenced.

5.2. Effects of physical activity interventions: Experiences from Switzerland

The importance of regular physical activity for health is well known in Switzerland and physical activity promotion activities are generally appreciated by the general population. Nevertheless, until recently the prevalence of physical inactivity has still been rising in the country. A growing number of large scale physical activity promotion projects have begun to target physically inactive individuals.

«Allez Hop!» is a nationwide project of the national health insurance companies, the foundation Health Promotion Switzerland, the Swiss Olympic Association and the Federal Office of Sports offering training and information courses aimed at motivating and supporting previously inactive people to become regularly active. The program manages to reach mainly middle age women, a segment of the population, which is less active than average. However, in 1997 62% of the course participants were already active at least three times a week. In one year follow-up of a sub-sample, the proportion of active individuals increased from 72% to 86% (Stamm et al., 2001). The 514 fitness trails ***"Vita Parcours"*** are sponsored by an insurance company and offer standardised sign posts and equipment for fitness exercises on a 2 to 3 km running track in the forest. In a representative survey more than 11.5% of the Swiss population declared to use the traditional "Vita Parcours" regularly during the summer months (Marti et al., 2002). In the ***action plan "environment and health"*** (Kahlmeier et al, 1997, Haller et al., 2000), a program of the Federal Office of Public Health in Collaboration with the Swiss Agency for the Environment, Forests and Landscape, projects on "mobility and well-being" are initiated and supported in one pilot region. One goal of the program is to reduce the negative effects of motorized traffic and increase the proportion of walking and cycling.

First intervention studies indicate both the possibilities and the limitations of interventions for behavioural change. The ***"Office in Motion"*** study used the ecological or settings approach in a white collar worksite intervention and has shown encouraging changes in previously inactive individuals. Energy expenditure trough moderate intensity activities increased particularly in those intervention worksites with the lowest activity levels at baseline (Titze et al, 2001). The one year follow up results suggest, that mainly changes in active commuting were maintained (unpublished results). A randomised controlled study was conducted in the primary care setting ***("Active upon Advice"***) offering a counselling session to increase lifestyle activities to the intervention group and an advise-only treatment to the controls. Almost half of the initially inactive patients were regularly active after one year – though both in the intervention and control group (Jimmy & Martin).

These experiences from Switzerland demonstrate that behavioural change in previously inactive individuals is possible. Expectations concerning the size of the intervention effect have to be realistic. Promotion of health enhancing physical activity remains a challenge.

However, to our knowledge, no evaluation of changes in individual physical activity behaviour through environmental or policy interventions to promote cycling and walking has been conducted in Switzerland so far.

5.3. Effects of physical activity interventions: International experiences

A recent systematic review summarizes the effectiveness of the different types of interventions to increase physical activity (Kahn et al., 2002). There is good evidence, that individually adapted interventions or community wide campaigns are effective. Environmental and policy level interventions were defined as interventions "creating or enhancing access to places for physical activity combined with informational outreach". Ten studies were included in the review, all from the

US. Eight studies were worksite interventions. The intervention programs involved changes such as provision of walking trails, building exercise facilities or provision of access to nearby facilities, all supported by informational and motivational measures on the individual level. Outcome measures were changes in aerobic capacity, energy expenditure, self-reported physical activity, frequency of physical activity or exercise scores. All studies were effective to increase physical activity. The authors conclude, that there is strong evidence that interventions "creating or enhancing access to places for physical activity combined with informational outreach". are effective to increase physical activity.

However, it seems that in a minority of these intervention included changes of the physical environment or even transport policies to encourage walking and cycling. On a website summarizing the results of this review, it is announced, that the accumulation of experience regarding "Transportation policy and infrastructure changes to promote non-motorized transit" and "Urban planning approaches - zoning and land use" is in progress (www.thecommunityguide.org).

Earlier reviews specifically on environmental and policy interventions (Sallis et al., 1998) confirm that there are only few studies available on this level of interventions, even if also here studies in a broader sense were included.

Two European studies on worksite interventions were not included in the recent review on effectiveness (Kahn et al, 2002). A promotion project in an industrial plant in Finland demonstrated, that walking or cycling to work can be successfully promoted, also among those not active at a regular basis (Oja et al., 1998). A limitation of this study is the uncontrolled design. In an randomised controlled trial in Scotland self-help material for active commuting to work was delivered to the intervention group (Mutrie et al., 2002). In the intervention group, the increase of walking to work was significantly higher than in the control group. No difference between the groups could be observed for cycling to work. The authors conclude, that before cycling can be promoted on the individual level, the necessary improvements on the environmental and policy level must be realised. These two studies promoted cycling and walking to work – however, also these interventions were located on the individual and organisational level and did not touch transportation policies or environmental changes.

Obviously, also on the international level, knowledge is scarce on the effectiveness of interventions targeting policy and environmental changes to increase physical activity. A current research focus is the assessment of environmental determinants for cycling and walking in cross-sectional studies (Moudon & Lee, 2003). For the first time, physical activity behaviour was assessed objectively with accelerometers, comparing two different neighbourhoods in San Diego (Saelens et al., 2003). The high-walkability neighbourhood had a mixture of single-family and multiple-family residences, and non-residential land uses such as shops and restaurants along the main road. The low-walkability neighbourhood had predominantly single-family residences and only a small commercial area in the periphery. Residents of the high-walkability neighbourhood had more than 70 minutes more activity per week than residents of the low-walkability neighbourhood. There was no difference in self-reported walking for exercise, leisure physical activity or objectively assessed vigorous activity. The 70 minute difference could therefore be mainly attributed to transport walking.

A randomised controlled trial of site specific advice for school travel plans in England showed an increase in the development of school travel plans, but after one year of follow-up there were no significant changes in travel pattterns among the schoolchildren (Rowland et al, 2003).

Without any doubt, there are many policies and interventions developed and realized by urban planning and transport agencies, which have the potential to increase physical activity levels also

among those not active on a regular basis. Just one example is the "Cycle City Odense" in Denmark where with more than 60 initiatives cycling was successfully increased at the end of the 20est and beginning if the 21st century, while in the rest of the country cycling decreased (www.cycleby.dk/english.asp). But it seems, that such interventions have never been evaluated for a physical activity outcome on the level of the individuals.

5.4. Conclusions

- In general, most experience regarding design and feasibility of intervention studies and the effects of these programs is available for interventions on the individual and group level. There is good evidence that interventions on these levels can increase physical activity among the inactive.
- There is good evidence that interventions in the worksite setting are effective to increase physical activity.
- There seem to be virtually no studies assessing the impact of interventions targeting transport policies and environmental changes on physical activity – neither on their effect to increase individual physical activity behaviour in general, and particularly not regarding their potential to reach the inactive segment of a population. An observed increase in bicycle use for example is far less relevant for public health if it occurs in individuals already physically active in other ways than if the same increase could be observed in a previously inactive group.
- It is difficult to quantify and compare intervention effects because of different measures for physical activity and the respective outcomes of the studies.

Therefore:

- Examples of good practice have to be documented.
- Baseline evaluations before the start of policy and environmental interventions are essential to assess any changes in individual physical activity behaviour.
- In general there are not enough financial resources in the health and physical activity sector to conduct environmental interventions. Therefore inter-sectoral collaborations with the traffic and environmental sector are necessary. The interventions of these partners should be evaluated also regarding individual physical activity behaviour.

5.5. Case Study Project in Switzerland

In view of the situation described above a case study was launched in Switzerland by the Division Environment and Health of the Institute of Social and Preventive Medicine of the University of Basle, by the Swiss Federal Office of Sports and by the Swiss Federal Office of Public Health. During the first phase of the project, the following questions were studied (see executive summary of the intermediate report in the annexe):

- Do transport interventions in Switzerland have the potential to promote Human Powered Mobility (HPM) or daily physical activity especially in formerly inactive people?
- Are there any Swiss transport intervention projects suitable as a case study by giving evidence that Human Powered Mobility has been increased?

Though quite a number of projects were identified with the potential to promote Human Powered Mobility (HPM) or daily physical activity in formerly inactive individuals, in none of them data was

available to quantify these effects. Therefore data collection in a number of selected projects is beginning in 2004 in order to estimate their effectiveness in the promotion of physical activity.

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Annexe:

University of Basel

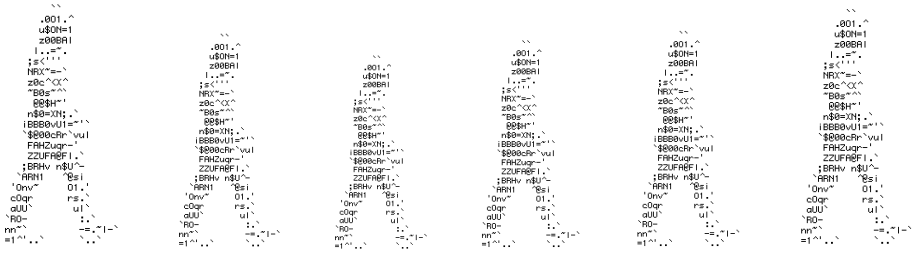
UNI BASEL

Institute for Social and Preventive Medicine

Director: Prof. Dr. med. U. Ackermann-Liebrich

October 2003

Project Title: **"EFFECTIVENESS OF TRANSPORT INTERVENTIONS TO PROMOTE HUMAN-POWERED MOBILITY (HPM) OR DAILY PHYSICAL ACTIVITY"**



Project manager: Prof. Dr. med. Ch. Braun-Fahrländer

Project researcher: Oliver Thommen Dombois, lic phil. I

Preface

There continue to be a great number of institutional obstacles to a transportation policy that supports bicycles and pedestrians, although there are many reasons to promote walking and cycling. However, interest in pedestrian and bicycle travel has grown in recent years. The present research report was in part written in view of the forthcoming International Conference of Health and Environmental Ministers in Budapest in June 2004. Since Switzerland is a member of a multinational working group of the "UN/ECE-WHO Pan-European Programme for Transport, Health and Environment" (THE PEP), we were interested in determining whether any of Switzerland's transport intervention projects would be suitable for presentation at the Budapest conference as a case study on the "Effects of walking and cycling promotion on physical activity behaviour". The working group is dealing with the impact of various forms of transport or travel on public health. At the request of the Federal Office of Sports (FOSPO) and the Swiss Federal Office of Public Health (SFOPH), the Institute for Social and Preventive Medicine at the University of Basel has compiled a systematic list of planned or already completed transport intervention projects and has examined their effective impact on physical activity patterns. This type of documentation was lacking in Switzerland until now. In concrete terms, the present document is concerned with evaluating the potential of transport intervention projects for promotion of human-powered mobility or daily physical activity. Fourteen projects in Switzerland are analysed from this specific perspective. The goal is not to rate these projects per se, since all of them represent important milestones on the path to developing a transport system that is more compatible with environmental and social objectives, but to present a systematic documentation of selected Swiss projects. These projects are examined to determine whether they can be used as concrete examples of how human-powered mobility can be promoted, especially in the case of previously inactive individuals. The managers of the various projects have generously provided data for this study and have reviewed the particular sections of the report dealing with their projects. We would like to take this opportunity to thank all the project managers for their constructive cooperation.

"all actions in this world
involve mobility
there is a path to work
and a path to rest
mobilization for war
and a peace movement
the pilgrim flies to the holy city
the executive rafts in the ravine
nothing functions without motion
even slowness needs it
in order to be recognized
even stillness would be nothing
without the comparison
the vibration of atoms
the leaves in the wind
the stars in the heavens
everything flows through space and time
motion means life"
(based on Aristotle)

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1. Introduction

1.1. Background

No-one doubts the health-enhancing effect of regular exercise, and the potential of physical activity is well documented. Nonetheless, the proportion of inactive individuals is increasing both nationally and internationally. One third of the Swiss population suffers from a lack of physical activity. Non-motorized transport (NMT) plays an important role in promoting physical activity. The potential of non-motorized travel – primarily walking and bicycling – is considerable but too little use is made of it. Switzerland is very active in a multinational working group that is part of the "UN/ECE-WHO Pan-European Programme for Transport, Health and Environment" (THE PEP) and deals with the effects of various forms of transportation on public health. Switzerland is currently examining whether it can present an exemplary case study on the "Effects of walking and cycling promotion on physical activity behaviour" in conjunction with the International Conference of Health and Environment Ministers in Budapest in June 2004.

1.2. Research questions

In conjunction with this project, which is being carried out by the Institute for Social and Preventive Medicine at the University of Basel (ISPMBS) at the request of the Federal Office of Sports (FOSPO) and the Swiss Federal Office of Public Health (SFOPH), the following questions were investigated:

- Do transport intervention projects in Switzerland have the potential to promote human-powered mobility or daily physical activity, especially in previously inactive individuals?
- Are there any specific projects that promote human-powered mobility?
- Has any project been documented that would be suitable for presentation as an exemplary case study at the Budapest conference in 2004?
- Are there any projects that could be developed into a case study in the future with proper support and accompanying research?

Transport intervention projects include, first of all, measures involving infrastructure. Such measures include the introduction of 20 mph speed zones, introduction of zones that can serve as meeting areas, roadway redesign, introduction of inner-city auto-free zones and traffic-calming features, improvement of local footpath networks, availability of covered parking areas for bicycles, parking space management, reimbursement of bicycling expenses for business purposes, introduction of a bicycle home-delivery service, etc. Second, transport intervention also includes measures in the areas of communication, information and mobility management. A distinction is made between categories I and II (see Sec. 2.2). Category I includes transport intervention projects that have the explicit goal of promoting daily physical activity and documenting changes in physical activity behaviour. Category II includes intervention projects that are aimed at promoting the shift from motorized to non-motorized travel and therefore have an implicit potential for human-powered mobility. The question is also raised in connection with these projects whether mode-shifting patterns have been documented. Since physical activity in daily life plays an important role in the promotion of physical activity for previously inactive individuals, the present research focuses specifically on this segment of the population.

The research questions listed above were investigated using concrete project examples from Switzerland.

1.3. Methodology

1.3.1. Procedure

To obtain information about relevant projects, an Internet search was performed. In addition, telephone interviews were conducted with project managers and with experts at various federal agencies and in the private sector. The following keywords – often in combination – were used for the

Internet search: transport, transport intervention, physical activity, promotion of physical activity, behavioural changes, (changes in) physical activity behaviour, modal-shift, health, promotion of health, mobility, mobility behaviour, physical activity in daily life, environment, non-motorized transport (or traffic or travel), human-powered mobility.

After the Internet search and the review of available project information, in-depth interviews were requested with the project managers of potentially interesting intervention projects (those having a connection between transport intervention and human-powered mobility). The interviews focused on project goals and any evaluation data concerning human-powered mobility or the modal split, i.e., the distribution among transport modes (are changes documented?). If the interviews – conducted by phone - provided evidence of a potential for promotion of physical activity, the projects were then included in the final selection.

The study examined transport intervention projects and their potential for promoting physical activity and not projects promoting physical activity per se.

1.3.2. Evaluation criteria

The following criteria were used for the systematic investigation of the projects:

- What are the project goals or objectives?
  - → Explicit promotion of human-powered mobility?
    (= Category I, see Sec. 2.2.)
  - → Implicit promotion of human-powered mobility?
    (= Category II, see Sec. 2.2.)
- What did, does or will the intervention consist of? (project description).
- Have the explicit project objectives been evaluated and documented? (initial situation, achievement of objectives).
- Have changes in human-powered mobility or in the modal split been discovered?
- Presentation of any results.
- Analysis of the potential for human-powered mobility (estimate of potential).
- Suitability for further work on the research focus.

2. Project overview

2.1. Projects studied

Fourteen projects were selected on the basis of the selection criteria cited above (see Tab. 1) from a large number of projects. At present, detailed information (interim reports, final reports, etc.) is still lacking on several projects, which prevents in-depth analysis and a final evaluation. The present report covers all the information received by the Institute for Social and Preventive Medicine (O. Thommen) by the end of October 2003.

2.2. Categorization of projects studied

The fourteen projects were combined in the following categories or subcategories based on their characterization.

Project overview			
Title	**Project area & scope**	**Description**	**Project status**
Category I - Promotion of physical activity as an explicit goal			
"Wellness dimension"	Crans-Montana – local	Influencing traffic volume in favour of pedestrians and public transport	Implementation phase
"Shopping on foot"	St. Gallen Rhine Valley – regional	Promotion of shopping on foot	Completed

"It's better on foot"	Canton Neuchâtel	Campaign to raise awareness among the population regarding issues of traffic safety (especially routes to school) and health	Implementation phase
"Experience your city"	Locarno – local	Promoting physical activity through non-motorized forms of mobility	Completed
Category II - Promotion of physical activity as an implicit goal			
A. Alternatives to private motor vehicle traffic			
Burgdorf, a model city for pedestrians and bicycles (FuVeMo)	Burgdorf - local	Promoting walking and cycling through new innovative facilities and services	Implementation of second project phase, 2002-2006
"Mobilo"	Basel, Gundeldingerfeld – on the neighbourhood level	Creation of environmentally compatible facilities and services	Implementation phase
B. Cycling promotion in general			
"Take your bike"	Canton Aargau	Campaign to promote cycling	Completed
"E-TOUR – Electric two wheelers on urban roads"	European demonstration project with Swiss participation (Basel & Mendrisio)	Promotion of electric two wheelers in daily life and in future-oriented mobility concepts	Completed
C. Cycling promotion by companies and institutions			
Pax Versicherungen, Basel	Basel	Cycling promotion by the company	Completed
Spitex Basel	Basel	Indirect promotion of cycling	-
Lucerne Cantonal Hospital	Lucerne	Mobility concept for staff	Implementation phase
Schaffhausen Cantonal Hospital	Schaffhausen	Mobility concept for staff	Implementation phase
D. Roadway design			
"20 mph zones … and children"	Zurich, Leimbach district	Impact of 20 mph zones on residential environment and on children's daily life	Completed
Upgrading and redesigning Seftigenstrasse	Köniz - local	Reducing the dominance of private motor vehicle traffic through infrastructural measures	Completed

Table 1: Overview of the projects studied

3. Description of the projects

The intervention projects are described below by category (cf. Sec. 2.2.). The project information is presented in three steps. First the project objectives and the project itself are described. This is followed by an overview of the results that are significant for our specific research focus and a conclusion (evaluation of potential and suitability for future accompanying research).

3.1. Category I - Promotion of physical activity as an explicit project goal

Four traffic intervention projects that deal explicitly with physical activity behaviour were identified.

3.1.1. "Wellness dimension" project in the Crans-Montana pilot region (in conjunction with the EHAP campaign plan[36])

Project goal:
Short-term: To reduce chronic traffic congestion – primarily in the winter in high sea-son (tourist traffic) – through an integrated policy (including promotion of health). The goal is to influence traffic volume for the benefit of pedestrians and public transport.

Long-term: creation of pedestrian zones and meeting areas in the central areas of Crans and Montana. Public transport and pedestrians are to have priority.

→ *Ultimate goal: mobility patterns that are more compatible with good health and environmental protection.*

Project description:
The Crans-Montana pilot region has been working since the summer of 2001 on a new approach for solving the mobility issue. The objective is to find a permanent overall solution based on a traffic and transportation plan that supports all types of mobility. A completely new traffic layout will be created in Crans-Montana. The goal is to close the centres of the two areas to through traffic, create two large pedestrian zones, and at the same time improve access to the large parking garages located near the town centres. All six municipalities (see map) – Icogne, Lens, Chermignon, Montana, Randogne, Molens – support the project. On a broader scale, 14 different projects are designed to motivate local inhabitants and visitors to the region to change their behaviour. Projects in the following areas have been launched: healthy eating, prevention of tobacco abuse, protection of cultural heritage (probably not within the EHAP framework but as a new project supported by the Montana region itself), energy conservation and promotion of local products. In this report we will take a closer look only at the five projects that involve the area of transport and physical activity.

Crans-Montana-Aminona Pilot Region: Central district and Municipalities

[36] The Swiss Environment and Health Action Plan (EHAP) is being implemented under the direction of the Office for Health and Environment of the Swiss Federal Office of Public Health (SFOPH). Under the APUG campaign plan, three pilot regions – including Crans-Montana – were selected. The Crans-Montana pilot region fits into the "Mobility and wellness" category.

Results:
Of the fourteen subprojects, the following five are related to our research focus:

1) ***Project: "Mobility for everyone"***
Initial measures for creating a smoother traffic flow have been underway since last winter. Traffic-obstructing parking lots have improved and detours have been established in certain places. In addition, measures for reducing illegal parking were instituted, and the use of ski lockers at the bottom of ski lifts was promoted so that more skiers would walk to the lifts. Efforts were made throughout the last ski season to reduce traffic volume and to encourage the use of public transport by installing appropriate signage and introducing specific parking regulations. The initial results have been promising: during the holidays and school vacations in February and March 2003, there was a significant reduction in private motor vehicle traffic, according to the director of the "Mobility for everyone" project group. The data on these results have not yet been made available to us.

2) ***Project: "Teaching trail – the path to sustainable development"***

The goal of this project is to make schoolchildren at the Crans-Montana regional school centre, local families and holiday guests more aware of the advantages of walking and of the concept of sustainable development. A teaching trail that links various locations in the resort with one another was developed with the assistance and input of the schoolchildren. The teaching trail has already been completed and is being used frequently by school classes.

3) ***Project: "Buy better products and drive less"***

Promotion of the sale and purchase of regional produce with the goal of both reducing passenger and delivery traffic and contributing to healthy eating. One result cited in the final report on shopping mobility published by the Haute École Valaisanne[37] shows that approximately 75% of shoppers rely on cars when going shopping (n=195). 20% walk (primarily older individuals), and 5% use public transportation. Bicycles do not seem to be an appropriate choice due to the steep grades. The limited use of public transport is due to the fact that buses run too infrequently and too irregularly, according to local residents. They get stuck in traffic jams, and the fares are too expensive. (People do not seem to be aware that public transport in the central district is free).

4 & 5) ***Projects: "Eat better and be more active" and "Support fitness and wellbeing"***
Physical activity is an explicit project objective for one of these planned projects and an implicit project objective for the other. The stated goal of the first project is to increase the level of physical activity, and this is to be measured by using a standardized questionnaire. According to François Parvex, Crans-Montana Project Manager, the project will most probably not be implemented. As for the second project, the focus will be on those forms of mobility that are compatible with good health. As with the first project, no detailed information about this project is available at the present time. However, according to F. Parvex this project will be essential for reinforcing and implementing the overarching campaigns, "Mobility for everybody" und "Crans-Montana, the region that walks".

Conclusion:
The project entitled "Mobility for everyone" is a genuine transport intervention project. Its goal is to reduce private motor vehicle traffic, and it targets tourists primarily . The second project is aimed at promoting human-powered mobility through a campaign to enhance awareness of sustainability issues. In the case of the third subproject, one doubts whether regional automobile traffic will be reduced by promoting regional produce. The available figures actually indicate that motorized mobility predominates for shopping purposes. All of these projects are still in the initial phase. The last two projects, which could possibly promote physical activity but have a questionable relationship to transport and the environment, are only project ideas at the moment. A telephone survey of 359 of the

[37] Etude de marché - rapport final - "achetez mieux en roulant moins". Haute Ecole Valaisanne (HEV). July 2002.

region's inhabitants was carried out in conjunction with an evaluation of the EHAP program. The questions included questions from the Swiss Health Survey and the physical activity survey as well as new questions with particular relevance for Montana[38]. The questions from the physical activity survey and the Swiss Health Survey can be compared with data for the whole of Switzerland[39]. Plans are to repeat this survey in 2006 in order to determine whether all the projects in Crans-Montana are bringing about changes in daily physical activity and use of transport modes. The findings from the Haute École Valaisanne study on shopping mobility will also be included in a future survey.

The Montana pilot region study is not yet suitable as an exemplary case study since potential changes are expected to take place over the next few years.

In order to create the conditions for a future exemplary case study, the regional survey in Crans-Montana will be supplemented by analogous regional surveys in Verbier (a municipality with automobile traffic that is not planning to become auto-free) and Zermatt (a town where cars are not permitted) in January 2004. This will create genuine reference groups whose development can be compared with that of Crans-Montana.

Information on the projects described above and on other projects is available at the following Internet sites: www.paes-crans-montana.ch and www.apug.ch.

3.1.2. Project: "Shopping on foot"

Project goal:

The "Shopping on foot" pilot project in the St. Gallen Rhine Valley area aims to increase the number of people who regularly walk to stores belonging to Volg, a large grocery chain, to do their shopping. Another objective is to improve walking's image and to increase awareness of one's own behaviour as regards physical activity. The goal is for people to view shopping on foot as a natural thing to do.

In the pilot project, the primary objective was to find out whether and how the public can be involved in a campaign promoting walking. The project's goal is to convince households in the target area not to purchase or use a car (or a second car). The immediate goal of the campaign, which lasted from 10 March to 4 April 2003, is to bring about a change in behaviour. Promoting physical activity is therefore an explicit project objective.

Project description:

The project focuses exclusively on walking, and a grocery store chain (Volg) is promoting it.

To motivate the public, action is taken to improve conditions for pedestrians over the long term. Various forms of advertising are used to bring attention to the campaign, including leaflets distributed to 12,000 households in the shopping radius of the 17 Volg stores or posters in the stores themselves. The leaflets, which were distributed widely throughout the area, included a survey questionnaire and a contest, the goal being to encourage participants to analyse their own behaviour. Using the questionnaire, people were to identify their motives for walking or the reasons for the lack of physical activity. People were also given the opportunity to make suggestions for improving the "pedestrian infrastructure". After completion of the project, the potential for improving local footpath networks, including traffic safety, will be discussed with the various municipalities.

Results:

A total of 12,000 households in 10 communities within the radius of 17 Volg stores between Azmoos,

[38] Evaluation of the Aktionsprogramms zum Aktionsplan Umwelt und Gesundheit (APUG): Ausgangslage in der Pilotregion Crans-Montana zum Teilbereich „Mobilität und Wohlbefinden". ISPM Basel. 2002.

[39] The physical activity survey was the source for questions dealing with people's assessment of the importance of physical activity for health, knowledge of how much physical activity is necessary for a positive impact on health, on the proportion of physically active individuals in Crans-Montana, and on whether the individuals surveyed felt that they themselves were sufficiently active physically. From the Swiss Health Survey came questions such as one dealing with the use of transport modes for daily mobility. In addition, people were asked about the number of hikes they take per month and the number of passengers using public transport.

Altstätten and Berneck were supplied with questionnaires in a one-time mass mailing campaign. In addition, questionnaires were available in the Volg stores. The return rate was 400. The results from the written survey in the St. Gallen Rhine Valley are as follows (see results at www.zu-fuss.ch):

- Women spend more time walking than men on a daily basis.
- Individuals who always have a car available spend less time walking than people who have no car.
- The majority of individuals who never have a car available or only if they make prior arrangements satisfy the WHO recommendation (a minimum of 30 minutes physical activity per day) just by daily walking (=52% of those surveyed).
- The people surveyed are most likely to respond to questions about their own health if the object is to promote walking.
- If the local grocery store were to close, people who had otherwise not had a car at their disposal or not at all times would rely more on a car.
- Individuals who regularly do their shopping on foot are more regular customers (35% shop four or more times per week) than customers who do their shopping by car (70% shop once a week).

Conclusion:
The qualitative survey offers interesting evidence that shopping on foot is effective for human-powered mobility. No evaluation of the impact on human-powered mobility is planned, however. The project is not designed to document changes in behaviour; it is solely an awareness-raising campaign. The project manager feels that the project has already been successful because the Volg management was interested in the project, participated in the press conference, and still considers the issue of walking to be very important.

The project is not suitable as an exemplary case study for our specific research focus. Since it was a pilot campaign that was limited in scope and time, no changes in behaviour were expected. At present, the financing that would be required to implement it on a larger scale (longer time frame and larger market area) is lacking, according to the project manager.

3.1.3. Project: "It's better on foot"

Project description and goals:
This campaign, which was developed by the Neuchâtel Commission on Traffic Education (Commission d'Education Routière= CER), was launched in conjunction with the national project, "Feel your Power". Its goal is to increase awareness among the population about issues of traffic safety (primarily the safety of routes to school) and their own health. For this purpose, the informational campaign is targeting the connection between health and safety on the roads and also the relationship between health and physical activity. Promotional material (T-shirts, caps, umbrellas, notepads, pens, paper shopping bags, etc.) was handed out to parents and children at selected schools in order to publicize the campaign. In addition, the project managers sought out local opportunities to speak with schoolchildren. The police also participated in the project by speaking about the issue with parents arriving by car to drop off or pick up their children.

The primary goal of the campaign was to motivate parents to walk their children to school and later to let them walk to school by themselves. (The assumption is that more and more parents are driving their children to school in the family car).

Since 1999, pilot campaigns have been carried out at various schools in Canton Neuchâtel. Each campaign lasts a full school year (from August to July). Each school is free to organize its own additional activities in order to increase awareness of the issue among parents and also the local population.

Pilot campaigns were carried out from 1999 to 2002 in the communities of La Chaux-de-Fonds, Le Locle, Neuchâtel, Colombier, Vilars and Marin.

Results:

The Institute for Social and Preventive Medicine at the University of Berne (ISPMBE)[40] conducted a parent survey in April and May 2002 in Le Locle, Neuchâtel and La Chaux-de-Fonds, and in May 2003 in Colombier, for the purpose of evaluating the impact of the campaign on parents. The evaluations yielded the following results (only those results are mentioned that are relevant for our research focus):

- In Le Locle, La Chaux-de-Fonds and Neuchâtel, 97% of the children walk to school on average, according to information provided by their parents (see table below). Nearly every fifth child also sometimes rides a bike or a scooter to school. Every twentieth child, approximately, occasionally takes the bus, and about every eighth child is also transported to school by car. (This result was due to the fact that the individuals surveyed were allowed to give more than one answer, and therefore the number of answers is higher than the number of persons [=N].) The percentage of children who ride a bicycle or scooter to school is higher in Neuchâtel than in Le Locle and La Chaux-de-Fonds. However, the percentage of children who travel to school by bus or are driven by car is also much higher there than in the other two schools.

School	N	Walking	Bicycle or scooter	Bus	Car	Total
Le Locle	80	95%	16.3%	3.8%	7.5%	122.6%
Neuchâtel	178	98.3%	24.2%	3.9%	7.9%	134.3%
La Chaux-de-Fonds	107	96.3%	10.3%	12.1%	21.5%	140.2%
Total	**365**	**97%**	**18.4%**	**6.3%**	**11.8%**	**133.4%**

Answers to the question: By what mode of transport does your child (do your children) go to school? (multiple answers possible).

- One fourth of the parents (of schoolchildren in the three towns listed above) stated that their children walk to school more often since the launching of the campaign than before. The change in behaviour for those children who get to school using different modes of transportation is as follows: ¼ of the children who walked to school before the campaign walk to school more often since the campaign. Of the children who rode a bike or scooter to school, more than one fifth now walk more, and of the children that rode the bus, nearly one third are walking more since the campaign. Of the children who were driven to school by their parents, almost half now walk to school more often.

- 89% of the parents of schoolchildren in Colombier state that their children walk to school. Around 20% of the children are walked to school by an adult. One fifth of the children are driven to school by car.

- Just under 10% of the parents state that their children have changed their attitude to walking to school since the campaign. About one sixth of these fall in the category of children who previously were either walked or driven to school.

The “Pedibus” (a walking bus; see picture below), a “school bus with feet” that walks children to school on specific routes accompanied by a parent, was the result of a parent initiative.

[40] Evaluation der Kampagne „A pied, c’est mieux!“. Institut für Sozial- und Präventivmedizin der Universität Bern (ISPMBE). June 2002 and 2003.

This service contributed significantly to the success of the campaign. In the process the children learn to be comfortable walking on the street. At the same time, they are getting regular physical activity and arrive safely at school and at home.

The schools also organized special school functions to call attention to the campaign, which was called “à pied c’est mieux” or “It’s better on foot” (see the picture below).

In addition, new pedestrian routes were clearly marked in order to increase the children’s safety.

Other communities in Canton Neuchâtel are interested in the campaign, especially in the “Pedibus” concept.

Conclusion:
An effective and open system of communication proved to be the primary predictor of success in this campaign. The project manager confirmed that a great deal of money was spent on information and advertising materials. The project can be rated as a good and successful campaign for increasing awareness or informing the public of the issue in question. It allowed for documentation of certain changes relating to patterns of behaviour. It also made it possible to discover local differences regarding driving children to school (21-24% in La Chaux-de-Fonds and Colombier compared with about 8% in Le Locle and Neuchâtel). The problem of driving children to school (chauffeuring) is viewed as relatively insignificant at the present time since the overwhelming majority of children are driven to school only occasionally, and this is why this project is not suitable as an exemplary case study for the Budapest conference.

The campaign was also able to appeal to parents, in particular, as shown by the “Pedibus” initiative. This represents a first step towards potential changes in behaviour.

3.1.4. Project: "Experience your city"

Project description and goals:
The goal of this project is to promote physical activity through non-motorized mobility. Another objective is to reduce the pollution caused by traffic.

As a means to this goal, the campaign strives to raise awareness among local institutions and the local population regarding the promotion of physical activity.

Two conferences were organized on this topic. In addition, three events promoting physical activity were held for local residents (in cooperation with the Office of Sports in Locarno as well as other organizations). Informational brochures (including conference documentation and results of a survey of elected officials in Locarno and adjacent communities) were also distributed to municipal authorities.

Another step was to involve primary schools, the police and a group called "Traffic and Environment" in the project (through a survey on routes to school).

The purpose of a subproject entitled "Promoting non-motorized mobility for travel from home to the Locarno elementary schools" is to investigate issues such as how schoolchildren get to school. Safety on the way to school is also included in this project. Schoolchildren were asked to mark on a map the most dangerous spots on their route to school. The ultimate goal is to develop a map of "safety routes".

Results:
The steps described above have met with only partial success to date. The effort to raise awareness among elected officials did not have the desired effect – neither the introduction of 20 mph zones nor the increase in traffic signals was implemented, although these were among the demands made at the last conference. The reasons for this are the strained financial situation of the city of Locarno and the failure to recognize the relationship between non-motorized travel and health. In addition, the promotion of non-motorized modes of transport provoked ideological resistance. According to the project managers, however, the campaign in Locarno did lead to cooperation between the local health department and the regional planning office and resulted in the initiation of a community vision for health and the environment. At the first conference, for example, the heads of the health department and the regional planning office got together for the first time to discuss issues such as mobility and sustainability. Representatives of the two agencies are now collaborating in an interdepartmental working group dealing with sustainability.

The primary schools and the police, in contrast to local elected officials, view the promotion of non-motorized transport as one of their priorities. The results of the subproject promoting non-motorized mobility for travel between home and elementary schools in Locarno are included in the final report for the overall project, which will be made available to the public in the near future.

Conclusion:
This is primarily a campaign to increase awareness and involves an attempt to motivate local authorities to be more committed to non-motorized forms of transportation. The extent to which action will be needed regarding human-powered mobility for home-to-school travel cannot be evaluated until the report from Ticino has been published. A decision will then be possible as to further collaboration and a possible follow-up survey (with a view towards a future exemplary case study).

3.2. Category II - Promotion of physical activity as an implicit goal

Category II includes ten projects that can be combined into four subcategories (see Sec. 2.2.).

3.2.1. Subcategory IIA - Alternatives to private motor vehicle traffic

Two projects fall in subcategory A. This category includes projects that offer alternatives to private motor vehicle traffic.

3.2.1.1. Project: "Burgdorf, model city for pedestrians and bicycles"

Project description and objectives:
An ongoing project referred to as “Model city for pedestrians and bicycles" (abbreviated in German as “FuVeMo”) has been underway in Burgdorf since 1995. Its goal is to promote walking and cycling through new innovative projects and services and to gradually replace automobile travel. The aim is to create a higher level of safety and traffic quality for non-motorized transport. The project’s empirical data and results will be used as a basis for projects in other cities and are intended to have a model function.

Ultimately, the goal is to identify the potential and limits of non-motorized transport for energy conservation. The focus is therefore on energy conservation since the city of Burgdorf was selected by the “Energy 2000" energy conservation program (now called EnergySwitzerland) as the model pedestrian city of German-speaking Switzerland.

The explicit goals for the second phase of the project, from 2002 to 2006 (following the first phase from 1995-2001) are as follows: The FuVeMo Burgdorf campaign will specifically promote non-motorized transport during the next five years. Awareness regarding the choice of environmentally friendly modes of transportation is to be enhanced. The project will focus on improving the interfaces between the various modes of transport.

Results:
Since ***five subprojects*** of the overall FuVeMo project are of interest for our research, only the results of those projects will be included in our evaluation. Information on the many other subprojects is available at the project website www.modelcity.ch.

> Subprojects I: “Meeting Area”
The pilot experiment referred to as “Strolling & meeting area”, which began in 1996, created a business-friendly area around the railroad station where traffic-calming measures were instituted – a 20 mph speed limit and right-of-way for pedestrians.

Results:
The idea of a mixed traffic zone based on low vehicle speeds was achieved. Roadway marking and signage, banners and large columns call people’s attention to the new traffic regime. The experiment proved successful in practice and became the basis for legislation passed by the Federal Council on 1 January 2002 governing traffic signaling and signage (20 mph speed limit, right-of-way for pedestrians, etc.).

Changes were identified in the choice of mode of transportation and in driving speeds. Motor vehicle traffic in the area around the station decreased 16.4%, while bicycle and pedestrian traffic increased 6.7% and 52%, respectively. Parallel research (a preliminary study of the Bahnhofstrasse mixed traffic zone together with video-based traffic counts by the Geographic Institute at the University of Berne in 1996 , speed studies in the station area conducted by Markwalder & Partner, and a study of energy consumption in municipal traffic by Metron in 1996) revealed a fuel reduction of approximately 16% resulting from automobile travel being replaced by cycling or walking and also from lower driving speeds. Motor vehicle speed in the mixed traffic zone dropped from an average of 28 mph in November 1996 to a little over 18 mph in July 2001.

Conclusion:
Although the mode-shifting effect is mentioned in the documents made available to us, it is unclear to which population the changes apply. It is also unclear whether individuals who switched from a car to a bicycle were already “sufficiently” active previously or whether previously inactive individuals became more active by switching. It is likewise unclear how long the shifting effect lasts. Sufficient information for an exemplary case study is therefore lacking. Since the changes lie in the past, it is also not possible to develop this project into an exemplary case study.

> Subproject II - "Burgdorf bicycle home-delivery service"

Project description and objectives:
A home delivery service (HDS) using Flyer electric bicycles has been operating since 1997 from the Burgdorf bicycle station. It was a first for Switzerland. People who shop at one of the approximately 50 stores in Burgdorf that participate in the home delivery service can leave their shopping bags at the respective business. The store will notify the home delivery service (HDS), whose couriers will pick up the purchases by bicycle and trailer and transport them to the customer's home (see photo).

The home delivery service is free of charge for customers and is conceived as an "environmental bonus" for individuals who do their shopping by using environmentally friendly means of transportation.

Results:

In conjunction with the HDS evaluation, which was conducted by Büro für Mobilität in Berne and Burgdorf[41], two different groups of individuals were interviewed in August and September 2002 (150 persons each over 18 years of age): The first group included previous customers, and the other group included people who had never before used the HDS. The first group was contacted randomly by telephone by the Burgdorf Bicycle Station, and the other group was surveyed, also randomly, on different weekdays at different times of the day. The evaluation report provided the following results:

- While about 4,100 deliveries were made in 1998, the number reached 8,900 in 2001, already more than twice as many. 13,000 deliveries were expected for 2002. These would be the equivalent of about 4,500 trips by car.
- The HDS has already delivered 40,000 purchases with a merchandise value of over CHF 2.5 million since its inception. The number of deliveries has grown from about 100 per month in the beginning to around 700 per month today.
- The transport habits of HDS customers for shopping purposes has changed since the service was introduced. A marked shifting effect from cars (down 21%) to non-motorized transport (bicycles up 18% and walking up 3%) has been noted.
- Around 750 households utilize the HDS (Burgdorf has 15,000 inhabitants): 58% of households use it three to seven times a month, and one fourth of households use it 8 to 12 times per month. These results provide evidence of great customer loyalty.
- The HDS is used by customers for the following three main reasons: purchases are too numerous or too heavy to carry (48%), shopping is easier (22%), and shopping can be combined with other activities (18%).
- Daily grocery purchases account for the majority of merchandise transported (89%).
- More than half of the HDS users are younger than 40 years of age. Those individuals older than 70 use the HDS most frequently (8 to 12 times per month).

A refund campaign designed to increase awareness of the HDS and attract new users is planned for the future. The purchase price of every 100th delivery would be refunded. In addition, there are plans to introduce a service charge that customers would pay voluntarily, but this would probably result in a

[41] Evaluation Velo-Hauslieferdienst Burgdorf. büro für mobilität ag Bern, Burgdorf. December 2002.

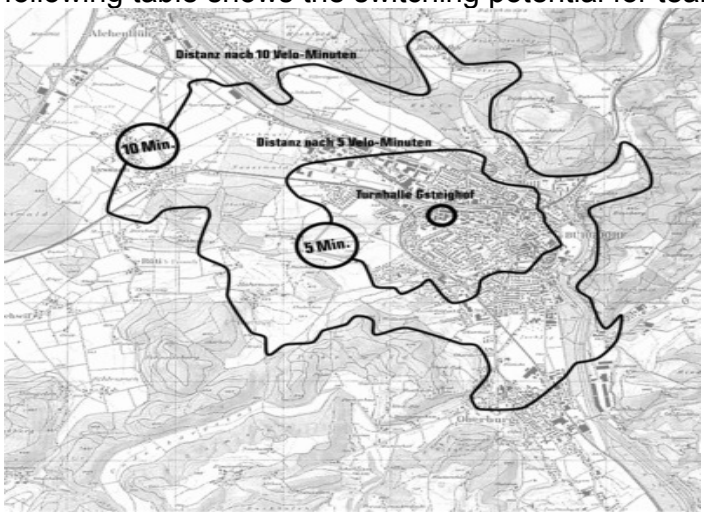
decrease in deliveries.

Conclusion:
The positive impact of the HDS on transport behaviour was already clear shortly after the project began. The shift from cars to public transport and/or non-motorized modes of transport for shopping purposes has since grown to a degree that is relevant (modal split in the direction of non-motorized transportation). The HDS provides a motivation for switching and therefore has considerable potential for increasing physical activity. The project would be suitable as a future exemplary case study if issues of physical activity could be integrated into it. To date there is no information on how frequently users and non-users of this service are engaged in physical activity. The project is therefore not suitable at the present time for our specific research focus. It is also unclear whether a further survey is planned or could be initiated. Our interest in participating in any future survey was communicated to Büro für Mobilität AG.

> Subproject III "Athletes on the road in Burgdorf" (mobility consulting for sports clubs)

Project description and goals:
With the pilot project referred to as "Athletes on the road in Burgdorf", which was carried out from March to October 2000, FuVeMo's goal was to increase awareness for the issue of "mobility" among members of sports clubs. A three-part mobility consulting program was carried out in close cooperation with over 30 clubs.

In an initial phase, the mobility habits of 600 Burgdorf citizens engaged in sports was studied between March and June 2000. The resulting data made it possible to create an individual "mobility profile" for each team and then to calculate and communicate that team's potential for switching from motorized to non-motorized means of transportation (cycling or walking). The following table shows the switching potential for teams located within a short-distance radius.



Cycling map "Burgdorf by the minute": "How far can I travel by bicycle in 5 or 10 minutes from the Gsteighof Gym?"

In the center: Gsteighof gymnasium
Inner circle: Distance after 5 min. by bicycle
Outer circle: Distance after 10 min. by bicycle

In the second phase, the club directors or managers conducted the actual mobility consulting themselves. They were assisted by the project researcher. The individuals engaged in sports activities were informed about the various ways of getting to practice and exercising at the same time. The goal was to motivate them to analyse their mobility habits critically and, if possible, to change them. A brochure containing the map shown above ("Burgdorf by the minute") was handed out to all the athletes. The map shows how far one can travel by bicycle from a centrally located Burgdorf sports facility in five or ten minutes.
In the last phase of the project, the athletes who had already participated in the first survey were interviewed again between the end of August and the end of September 2000 about their mobility habits. Only 300 athletes participated in the second survey, since many clubs were not holding regular practice sessions during that time period.

Degree of Potential	Number of Teams	Percentage
Average to great	16	40%
Low to very low	16	40%
Non-existent	8	20%

Potential for switching from cars to cycling or walking for short distances (1-3 km)

Results:

The FuVeMo project manager was in charge of evaluating this project. A civilian service worker was responsible for processing the project data. Büro für Mobilität had the task of writing up the final report. When the first and second surveys were compared, it was found that the percentage of individuals driving cars (or other motor vehicles) as their preferred mode of transportation had been reduced from 41% to 35% as the result of the project (see table below). The percentage choosing bicycles grew 8%, which means that every sixth motor vehicle driver switched to a bicycle.

The second survey included a question regarding changes in mobility habits in daily transportation. Almost one-fifth of the individuals surveyed (18% of 274) indicated that they had also changed their daily mobility habits (for shopping, commuting, etc.). All evaluations are based on the subjective responses of the sports participants. A plausibility check by random samples was only done in the case of a few sports clubs. These checks showed that the questionnaires had been filled out truthfully.

Transport Mode	**1st Survey** (June 2000)	**2nd Survey** (Sept. 2000)	Difference
Car (as driver)	38%	32%	-6%
Motorbike, motorcycle	3%	3%	0
Total drivers of motor vehicles	**41%**	**35%**	**-6%**
Car (as passenger)	15%	15%	0
Bus, train	4%	4%	0
Bicycle	26%	34%	+8%
Walking or skating	14%	12%	-2%
Total using non-motorized transport, public transport or car pooling	**59%**	**65%**	**+6%**

Summary of mobility habits in travel to sports practice – comparison between 1st and 2nd survey

Conclusion:

The first mobility consulting project of this type in Switzerland is distinguished by the following features: personal interviews were conducted with club managers, which led to their effective involvement in the project. The questionnaires and also the tips for athletes were short and easily understood by all participants. The local media regularly publicized the project. This, along with its local nature, resulted in a high level of identification among the athletes.

This project involved mobility-related consulting and was not a transport intervention project in the sense of infrastructure. A shifting effect was documented, i.e., the project was able to influence motorized leisure or sports-related transport.

We should qualify these statements by noting that the target public for this campaign consisted of athletes whose level of physical activity was certainly adequate as defined by physical activity recommendations. For this reason, the project is not suitable as an exemplary case study, although it is a very reasonable and successful project from an environmental perspective. It would be interesting to know how long the shifting effect lasts and whether the change in mobility awareness regarding choice of transport mode also applies to everyday trips other than the journey to and from training sessions.

> Subproject IV - "Safety on the way to school"

Project description and goal:
Children should be able to walk on public streets without risk. This will promote not only safety but also self-reliance on the part of the children and will prevent situations in which parents (because of the risk) have to drive their children to school (parental chauffeuring).

In this safety campaign for children, FuVeMo wanted to know which locations the schoolchildren themselves consider to be dangerous. Steps to eliminate safety deficiencies would then be developed.

Results:

The broadly designed FuVeMo survey referred to as "The Safe Route to School", which was conducted in 1998 in Burgdorf and targeted all 1,600 children in primary and secondary schools as well as kindergarten children aged six years and older, revealed that 55% of the children walk to school, 38% ride a bike, and 2% take the bus or ride a school bus. For the remaining 5%, it was not possible to assign the respondent to a specific category since more than one answer was given. These double answers included parental chauffeuring, i.e., parents driving their children to school.

Another survey result showed that three out of ten Burgdorf children felt they were at risk on their way to school. A total of 119 locations were rated as dangerous or hazardous by the children. After 7 inspection tours of the identified locations by school officials and planning experts, each tour lasting several hours, a priority-ranked list of recommended action for 70 critical locations was created and turned over to the city. This will become part of the Burgdorf traffic improvement plan and will be implemented in the next few years. The most dangerous locations will be redesigned or upgraded by 2004.

Conclusion:
Unfortunately, cars were not a possible answer for the question about choice of transport mode. (The questions were addressed to the children, but the answers for the younger children were filled in by their parents). For this reason, there are no figures on transportation by car or parental chauffeuring. The authors of the report mention only that there were "few" such answers (spontaneous answers). Although it can be assumed that the percentage of auto trips would have been higher if the survey had asked about it specifically, the overwhelming majority of children in Burgdorf appear to walk or ride a bicycle to school. The project is not suitable for our specific research focus since car trips and transport mode shifting are not documented.

> Subproject V - "Safety in public spaces"

Project description and goal:
Pedestrians who experience fear or anxiety will choose another mode of transportation in the future, generally the car. A working group of the Burgdorf model city project compiled a report after not quite two years of work that lists all the critical spots in the city that make people uncomfortable or fearful. Examples are the lack of street lights on various streets, situations with poor visibility at night, etc.

Results:
The report is based on a large number of opinions submitted by organizations such as neighbourhood associations, women's groups and youth groups. All potentially dangerous locations were inspected by users and planning experts in conjunction with two nighttime inspection tours. The working group's report was submitted to the city in July 2000. It listed 41 problematic locations and proposed specific improvements for approximately 30 of them. By 2001, various planning measures had been implemented, such as cutting back trees that blocked the view. The most complicated and expensive proposal is the construction of improved steps behind Migros, a large supermarket. This will make the steps leading up to the residential area completely safe, even at night, and also somewhat easier to negotiate. Of particular long-term relevance are social measures such as efforts to increase awareness on the part of groups that are at risk (especially women).

Conclusion:
The project was not evaluated and therefore did not provide concrete data. In addition, the potential for human-powered mobility is modest, and therefore this project is not relevant for our specific research focus.

Overall evaluation of the "Model city for pedestrians and bicycles" project
Burgdorf's multi-facetted mobility program contains many good and innovative subprojects.[42] It is being supported by a broad group of sponsors and is profiting from strong support among the local population and from the involvement of business and elected officials. An important feature of all the projects is that they are not against drivers of automobiles but in favour of promoting non-motorized forms of transportation. A before and after comparison is impossible since the mobility habits of Burgdorf's citizens were not documented at the beginning of the project. Many developments in the model city have been described but have not been documented by empirical evidence.
The project on the bicycle home-delivery service is of interest for our research focus since it can be developed into an exemplary case study in the future.

3.2.1.2. Project: "Mobilo"

Project description and goals:
The project aims to create a range of environmentally compatible mobility services in a redeveloped former industrial area of Basel (where the Sulzer-Burckhardt machine factory was once located). A well-linked transportation network and an effective system for providing information to people living in

[42] Another subproject that could be of interest in the future is called "Jackpot at work". In this project, one employee is selected at random once a week on a randomly chosen day. If this employee has come to work that day using an environmentally compatible mode of transportation (public transport, bicycle or walking) or in a car pool, that employee receives CHF 50. If the person selected has driven alone by car on this particular day, the prize money remains in the jackpot. The three-month test phase, which is being conducted at a company located in Burgdorf, will be completed by mid-November. Evaluation of the project by Büro für Mobilität should be completed by the beginning of next year.

the area are designed to demonstrate the attractiveness of public transport in combination with cycling and walking.

The project offers alternatives to private motor vehicle traffic and parking problems. These alternatives consist of a wide range of vehicles and services (discounted rail and bus passes, student passes, public mobility services, fun bikes, etc.) that meet individual transport needs (information available at www.mobilo.ch). The area is a pilot project of the "2,000-watt Society" program and the national "Sustainable Neighbourhood Development" research program and therefore has the goal of reducing average per capita energy consumption from 6,000 watts to 2,000 watts.

Results:
No results were available by 30 October 2003.

Conclusion: This is an integrative, small-scale neighbourhood development project that is battling severe financial problems, according to the project manager. The project, which offers incentives to switch from private motor vehicle transport to modes of transportation that are more compatible environmentally and attempts to increase the attractiveness of an intermodal transportation system certainly has potential for human-powered mobility. At the start of the project, however, there was no baseline survey. The physical activity habits of Mobilo users were not determined. Perhaps this information could be obtained and evaluated in a later survey. Contact was made with the project manager at the environmental centre in Langenbruck. It would basically be possible in the future to integrate three or four additional questions on mobility habits into the existing questionnaire, which has to be filled out by new members of Mobilo when they apply for membership. Because of the project's financial problems, it is unclear how many new members would provide such information. At the present time the project is not of interest for our specific research focus since no information is available about physical activity and mobility behaviour.

3.2.2. Subcategory IIB - Cycling promotion in general

The second subcategory, which deals with cycling promotion in general, includes two projects in Canton Aargau: "Take your bike" and the E-Tour Project, "Electric two wheelers on urban roads".

3.2.2.1. Project: "Take your bike"

Project description and goal: The cantonal campaign entitled "Take your bike" was initiated at the end of 1998 in response to a proposal by the public health department of Canton Aargau. Its goal is to convince the Aargau population to rely more on bicycles in their daily activities. The campaign was triggered by a partial result of the Aargau section of the Swiss Health Survey of 1992-1993. It became clear that broad segments of the population desired a reduction in traffic-related noise and air pollution. The campaign was aimed at municipal authorities and human resources managers at companies and especially at the local population. Three areas of concentration were planned: "Cycling on a daily basis" (primarily promotion of a bicycle-friendly infrastructure), "Cycling for fun" (cycling for pleasure during leisure hours) and "Cycling events" (motivating target groups – young people, women and working people – to participate actively in events and campaigns).

Results:

The Institute for Social and Preventive Medicine (ISPM) in Berne[43] conducted a survey of 430 individuals in Canton Aargau in August and September 2000. Awareness, acceptance of and response to the campaign were evaluated as were the population's needs, assessments and opinions about the project.

The primary result of the project was to get people to think about the issue in greater depth. The project was not able to convince anyone to adopt new behaviour, i.e., it did not lead to much of an increase in bicycle use (6% of respondents indicated they rode bicycles more than before the beginning of the campaign, but nobody indicated that they had begun riding a bicycle for the first time as the result of the campaign). Nonetheless, the campaign had a positive effect on health promotion in the canton, according to the canton's official physician.

Of interest is the conclusion of the evaluation report by ISPM Berne that the canton's attempts to convince municipalities to improve the infrastructure for cyclists, along with promoting public health, did not make much headway.

Conclusion:
The data on physical activity behaviour or transport mode shifting are lacking since no baseline survey was conducted. It is thus virtually impossible to track effects of the campaign over the medium and long term.
The potential for increased physical activity must be classified as limited, based on the evaluation. This is no surprise since this project was purely an informational campaign. This project is therefore not suitable for our specific research focus.

3.2.2.2. Project: "E-TOUR – Electric Two Wheelers on Urban Roads"

Project description and goal:

E-TOUR is a European demonstration project that involves eight separate projects in different European cities. Swiss participation consists of combined projects: large-scale test involving LEVs (light electric vehicles) in Mendrisio[44] and its partner municipalities(1995-2001), the Basel campaign "Better mobility" and the national programme called "NewRide".[45] The research projects in Switzerland focus on analysing the impact of electric two wheelers (e-bikes and e-scooters) on mobility habits. They also look into the meaningful use of two-wheeled electric vehicles in daily activities and future-oriented mobility concepts in general.

Energy conservation and the promotion of sustainable energy are the key points of the campaign. (Example: an e-bike needs only 1 kWh of solar power for 100 km. This is the equivalent of a single decilitre of petrol).

The impact of electric two wheelers on mobility behaviour was examined on the basis of mileage surveys, mobility records and 22 hypotheses. In order to obtain the necessary data, the mobility of LEV buyers in the four days before the purchase and one year after the purchase was determined through use of a mobility diary. This permits conclusions about the number of trips, their distance and duration and the purpose of the trips and also about choice of mode of transportation. In addition, the mileages of all motor vehicles in the household were surveyed before and after purchase of the LEV. Both surveys were supplemented by a telephone interview.

Results:

A user profile of e-bike purchasers was created based on socioeconomic and personal data. By the

[43] Institut für Sozial- und Präventivmedizin der Universität Bern. Evaluation der Gesundheitsförderungskampagne „Nimm s Velo" des Kantons Aargau, June 2001.

[44] The "Better mobility" campaign aims to motivate commuters to switch from motor vehicles to low-energy and low-pollutant modes of transportation. Beginning in March 2000, residents of the city of Basel could purchase one of 400 electric bicycles (e-bikes) for CHF 2,100 instead of the full price of CHF 3,900. After five months, all of the subsidized e-bikes were sold. The second part of the "Better mobility" campaign is called "600 e-bikes for Basel companies". The canton is now offering all companies based in Canton Basel-City 600 e-bikes at a reduced price of CHF 900 each. The campaign will last a year and, like all previous campaigns, is being run according to the motto, "s het, so lang s het!" (first come, first served). Further information is available at www.aue-bs.ch/de/energie/aktionen/menu_e_2_7.html

[45] NewRide – the program for sustainable mobility: www.newride.ch

end of 2000, data on over 550 e-bike owners from Mendrisio, Wohlen (BE), Muttenz, Riehen and Basel-City had been recorded. 300 people were interviewed by telephone. The following results were obtained:

- More men (66%) than women ride an e-bike. About 80% of the LEV buyers in the German-speaking areas of Switzerland have a public transport pass, compared with only 30% in Ticino, the Italian-speaking section.
- The largest user group in German-speaking Switzerland is composed of 40- to 50-year-olds, followed by the 30 to 40-year olds. In Mendrisio, people over 50 represent the largest user group, followed by the 40- to 50-year olds.
- The majority of e-bike users in German-speaking Switzerland have a university or technical college degree, whereas in Mendrisio the majority received vocational training.
- In daily activities and for local travel, LEV drivers use bicycles and public transport most frequently (Mendrisio is not included here in the comparison).

Other facts regarding the two projects:

- In spite of the high degree of acceptance enjoyed by LEVs within Switzerland, especially among politicians and government officials, the demand for them among the 300 people surveyed had not yet increased significantly. After all, the prices are still high and the delivery times are long. Nonetheless, about 40% more electric two wheelers were sold throughout Switzerland in the first six months of this year than in the previous year (1,000 electric two wheelers in 2003 compared with 600 in the previous year). Considering the slow economy, this result is quite impressive.
- 90% of households purchase LEVs as an extra vehicle. Very few replace another vehicle by purchasing an LEV.
- The reason for buying an e-bike was frequently the fact that an additional vehicle was needed in the household due to a change in the socioeconomic situation (new commute, additional person in the household with a driver's license, the household had moved, etc.).
- In 75% of the households, the introduction of an e-bike resulted in a reduction in annual mileage driven by the other motorized vehicles. Because of the small sample, these figures are not significant statistically.
- On average, purchase of the LEV did not lead to an increase in mobility on the part of the principal users.
- The degree of motorization is higher in Canton Ticino than in other regions of Switzerland.
- The degree to which e-scooters take the place of mileage driven by conventional vehicles is significantly higher than for e-bikes.

Specific findings from the evaluation of the "Better mobility" project by the University of Berne's Interdisciplinary Coordination Unit for General Ecology[46]:

- E-bikes are primarily used on workdays. They are used first and foremost for commuting, and somewhat less frequently for shopping or for recreational purposes. On weekends, the use of e-bikes for shopping (Saturdays) and recreation (Saturday and Sunday) declines, compared with workdays, while the use of cars (and public transport for recreational purposes) increases (see table.)

[46] Evaluation of the Basel campaign „die bessere Mobilität" 2000. Interfakultäre Koordinationsstelle für Allgemeine Ökologie (IKAÖ), Universität Bern, 2002.

Workdays	E-Bike	Walking	Bicycle	Motorcycle	Car	Public transport
Commuting	74.6%	-	5.1%	1.7%	11.8%	6.7%
Shopping	47.1%	29.4%	29.4%	-	14.7%	-
Recreation	43.7%	12.5%	12.5%	-	18.8%	6.2%
Saturday						
Shopping	27%	16.2%	16.2%	-	37.8%	2.3%
Recreation	38.5%	7.7%	11.5%	-	26.9%	15.4%
Sunday						
Recreation	14.2%	6.3%	15.9%	-	49.2%	14.3%

Choice of mode of transport according to trip purpose one year after purchase of an e-bike (n=70)

- The e-bike is used for different purposes and is therefore multifunctional. Different reasons for making a trip are also often combined, especially “work and recreation”, “work and shopping” and “shopping and recreation”.
- For 64.6% of respondents, the LEV is a substitute for the conventional bicycle, and for 18.5% the e-bike replaces the car.
- 60% of those surveyed indicate that the purchase of an e-bike did not bring about a change in their mobility awareness. The 40% that saw a change cited the following reasons: feeling more mobile, consciously wanting to drive a car less often, using an e-bike as moral pressure for driving a car less, being more aware of traffic, and demonstrating one’s interest in alternative vehicles.

A detailed compilation of the results of the entire E-TOUR project will follow in the final report, which will be published by SAEFL in early 2004 as an environmental document. In order to continue to promote the sale of electric two wheelers, the NewRide program was launched throughout Switzerland (further information available at www.newride.ch).

Conclusion:
The well documented project shows that LEVs represent a genuine mobility alternative, especially for local transport. The high prices, in particular, are an obstacle.
E-bikes can certainly be an appropriate means for promoting physical activity or public health. (The rider’s pulse rate is more regular than with conventional bicycles, which is ideal for people just beginning to ride a bike or picking it up again). However, if the LEV replaces a conventional bicycle, which is happening to a great extent in the Basel campaign, the opposite effect cannot be ruled out. For short distances at least, decreases in human-powered mobility result. This could be different for longer distances.
Still undetermined is whether e-bikes result in more physical activity and whether the project appeals to previously inactive individuals. Evaluation to date of the mobility diaries (before and after) from Basel shows, among other things, that buyers of e-bikes, in particular, rely less on the bicycle and the automobile.
At the present time, the E-TOUR project is not suitable as an exemplary case study. If additional data on mobility or physical activity habits should be surveyed, then the project could develop into an appropriate case study.

3.2.3. Subcategory IIC - Cycling promotion in the workplace

Subcategory C includes four projects that aim to improve cycling promotion in the workplace.

3.2.3.1. Pax Versicherung Basel

Project description and goal:

At this insurance company in Basel, incentives designed to increase bicycle use are offered in the form of the following special programmes: free bicycle registration sticker, annual bicycle inspection including small repairs, covered parking area, bicycle station with air pump and tools and shower

facilities. There is also a monthly commuter jackpot that can be won by any individual who on the day of the drawing gets to work by walking, by bicycle or by public transport. This has the effect of publicizing the issue on a regular basis.
Results:
Of 280 employees, 35 to 40 commute by bicycle. Most of them also do so in the colder period of the year. This was determined through manual bicycle counts. According to the person in charge of the environmental office, this is the extent of the transport mode shifting effect.

Conclusion:
It is certainly possible to offer incentives at the workplace for more physical activity through the special programmes or services listed above. For this purpose, however, awareness of the issue on the part of employees would have to be increased. In the opinion of the project manager, people in some segments of the company might tire of the issue and polarization could result.
Data on bicycle use are only obtained through the manual counts that are made on a sporadic basis. Information on actual changes in mobility habits is not available, and the project is not suitable as an exemplary case study for this reason.

3.2.3.2. Spitex Basel

Project description and goal:
Purely economic considerations led Spitex Basel to decide to use bicycles exclusively for service calls to Spitex customers. Cycling is therefore an important criterion of potential employment with Spitex. What is involved here is an “unconscious-conscious” promotion of cycling.

Since cycling is a requirement or a basic condition for employment, the potential for increased physical activity appears to be considerable. According to the head of human resources and training, the people that are hired tend to be individuals who also ride bicycles otherwise. However, data on the physical activity habits of Spitex employees is not available.

Conclusion:
The employees of Spitex Basel are definitely an interesting group for investigation and could eventually be compared with other Spitex organizations. For this purpose, a before and after survey would have to be carried out in the future – in two different Spitex organizations, for example. This would make it possible to study the extent to which work for Spitex Basel affects physical activity behaviour and possibly also mobility habits and whether this has an effect on the number of sick days. In order to determine whether a survey of this type is suitable as a future exemplary case study, it would first be necessary to calculate how large the population would have to be in order to obtain valid evidence. In addition, one would have to decide to what extent this Spitex Basel policy, which involves organization of work, can be considered a “transport intervention project”.

3.2.3.3. Lucerne Cantonal Hospital

Project description and goals:
Cycling promotion at the workplace is based on active promotion of health and wellness by rewarding employees who commute to work daily by bicycle and thus are doing something actively for their health.
The project aims to shift commuter traffic from the automobile to the bicycle or to public transport. This goal is made attractive to employees through a number of different programs and services. These include regularly conducted “cycling campaign days”, bicycle inspection, reimbursement of expenses when bicycles are used for business purposes (CHF 5 per trip, the equivalent of a round-trip bus ticket within the city), the switching campaign called "Your parking card for a bicycle key" in 1999 (a three-month campaign during which it was possible to trade in a parking pass for a bicycle or e-bike, including equipment such as helmet, raingear, etc., and a bus pass), a competition in 2000 entitled “Hospital mobility – getting to work without a car” (the winner was the hospital department with the highest proportion of cyclists, pedestrians and users of public transport), etc.

Planning for a car-pooling project (a platform for ride sharing) is currently underway. The project will be launched next spring. Lucerne Cantonal Hospital is also experimenting with using parking regulations to counteract parking problems and to restrict excessive private vehicle traffic. All employees have the right to commute by car, but not all of them have the right to a parking spot or a parking pass. Employees without parking privileges are those who live in the restricted zone (City of Lucerne, Ebikon, Emmen, Emmenbrücke, Horw, Kastanienbaum, Kriens, Littau, Meggen, Reussbühl and St. Niklausen). Exceptions are made for work at night, on weekends and on holidays.

Results:

The large number of different campaigns found a positive response among employees, as shown by a study conducted at the beginning of 2001 by the College of Business in Lucerne[47]. This study includes an analysis of the current mobility behaviour of employees (choice of transport mode, impact of hospital programmes and campaigns on choice of transport mode, etc.). For this purpose, a random survey of 400 employees was conducted at the hospital. The goal of the study was to develop and/or present actions that can lead to more sustainable mobility habits. A selection of results is shown below:

- In the summer, most employees (41%) use cars to get to work, followed by 23% who commute by bicycle. Public transportation is in third place, with just under 19% of employees. 12% of employees walk to work, while 6% commute by motorbike or motorcycle (see table).

	Summer Half of Year	Winter Half of Year
Car	40.7%	47.8%
Motorbike/motorcycle	6.4%	2.3%
Bicycle	22.5%	12.8%
Public transport	18.7%	25.6%
Walking	11.5%	11.0%
Other:	0.3%	0.3%

Mode of transportation used in winter half and summer half of year in %

Although well over half of the employees live in Lucerne or in the city's suburban areas and thus have no parking privileges, a large percentage of employees prefer to commute in their own private vehicles. In the winter months, private cars are used for commuting by almost 50% of employees. Public transport, at about 25%, is in second place. Bicycles are used by just under 13% of employees, while 11% walk to work. Only 2% use a motorbike or motorcycle. Compared with the summer months, quite a few employees give up riding a bicycle or a motorbike or motorcycle in the winter, and thus usage of these two categories is down by 10% and 4%, respectively. These decreases are balanced out by increased use of private automobiles and public transport (up 7% each).

- Use of a car increases among older individuals. People under 30 years of age, for example, use cars and bicycles equally (31% each) in the summer half of the year, whereas the percentage using bicycles drops significantly in the winter (to 13%).
- When mobility behaviour is analysed by sex, then the only differences relate to the use of public transport: women use public transportation twice as often as men in both summer and winter.
- Employees who regularly work shifts or on weekends rely on a car or bicycle as their second choice in the summer half of the year. Individuals who never work shifts or on weekends choose public transport as their second choice after cars in the summer. In the winter half of the year, the only shift in choice of transport mode among regular shift employees is from bicycles to cars.
- Employees are well informed about the individual programmes and campaigns of the "Hospital mobility" working group. Participation in the individual campaigns does not

[47] Kaufmann, M; Erzinger, S.: Spital Mobil – Mobilitätsmanagement am Kantonsspital Luzern. Hochschule für Wirtschaft Luzern. Projektarbeit 2002.

exceed 25% of employees, however. The report's authors conclude that at the present time the potential for increasing the number of employees who commute by bicycle has virtually been exhausted.

Conclusion: The Lucerne Cantonal Hospital, as represented by its "Hospital mobility" working group, is seriously striving to encourage more employees to commute by bicycle. This is already reflected by the fact that the project is supported by the top management, that a hired external coordinator was made part of the working group in 2001 as an expert representative, and that the College of Business in Lucerne was commissioned to undertake the study cited above. The information policy of the working group is also very good and aggressive. The bicycle issue is constantly highlighted. An ample number of incentives for increased physical activity are offered by the various services and programmes. In order to bring about an effective shift in employees' private vehicle usage, continued willingness of hospital management to invest money in various projects will be required.

The impact of the campaigns and programmes of the "Hospital Mobility" working group on choice of transport mode cannot be determined since the mobility habits of employees prior to the inception of the many different campaigns were not surveyed and thus comparative data for the research study are lacking. For this reason, there are also no figures on a potential switching effect.

The study conducted by the College of Business in Lucerne is accordingly a baseline survey (documentation of current conditions and interesting data) on which future studies can be based. If the study is repeated, the project could be developed into an exemplary case study.

3.2.3.4. Schaffhausen Cantonal Hospital

Project description and goal:

The Schaffhausen Cantonal Hospital wants to eliminate parking problems (entrances and exits are blocked by illegally parked cars, patients cannot park close to the hospital, etc.) and promote the use of bicycles (and thus employee health). This is being done through the following measures:

- Bicycles and exhibit panels with posters in the hospital entrance lobby alert employees, visitors and patients to the fact that large segments of the population suffer from a lack of physical activity.
- Employees who give up their parking pass (which allows them to park in the hospital's own parking lot) receive an environmental bonus of CHF 30 per month and can participate in a lottery in which the prize is a new high-tech bicycle valued at CHF 2,000. Employees who walk to work or who commute by bicycle or bus also receive the monthly bonus of CHF 30.
- Parking fees are being increased to an average of CHF 50.00 per month and a maximum of CHF 150.00. The closer an employee lives, the more expensive the parking fee will be. ·
- The hospital is providing bicycles for up to three months to those who would like to commute by bicycle on a trial basis.
- New bike racks and tools are available.
- People working night shifts who can no longer use public transportation can get home more cheaply by taxi thanks to a CHF 5 taxi coupon.
- Bicycles provided by the hospital for transport to nearby facilities are clearly labelled.
- Regulations covering transport expenses for business purposes: these have been approved by hospital management but not yet implemented.

Results:

An internal study by the staff of Environment and Safety showed that 386 employees (47%) live in the city of Schaffhausen within a radius of 1.5 miles from the hospital. These data were necessary in order to generate a key for the parking fees. The new parking lot management system led 104 employees to give up their parking passes.

In addition, some other programs have been documented, but have unfortunately not yet been

evaluated.

Conclusion:
A service provider is making employees aware that their state of health and fitness is their own responsibility. The project promotes commuting by bicycle and public transport and at the same time limits parking and raises parking fees.

Plenty of incentives for increased physical activity are provided by the many different programs financed and supported by hospital management. Since there was no baseline survey and information on physical activity habits is lacking, the project is not suitable for our specific research focus.

3.2.4. Subcategory IID - Roadway design

This category includes two projects that deal with upgrading or redesigning a neighbourhood or roadway.

3.2.4.1. Project:"20 mph Zones and Children" – A before and after investigation in Zurich-Leimbach[48]

Project description and goal:
The effects of 20 mph zones on the daily life of children was studied at the request of the Zurich City Council. Of particular interest was the question whether the introduction of these speed zones, supplemented by additional parallel measures, would lead to a better quality of life in the residential environment. The suburb of Zurich-Leimbach, which is characterized by housing developments built by cooperatives and the municipal government, served as the area of study. Parking time limits were introduced in 1997 in the form of the "blue zone", and the 20 mph zone was instituted in February 1998.

The study was conducted through two written surveys of parents and children, both preschool and school-age children. In the first survey in 1997 (216 questionaires sent, 42% returned), children from two to nine years of age were included, whereas the second survey in 2000 (214 questionaires sent, 70% returned) was limited to five- to nine-year-olds (at the time of the study, Leimbach had about 220 families with children in the desired age group). While the first survey covered residents' expectations regarding introduction of the 20 mph zones, the purpose of the second survey was to get the residents' opinions after two years. Both surveys contained a household questionnaire and a children's questionnaire. To the children's questionnaire was attached a map of Leimbach on which the parents could mark their residence and all the locations in the neighbourhood that the child can reach unaccompanied or at which it is allowed to play. For the survey in 2000, it was also possible to mark the various hazardous spots on the way to kindergarten, school or to recreational activities.

In order to guarantee before and after comparisons, a large number of the questions in the first survey were used again three years later. Since the composition of the neighbourhood's population and the individual households had changed a great deal in those three years (families moving away, families moving in, children excluded from the research population because of age, etc.), it was not possible to reach exactly the same families in the second survey. The surveys were therefore conducted using a comparable group of people.

Selective observations of the neighbourhood were made prior to the written surveys. A systematic analysis of the children's range of activity was not possible due to the size of the area being studied. The goal of the observations was to discover the major locations where children played.

Results:
We will describe only those results that have a direct relationship to our research focus.

[48] All data are taken from the reports entitled "Tempo-30-Zonen…und die Kinder" and "Schulwegsicherheit in Leimbach" (follow-up evaluation to the first report) by M. Hüttenmoser and D. Sauter.

- The introduction of a 20 mph limit means that most parents (about 73%) consider the routes to kindergarten and to the schools to be less dangerous.
- More than half of the parents (56%) are of the opinion that riding bicycles within the 20 mph zone offers children a greater degree of safety.
- Even after the introduction of the speed limit, over half of the parents consider their children at risk from the traffic. The reasons for this included too much traffic or excessive speeds (individual speeders have a great effect on parents' subjective feeling of safety and accordingly on the freedom of movement of their children), parked cars that restrict visibility, crossings without traffic lights, and especially crossing or walking along main streets. Because of these fears, the extent to which parents accompany their children increased 7% since introduction of the 20 mph zones – in spite of reduction in hazards on the way to school (less among schoolchildren than among kindergartners). This result should be interpreted very carefully, however, since the numbers are very small and since the number of children per family in the second survey differs markedly from the number in the first survey. The majority of children (74% before and 72% after introduction of the 20 mph limit) are never driven to school by car.
- Hazardous situations in the immediate vicinity of the particular residential location (residential environment) were reduced by introducing 20 mph zones. 62% of parents felt the traffic situation before introduction of the 20 mph limit was dangerous. After introduction of the limit, 49% of the parents see hazardous traffic situations. However, the 20 mph limit did not increase the attractiveness of play opportunities in the residential environment. This also has to do with the good living and playing situation that already existed in the neighbourhood.
- Unaccompanied play outdoors was also not affected (over 90% of children continue to play outdoors without supervision). The duration of play and the number of playmates also remain equal, on the whole.
- The children's range of activity and the number of play locations they can reach independently has declined on the average (especially play locations that are 100 meters or more away from the residence). The results are similar for those places that children go to in order to perform certain tasks (kindergarten, school, shopping, etc.). This is related especially to the fact that children were more often forbidden to cross a main street after introduction of the speed limit than before (47% before introduction of the 20 mph limit compared with 60% thereafter).
- Introduction of the "blue zone" and staggered parking (parking spaces have a high occupancy rate, even during the day) is rated by parents as negative on the whole (no improvement or even worsening), especially since the street ends up having poorer visibility, being more dangerous and less friendly to interpersonal contact.

Conclusion:
The 20 mph speed limit regulation is viewed as a good thing by the parents, but they feel that implementation of speed limits has been deficient. Safety for children in the residential environment is improved by introduction of the 20 mph zone. Nonetheless, the majority of parents feel their children are still at risk from the traffic.

It is also true that driving children to school is hardly a factor in this study. The majority of cases in which parents accompany their children involves walking.

There were hardly any changes as regards independent play in the vicinity of the residence location. Many children were able to do this even before the 20 mph speed limit was introduced since Leimbach had a good residential environment and was considered a privileged neighbourhood from this point of view, even before introduction of the 20 mph zones. What is still unclear is whether introduction of the 20 mph limit in a neighbourhood with a less positive baseline situation as regards quality of residential environment would have had a perceptible impact.

Ultimately, the project shows that the response of parents to the measures taken is positive. Introduction of the 20 mph zone in the Leimbach neighbourhood has brought about an improvement in children's mobility. Concrete evidence regarding an "increase" in children's daily or recreational physical activity is not provided by the study. Therefore this transport intervention project is also not

relevant for our research focus.

3.2.4.2. Project: "Upgrading and redesigning Seftigenstrasse" (Köniz)

Project goals and description:

The street named Seftigenstrasse in the Wabern section of Köniz, which is a regional arterial road and a local shopping street – is scheduled to be upgraded and redesigned in order to limit the dominance of private motor vehicle traffic (up to 22,000 motor vehicles per day). The project is designed to achieve the following objectives:

- Reduction of separating features – the street is to be designed sides of the street are interconnected.
- Provision for public transport and regional transportation connections.
- Improvement of the situation for non-motorized traffic: easier crossing possibilities for pedestrians and safe bicycle connections for cyclists by creating crossings, central islands and bike lanes = implicit promotion of human-powered mobility.
- Development and creation of attractive frontage areas for businesses.

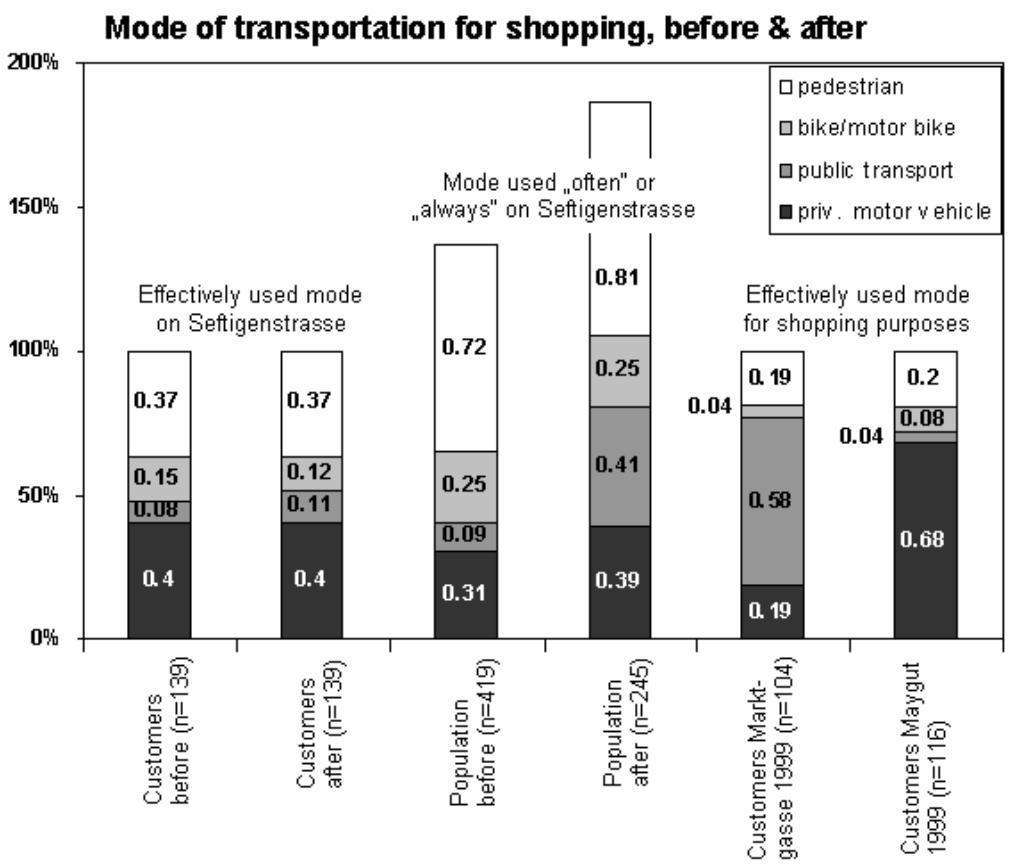
Results:

- The before and after comparison showed that pedestrian traffic at the main counting point near the centre of the city increased 11% over the entire week. Crossings via the pedestrian crossing at the centre of the village also increased sharply. At the same time, a general decrease in crossing without using the pedestrian crossing and in waiting times for crossings was noted. This sharp reduction must also be attributed to the fact that there are more pedestrian crossings than before.
- Conditions for cyclists were fundamentally improved by a continuous bike lane, in particular. This was indicated by the following data collected at the main counting point: the average percentage of cyclists on all days of the week increased 56% per day. In the entire Seftigenstrasse area, there was a significant increase in the number of bicycles.
- When the total traffic during peak hours (7:00 to 8:00 am and 5:00 to 6:00 pm) was analysed, it was found that the percentage of private motor vehicles remained stable while the percentage of pedestrians and cyclists increased. The public transport percentage decreased slightly. As the following table shows, the modal split favoured non-motorized traffic.

Choice of Transport Mode	**1995**	**1998**
Car	69%	70%
Public transport	25%	18%
Bicycle or motorbike	3%	8%
Walking	3%	4%

Modal split in passenger traffic during peak morning and evening hours

- As shown by measured data, there was no traffic shift to parallel secondary roads (bypassing). This is explained by the improved traffic flow on the main road.
- The population survey examined whether there was a switch from private motor vehicle transport to non-motorized transport for shopping purposes. As shown by the following diagram, customers' choices of transport mode were not changed by roadway upgrading and redesign.



Non-motorized transport remained the dominant mode for shopping purposes. Pedestrians formed the largest customer segment for the retail trade.

Additional results are given in the final report prepared by IKAÖ and GIUB (Geographic Institute at the University of Berne) (www.ikaoe.unibe.ch/forschung/umwelt.verkehr/pdf/Schlussbericht_Seftigenstr.pdf)[49].

The photographic comparison below (before and after) provides visual documentation of the implementation or result of the redesign project.

Before After

Conclusion:

This project, which was very well documented (all explicit project objectives were evaluated), shows

[49] Haefeli U., Matti D., Seewer U. (2000): Die Sanierung und Umgestaltung der Seftigenstrasse: Auswirkungen auf Lebensqualität und Einkaufsverhalten der NutzerInnen (mit besonderer Berücksichtigung des Langsamverkehrs und der Ertragssituation des Detailhandels). Schlussbericht der Wirkungsanalyse. Berne: IKAÖ und GIUB.

that the attractiveness of a local through road for non-motorized transport can be increased through appropriate structural measures. An increase in pedestrian and bicycle or motorbike traffic on the redesigned road while the level of private motor vehicle traffic remained constant has been documented.

Whether a shifting effect from private motor vehicle transport to non-motorized transport (human-powered mobility) took place was only examined in the case of transport for shopping purposes. Also unanswered is the question of who switched from motorized to non-motorized modes of transportation.

The project offers only limited information for our specific research focus and is therefore not very suitable as an exemplary case study.

4. Overall Evaluation

4.1. Findings

- Throughout Switzerland, transport intervention projects rarely deal explicitly with the physical activity aspect. Frequently there is a lack of in-depth surveys on the impact of transport intervention projects themselves, such as their effect on choice of transport mode or a shift in transport mode.
- Some projects have effectively documented the shift from motorized mobility to non-motorized mobility. In order to estimate the potential of these projects for human-powered mobility, however, important information is lacking: We do not know and were not able to find data in the project documentation regarding whether the individuals that switch from motorized to non-motorized mobility are physically inactive individuals or whether individuals who are already very active physically increase their level of physical activity to some extent as a result of the mode-switching effect. Information on this question would be very important, however, for rating transport intervention projects with respect to the promotion of human-powered mobility.
- In the case of some transport intervention projects (home delivery service in Burgdorf, E-Tour – electric two wheelers on urban roads, promotion of bicycle commuting at the cantonal hospitals in Lucerne or Schaffhausen) it would have been possible to obtain relevant information for an exemplary case study if such data collection had been planned in advance. It is not really possible to collect such data after the fact.
- In general, we should note that the effectiveness of intervention projects can only be evaluated over the medium and long term since both project implementation and intended changes in behaviour take time.
- A number of major projects that were professionally conducted and evaluated were implemented in conjunction with “Energy 2000” and have now been completed. They can no longer be used as exemplary case studies.
- As shown by the examples from Burgdorf and Canton Neuchâtel, the problem of parents driving their children to school can be viewed as a relatively minor problem at the present time.

4.2. Potential exemplary case studies

In the case of the following ongoing or planned projects, parallel research and evaluation would be conceivable:

- **Montana**: The effect of the overall "Mobility for everyone” project on the behaviour of the population of Montana with respect to physical activity and mobility can be compared not only with data from throughout Switzerland but also with parallel data from the communities of Verbier and Zermatt. The same representative survey will be conducted there in January 2004. The survey would then have to be repeated in the two towns in 2006, as is planned for Montana. This would make it possible to compare the impact of the Montana project with more meaningful regional surveys (control groups) and to determine possible impact more effectively.
- **Locarno:** If evaluation of the project referred to as “promoting non-motorized mobility in travel from home to the elementary schools of Locarno" shows that action is required with respect to human-powered mobility, then the possibility of a follow-up survey can be discussed with the project managers.
- **Burgdorf**: In the case of the home delivery service project, it would be necessary to determine how physically active the people are who switch from motorized to non-motorized forms of

mobility as the result of transport intervention. It should also be determined whether questions relating to physical activity could be integrated into future surveys of users and non-users of this service.

– Since collaboration could also result in the case of the **E-TOUR** project and the **cycling promotion** projects **at the cantonal hospitals in Lucerne and Schaffhausen**, contact with the respective project managers will be maintained.

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TRANSPORT RELATED HEALTH IMPACTS - COSTS AND BENEFITS WITH A PARTICULAR FOCUS ON CHILDREN

Transnational Project and Workshop Series of Austria, France, Malta, Sweden, Switzerland and The Netherlands

TOPIC PAPER ON PHYSICAL ACTIVITY IN CHILDREN

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Table of contents

1. Introduction and summaries

1.1. The Topic Paper on Physical Activity in Children within THE PEP

This topic paper has been developed in the project "Transport Related Health Impacts, Costs and Benefits with a Particular Focus on Children" within the context of the UNECE- WHO Pan-European Programme for Transport, Health and Environment - THE PEP. The aim of the project is to provide a review on the state of the art of transport related health impacts, costs and benefits, as well as to develop recommendations on political implementation strategies and to contribute to the development of WHO-Guidelines for the economic valuation of transport related health effects.

The aim of the document is to review methods for assessing the exposures, epidemiological status, effects and health impacts of transport-related physical activity specifically in children and to identify the respective research gaps. A first version of the paper has been produced mainly from the national perspective of Switzerland, after that more international experiences and perspectives were integrated. General aspects not specific to children have been treated in a separate Topic Paper, as will be the implications, recommendations and examples of good practice for the political process.

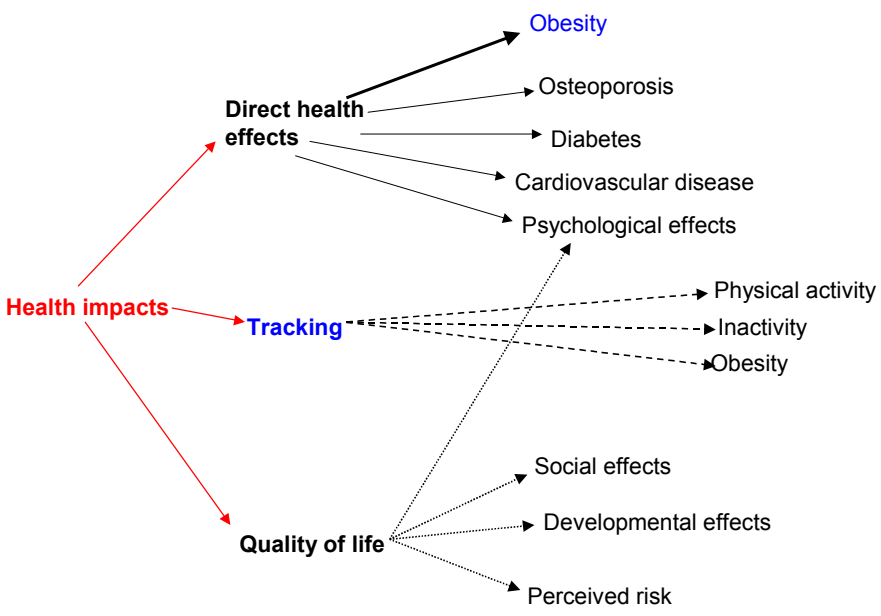
Conceptually, health impacts of physical activity in children can be expected on three levels (figure 1):

Direct health effects are clearest and most easily quantifiable for obesity, other effects include osteoporosis, diabetes type II, cardiovascular disease and psychological effects.

Tracking exists for physical activity, inactivity and obesity and can engender all health conditions associated with these in later life.

Quality of life aspects include again psychological effects of physical activity, but also social effects, developmental effects and risk perception.

Figure 1: Conceptual overview of health impacts of physical activity in children



The varying levels of evidence for the different effects and their consequences are summarised in the chapters below and elaborated in more detail in the following sections of the Topic Paper.

1.2. Sources and methods of exposure assessment in children - summary

The measurement of physical activity represents several challenges, in particular with respect to transport and health. While a considerable number of studies exists on physical activity behaviour and on related parameters in children, internationally standardised instruments and an internationally standardised monitoring system still is missing.

While associations between overall physical activity and health are clear, the contribution of transport related physical activity to overall physical activity is difficult to assess, not least because of the different methods and data sources for those aspects.

In large surveys, physical activity has traditionally been measured using recall questionnaires and several approaches to measure physical activity in adults have been modified for application to children. These techniques may provide specific data on physical activities including frequency and duration; however, they can be biased by self-reporting and recall ability especially in younger children and must be used cautiously in a population of young age. Several questionnaires have been developed to measure physical activity of children and adolescents but only a few of them provide detailed data on transport related physical activities.

Direct observations have several advantages over other filed methods but the high costs caused by intensive and time consuming labour are a disadvantage of this method.

Devices such as heart rate monitors, pedometers and accelerometers are becoming increasingly popular as objective measurement tools for physical activity. These devices reduce the subjectivity inherent in survey methods and can be used with large groups of individuals.

To understand why some children are less active than others and how to encourage them to be more active, to better assess the relationship between inactivity and diseases or other risk factors, physical activity needs to be measured accurately and reliably. To do so, the use of accelerometers, or pedometers, or heart-rate monitors may be of a great help, ideally linked with some direct observations and/or questionnaires to overcome some of the limitations of each measurement method. One of the objectives of physical activity research should be to determine the best assessment methods.

1.3. Physical activity patterns in children - summary

Even though no internationally accepted standards for the measurement of physical activity in children exist, a number of studies in different countries have addressed the issue.

In general, they indicate high levels of inactivity in populations of young age and a tendency towards declining activity levels over age and time. All recent studies which examined the pattern of overall physical activity from childhood to adolescence, confirmed a decline in active behaviour, which starts

at puberty and continues through to young adulthood. There is a higher likelihood of physically active young people to be more active in later life as well (low to moderate tracking of physical activity), and though the number of studies is limited, there are indications that transport-related physical activity can make an important contribution to overall physical activity in children.

Levels of activity are correlated with a number of socio-cultural parameters. The contribution of school-based physical education seems to be particularly important in groups with low activity levels.

A wealth of data exists on overweight and obesity which are also influenced by other factors, but can be seen, to a certain extent, as a correlate of physical activity behaviour. The prevalence of both conditions is high and rising in most of today's societies.

1.4. Health Impacts of Physical Activity in Children - summary

Direct health impacts of physical activity in children have been shown for obesity, diabetes type II, osteoporosis, psychological effects and predictors of cardiovascular disease. By assuming tracking of physical activity from adolescence to adulthood, it is perceivable that all health effects of physical activity in adults can be influenced by increasing and maintaining active behaviour in young people. Only the first estimations of the health effects of physical activity on the population level including all age groups exist; no specific models have been developed for children so far.

1.5. The effectiveness of interventions to increase physical activity in children - summary

Many interventions to increase physical activity in children have been developed, but only a few of them have had their effectiveness evaluated. Currently, prompts to encourage stair use, community-wide campaigns, school-based physical education, social support in community settings, and creation of or enhanced access to places for physical activity combined with informational outreach activities can be deemed effective. For a number of other interventions evidence remains insufficient to assess their effectiveness. There is a clear need to develop more interventions to increase physical activity and more specifically transport-related physical activity and to assess their effectiveness.

2. Sources and methods of exposure assessment in children

2.1. Methods and sources of assessment of overall physical activity

The measurement of physical activity presents several challenges, in particular with respect to transport and health. First of all, a consensual definition of physical activity on the population level still is missing (Department of Health and Human Services, 1996). Second, reliable and valid measures of transportation-related physical activity are needed to better characterize the range of activity that is associated with health. (Pratt 1999)

Sedentarism is increasing in children as well as in adults in western countries (Troiano 2002).

However, in the US for instance, national estimates of overall physical activity using questionnaires appear to be reliable and valid for adults but may be less so for adolescents, and are poor measures for children. Physical activity has traditionally been measured with surveys and recall instruments and several approaches to measure physical activity in adults have been modified for application to children (Pate 1993, Saris 1986) including direct observation (Durant 1993) and recall questionnaires (Ross 1985, Ross 1987, Sallis 1991). However, these techniques must be used cautiously in a pediatric population that has difficulty recalling such information (Sirard 2001, Pate 1993).

Physical activity questionnaires may provide specific data on physical activities including frequency and duration. As mentioned above, they are biased by self-reporting and recall ability especially in younger children. They tend to overestimate their physical activity (Sallis 1993). However, several questionnaires were developed to measure physical activity of children and adolescents with good reliability and validity (Kohl 2000). Although they ask for all activities, just a few provide detailed data on transport related physical activities.

Direct observations have several advantages over other filed methods. This method shows a high inter-observer reliability and correlates with other techniques such as motion sensor (Noland 1990), heart rate (O'Hara 1989), and calorimetry (Puhl 1990). Additionally, observations can provide information on the type of physical activity that occurs (O'Hara 1989) and its connection to the environment. It is less biased by self-reporting and recall ability than questionnaires for children. The high costs caused by intensive labour and time consumption are a disadvantage of this method.

Devices such as heart rate monitors (Klesges 1987, Livingstone 2000), pedometers and accelerometers (Janz 1994, Janz 1995, Rowlands 1997, Trost 2000) are becoming increasingly popular as objective measurement tools for physical activity (Sirard 2001). These devices reduce the subjectivity inherent in survey methods and can be used with large groups of individuals.

Heart rate monitors provide an adequate indication of the relative stress placed upon the cardiopulmonary system resulting form physical activity (Welsman 1992). They allow the assessment of patterns of activity as well as energy expenditure (Falgairette 1996, Gavarry 2003). They are unobtrusive, impose minimal participant and experimenter burden and are relatively cost effective for

use in small to moderate size studies. However, they require a first calibration set up and the linear relationship between heart rate and oxygen consumption (VO2) is not as robust at the low end of the physical activity spectrum (Livingstone 2000, Mc Ardle 1991). Psychological and environmental stress, as well as caffeine and some medications can also affect heart rate (Emons 1992, Saris 1986). Heart rate monitoring also lags behind movement, particularly as children's physical activity is intermittent in nature.

Motion sensors such as pedometers and accelerometers have become important activity assessment tools. They are valid tools for quantifying physical activity in children (Janz 1994, Trost 2000). However, both methods are not appropriate to assess movement counts or energy expenditure in several activities like water sports, cycling, skiing, and walking or running at incline or with additional weight.

Pedometers are relatively simple electronic devices, inexpensive, re-usable, objective and non-reactive. They offer potential for large population studies (Eston 1998).

They only detect total count of steps with an acceptable accuracy (Bassett 1996) and are less expensive than accelerometers, but cannot assess the intensity of activities performed. Validation studies in children (4-11 years) wearing recent pedometers models have shown favourable validity (Sirard 2001).

Assessment of physical activity with a pedometer and its relationship with VO2max has been studied among adolescents in Switzerland (Michaud 2002). The survey included 233 Swiss adolescents aged 11 to 15 who carried a pedometer (Pedoboy) during seven consecutive days. VO2max was estimated through an endurance shuttle run test. The physical activity recorded by the pedometer did not vary from one day to the other ($p > 0.05$). The physical activity was higher among boys than among girls ($p < 0.001$) and higher among younger adolescents (6th versus 8th grade; $p < 0.001$). The correlation between physical activity and estimated VO2max was 0.30 ($p < 0.01$). The authors' conclusions were that the use of a pedometer to assess physical activity over one entire week is feasible among adolescents and the record provided by the pedometer gives an objective measure of the usual physical activity and, as such, is relatively well correlated with aerobic capacity.

Accelerometers are more sophisticated electronic devices that measure accelerations produced by body movement. The Caltrac monitor was one of the first commercially available accelerometers; newer monitors seem to provide more accurate assessment and show very good validity to assess childrens physical activity (Puyau 2002, Sirard 2001). Triaxial accelerometers provide the best assessment of activity. Some accelerometers have a "black box" design, therefore they attract little attention from children. This feature makes it less likely that the subjects will manipulate these pre-programmed tools. Nevertheless, they have limited ability to assess cycling or other activities with limited torso movement.

Laboratory and field validation studies of pedometers and accelerometers yield relatively high correlations with oxygen consumption ($r = 0.62$ to 0.93) or direct observation ($r = 0.80$ to 0.97) as criterion measures, although they may not be able to capture all physical activity.

To understand why some children are less active than others and how to encourage them to be more active, to better assess the relationship between sedentarism and diseases or other risk factors, physical activity needs to be measured accurately and reliably. To do so, the use of accelerometers, or pedometers, or heart-rate monitors may be of a great help, ideally linked with some direct observations and/or questionnaires to overcome some of the limitations of each measurement method (Pols 1998). One of the role of physical activity research should be to determine the best assessment methods.

2.2. Methods and sources of activity-related parameters (fitness, motor skills, body composition)

In adults, a strong relationship between the amount of physical activity and other parameters such as aerobic fitness (US Department of Health and Human Services 1996), metabolic factors (Kokkinos 1999), and the amount of body fat (Kriketos 2000) does exist. In children and adolescents the relationship between habitual physical activity and aerobic fitness is not as clear (Armstrong 1991, Boreham 1997, Katzmarzyk 1998). Studies about the association of physical activity and body fat in children and adolescent found controversial results (Eklund 2001, Hernandez 1999). Inactivity may be more related to the maintenance of childhood obesity (Trost 2001). However, in children and adolescent, movements skills (Okely 2001), blood lipids (Schmidt 1997) and insulin sensitivity (Schmitz 2002) are significantly associated with physical activity.

Aerobic fitness is usually estimated by laboratory methods such us measuring maximal oxygen consumption (VO2 max) on treadmill or cycle ergometers (ACSM 1995). This assessment involves expensive equipment and is time consuming for both the examiner and the subjects. Additionally, maximal oxygen consumption can accurately be estimated by sub-maximal exercise tests in the laboratory setting without measurement of expired gases. One of these classic procedures is referred to as the Astrand-Rhyming cycle ergometer test (Astrand 1954). Field tests are more feasible for mass testing. Generally, these methods require little equipment and are less expensive. A popular field test is the distance covered during a 12-minute walk/run test (Cooper 1968), an easily obtained measurement of physical performance; it has been found to be related to cardiorespiratory fitness and to body composition in adolescents who are overweight (Drinkard 2001).

Other examples of field tests are step and walk tests. Several fitness test batteries were developed to determine aerobic fitness, strength, and flexibility and motor skills (Morrow 2000). Body mass index is strongly associated with body fat. In children, overweight and adiposity are defined by specific BMI categories different from the ones used in adults (Cole 2000).

2.3. Methods and sources of assessment of transport-related physical activity

Measurement of transport-related physical activity in children and adolescents raises a lot of methodological issues (Pols 1998), explaining the scarcity of surveys in European countries and in Switzerland.

2.3. a Collection of data using questionnaires.

Examples are:

- The Bogalusa Heart Study where physical and sedentary activity, including transport-related physical activity, were examined using a 24-h recall instrument, the Self-Administered Physical Activity Checklist, in school children grades 5-8, ages 9-15 yr (N = 995, Myers1996).

- The Swiss Health Survey: Physical activity trends in Switzerland: 1992-1997. Since 1992 Switzerland has carried out 5-yearly representative statistical surveys on the population health (Mikrozensus 2000). In 1992 and 1997 about 15 000 individuals older than 14 years of age were questioned in an telephone interview. Physical activity was assessed by the number of sweat episodes during leisure time and hours of exercise per week. In 1997, it was also assessed whether the interviewees usually walked or cycled for at least 20 minutes a day for transport purposes. In Switzerland, there is no representative data available on overall physical activity in children under the age of 15.
- The Swiss 2000 microcensus: data about children's travel. Since 1974, Switzerland has carried out 5-yearly representative statistical surveys of the population's travel behaviour (Office fédéral de la statistique). In 2000, as part of this Microcensus project (Mikrozensus 2000), the Swiss Federal Office of Spatial Development and the Swiss Federal Statistical Office collected data about population's travel behaviour in 27 918 households (29 407 persons aged 6 years and older) who were interviewed on the telephone. Individual travel behaviour (number of travel journeys, modes of transport, distances travelled per journey, time spent travelling) was assessed in detail for the day preceding the interview. The sample size was large with 3071 children aged 6 to 14 years. A secondary analyses of the travel behaviour microcensus data has been performed by the Swiss Council for Accident Prevention for the age groups 6-9 and 10-14 years (3071 children). The Swiss results will be integrated into a chapter on Children's Travel in the final report of the OECD's Road Transport Programme study on child road safety appearing in spring 2004. This report will also provide data on children's travel behaviour of other countries. The results for Switzerland are summarized in paragraph 2.1.

2.3. b Objective measurement to investigate the physical activity of children

A very good example of possible objective measurement to investigate the physical activity patterns of primary school children by mode of travel to school is provided by Cooper's study (Cooper 2003). In this study, children were recruited from five urban primary schools in Bristol, England. Physical activity was objectively measured for seven days using an accelerometer (Computer Science and Applications Inc., Shalimar, Fl., model 7164) programmed to record data every minute. This accelerometer was worn on an adjustable elastic belt around the waist, positioned above the right hip. Children were asked to wear the monitor during waking hours, except when swimming or bathing. At the end of the measurement period the accelerometers were downloaded into a personal computer for analysis. Daily travel to school was measured using a brief questionnaire asking how the children usually travelled to and from school (car/cycle/bus/walk), and how long the journey took. The total volume of physical activity and the time spent in activity of at least moderate intensity recorded by the accelerometer was estimated for weekdays and the weekend, and groups of children compared by mode of transport to school.

2.3. c Sports activity, physical activity and fitness of 9- to 19-year old teenagers in the canton de Vaud (Switzerland)

A survey on physical fitness, physical activity and health was conducted in a region of Switzerland (canton de Vaud), in a sample of 3540 students 9 to 19 years-old (Michaud 1999). The project included a battery of physical fitness tests, anthropometrics measurements and a self-report

questionnaire on physical activity, and life styles (Narring 1999). Sports, leisure time activity (i.e. watching television) and habitual physical activity (i.e. transportation used to go to school) were also included.

An ancillary study in a sub sample assessed daily physical activity with a pedometer, dietary intake with a 3-day dietary record, serum lipids and nutritional status.

In this study, physical fitness was assessed by a set of six tests derived from an European study (EUROFIT 1993) :

- Sit-and-reach test (flexibility)
- 5m x 10 run (speed)
- sit-up test (muscular endurance)
- 50 plate tapping (strength)
- 20m shuttle run test (cardiorespiratory endurance).
- The body composition was assessed by measuring skinfold thicknesses in 4 sites: bicipital, tricipital, scapular, suprailiac.

2.3. d Perspectives in Switzerland

In a local kindergarten project (www.hepa.ch/gf/evilard) a methodology has been developed by which the transport mode of 5 to 6 year old children can be assessed without expert involvement by using appropriate interview techniques through kindergarten teachers and by observation through older children (publication in preparation).

Starting in 2004, it is planned to conduct a pilot study to include a monitoring of physical activity using questionnaires and accelerometers in the Swiss Study on Childhood Allergy and Respiratory Symptoms with respect to air pollution (SCARPOL). This will allow to study children's physical activity patterns and associations between physical activity and objectively assessed parameters in the built environment of the children's homes and schools (GIS data base).

In conclusion, the accurate measurement of transport-related physical activity as well as that of overall physical activity is critical for determining current levels of physical activity, monitoring compliance with physical activity guidelines, understanding the dose-response relationship between physical activity and health and determining the effectiveness of intervention programs designed to improve physical activity.

3. Physical activity patterns in children

3.1. Prevalences and time trends in overall physical activity or activity related parameters

Up to now, no internationally accepted standards for the measurement of physical activity in children and no global estimates of children's physical activity exist. However, a number of studies in different countries have addressed this issue. In 1995 already, Harsha's review concluded that today's children

are probably less fit than children 20 years ago (Harsha 1995). Children are heavier and tend to be more overweight and sedentary than earlier. The relationships between fitness and cardiovascular risk factors in children are very similar to those in adults. Those children who perform better on standardized fitness tests have more favorable body composition and lipid profiles. This was confirmed a few years later (Boreham 2001) :"It is clear that, despite their natural tendencies, children have become less physically active in recent decades, with children today expending approximately 600 kcal days' less than their counterparts 50 years ago".

3.1. a Physical activity in Switzerland: 1992-1997

Although the Swiss Health Surveys of 1992 and 1997 were just five years apart, changes in physical activity have occurred over this short period (Lamprecht 1999). Whereas the proportion of individuals sweating on several days of the week as a result of physical activity during leisure time remained almost constant between 1992 and 1997 in the Swiss population of 15 years or more of age, striking shifts had occurred in the percentages for the moderately active and inactive groups. The proportion of inactive individuals rose by about four percentage points between 1992 and 1997. In other words: physical inactivity in the Swiss population has increased by over a tenth in just five years.

The youngest age group that can be studied separately in the Swiss Health Survey are the 15-24 year old. Between 1992 and 1997, in this age group, the percentage of those meeting the criteria of at least three sweat episodes per week increased from 39.3% to 43.2%, whereas the percentage of those completely inactive decreased from 19.6% to 18.1%. In 1997, some 40% of this young people (15-24) declared to walk or cycle usually for at least 20 minutes a day for transport purposes (Lamprecht 1999). The results of the Swiss Health Survey 2002 will be available late 2003.

3.1. b Sports activity, physical activity and fitness of 9- to 19-year old teenagers in the canton de Vaud (Switzerland)

From September 1996 until March 1997, 3540 subjects (age 9 to 19 years, 1778 girls, 1762 boys) from the canton of Vaud were enrolled in a study which included 7 tests evaluating different components of fitness, anthropometric measures and a self-administered questionnaire assessing physical activity, health and lifestyles (Michaud 1999). Most of the respondents performed sports on a regular basis but boys engaged in physical and sports activities much more often than girls: 75% of boys versus 56% of girls spent at least one hour a day in activities inducing sweating, an index of moderate to vigorous physical activity ($p < 0.001$). Depending on the grade, 56 to 74% of girls and 62 to 88% of boys reported participation in sports clubs ($p < 0.01$); current participation ranges from 33 to 46% among girls and 64 to 69% among boys ($p < 0.001$). Participation in physical and sports activities was lower after age 15 than before, and also lower among girls than among boys. As far as fitness is concerned, girls exhibit greater flexibility than boys, while the latter exhibit greater strength and endurance, especially after age 15. Calculated values for the BMI and VO2max are within the ranges published in the international literature for both sexes. .

3.1. c Exercise in Dublin children aged 7-9 years

In Dublin children aged 7-9 years (Hussey 2001), some 39% of children were found to be participating in hard exercise for at least 20 minutes three or more times a week, with fewer girls (28%) than boys (53%) contributing to this result. A further 57% of children were engaging in at least 20 minutes of light exercise three or more times a week, with no sex differences. Most (78%) of the children were spending one to three hours a day sedentary in front of a screen.

3.2. Prevalences and trends in overweight and obesity

Although overweight and obesity are also influenced by other factors including diet, physical activity remains a major predictor of body fat (Nestle 2000). Therefore, BMI can be seen as a correlate of physical activity behaviour. For this reason a specific chapter is introduced in this report summarising the findings in this field.

First, it can be reminded that BMI is a good estimator of body fat. A strong and age-independent association has been found between BMI and body fat percentage calculated from multisite skinfold thicknesses (Zimmermann 2003). By regression, 74% of variability of body fat percentage was explained by BMI, in both boys and girls. Second, in childhood, the most important periods of risk appear to be the periods of adiposity rebound and adolescence (Dietz 2001).

3.2.a. Importance of the definition used

The references used to define obesity and overweight in children are of importance.

New growth charts from the U.S. Centers for Disease Control and Prevention (CDC) include an age- and sex-specific BMI reference for children aged 2–20 years (Kuczmarski 2000). The International Obesity Task Force (IOTF) has also published age- and sex-specific BMI criteria for children and proposed them as international references (Cole 2000). Because these two reference criteria differ, they may produce varying estimates of overweight and obesity (Reilly 2000, Flegal 2001, Kain 2002). This has been showed for instance in Swiss and Chilean children. In a national study of the prevalence of overweight and obesity in 6-12 y-old Swiss children, the BMIs of the Swiss children were compared with US, UK, French and Swiss reference data (Zimmermann, 2000). Depending on which reference data were used, the prevalence of obesity varied between 9.7 and 16.1% and the prevalence of overweight varied between 21.7 and 34.2%. Among Chilean 6-y-old boys and girls, gender-specific prevalence of overweight and obesity were determined in 1987, 1990, 1993, 1996 and 2000 (Kain 2002). The prevalence of overweight determined by WHO increased from 15% in 1987 to 20% in 2000 for boys and from 17.2 to 21.8% for girls. With BMI-CDC, the increase was from 13.2 to 19.2% for boys and 12 to 18.5% for girls. With BMI-IOTF, rates were very similar. Prevalence of obesity using WHO criteria increased from 6.5% in 1987 to 17% in 2000 for boys and from 7.8 to 18.6% for girls. Using BMI-CDC, the increase was from 5.1 to 14.7% for boys and from 4 to 15.8% for girls; using BMI-IOTF prevalence estimates were much lower.

In a very recent study to be published (Zimmmermann 2003), age- and sex-specific BMI criteria from the IOTF and CDC with body fat percentage from multisite skinfold thicknesses was used to identify overweight and obesity in Swiss children. Sensitivity and specificity of the IOTF and CDC overweight criteria, and the CDC obesity criteria, were high. The sensitivity of the IOTF obesity criteria was only

48 and 62% in boys and girls, respectively. Overall, the performance of the CDC references was superior. Using the CDC criteria, the prevalence of overweight and obesity was 19.1 and 20.3% and 5.9 and 7.6%, in girls and boys, respectively.

3.2. b. Prevalences and trends in the US, Canada, Australia

Fifteen percent of young Americans are overweight, up from about 5 percent in the early 1970s. (Troiano 2002). This rising prevalence of obesity indicates that children's energy intake exceed their energy expenditure. It is a possible marker of children physical activity/inactivity when physical activity data still are missing. Current international data about the prevalence of overweight and obesity in children are therefore presented below.

In 1999-2000 as part of the National Health and Nutrition Examination Survey (NHANES), a cross-sectional, stratified, multistage probability sample of the US population (Ogden 2002). The prevalence of overweight was 15.5% among 12-19 year-olds, 15.3% among 6-11 year-olds, and 10.4% among 2-5 year-olds, compared with 10.5%, 11.3%, and 7.2%, respectively, in 1988-1994 (NHANES III). The prevalence of overweight among non-Hispanic black and Mexican-American adolescents increased more than 10 percentage points between 1988-1994 and 1999-2000.

In Canada, between 1981 and 1996, the prevalence of overweight increased from 11 to 33% in boys and from 13 to 27% in girls, while the prevalence of obesity increased from 2 to 10% in boys and from 2 to 9% in girls (Tremblay 2002).

The prevalence of overweight and obesity in Australian children was assessed in two national samples, 10 years apart (1985 and 1995), using the new standard international definitions of the IOTF (Magarey 2001). In 1985 (8,492 schoolchildren aged 7-15 years), 9.3% of boys and 10.6% of girls were overweight and a further 1.7% of boys and 1.6% of girls were obese. In the 1995 sample (2,962 children aged 2-18 years), overall 15.0% of boys (varied with age from 10.4% to 20.0%) and 15.8% of girls (varied with age from 14.5% to 17.2%) were overweight, and a further 4.5% of boys (2.4%-6.8%) and 5.3% of girls (4.2%-6.3%) were obese.

3.2. c. Prevalences and trends in Europe

Large studies in European children usually show patterns of overweight and obesity which are lower than US and Australian data but with increasing prevalences.

For instance, the prevalences of overweight and obesity in children 5- and 6-y-old entering school in Germany, Bavaria, were assessed in 1982-1997 (Kalies 2002) as defined by international reference values. These prevalences were 9.4 and 3.1% for 5-y-old boys, 10.0 and 2.9% for 6-y-old boys, 12.2 and 3.3% for 5-y-old girls and 12.4 and 3.3% for 6-y-old girls. The time trend between 1982 and 1997 showed an increase of the BMI distribution in the upper percentiles, whereas the lower percentiles did not change substantially. The increased prevalences of overweight/obesity for both sexes as defined by international references increased from 8.5/1.8% in 1982 to 12.3/2.8% in 1997.

In the city of Thessaloniki, in Greece, the prevalence of overweight and obesity among schoolchildren (6-17 yr) is 22.2% and 4.1%, respectively, and has been increasing in the last decades, especially among boys (Krassas 2001).

In Sweden, in 1997, it was found that 12.3%, 11.6% and 11.4% of the boys in the 12-, 15- and 18-y-old age groups and 6.8%, 5.5% and 4.8% of the girls in the same age groups were overweight and 7.9%, 8.9% and 7.3% of the boys and 5.1%, 4.2% and 3.9% of the girls were obese (Berg 2001).

Prevalence and change in prevalence of overweight and obesity, as defined by the international obesity task force, was evaluated in Scotland children aged 4 to 11 years (Chinn 2001). Little change was found in the prevalence of overweight or obesity from 1974 to 1984. However, from 1984 to 1994 overweight increased from 5.4% to 9.0% in English boys and from 6.4% to 10.0% in Scottish boys. Values for girls were 9.3% to 13. 5% and 10.4% to 15.8%, respectively. The prevalence of obesity increased correspondingly, reaching 1.7% (English boys), 2.1% (Scottish boys), 2.6% (English girls), and 3.2% (Scottish girls).

In Belgian children the degree of overweight and obesity have increased between 1969 and 1993 (Hulens 2001).

In fact, obesity is no longer just a problem of Western countries. In Taiwan, in 1980 and 1994, 1500 children were randomly selected from junior high schools (Chu 2001). Although the percentage of overweight children remained steady from 1980 to 1994 in both genders, the prevalence and trends of obesity increased significantly, especially among boys and older girls.

3.3 Development of physical activity from childhood to adolescence

It is a common belief that children naturally engage in a lot of physical activity but slowly discard their active behaviour as they grow up. This raises concerns for the adolescents' health status but also for the maintenance of a healthy lifestyle into adulthood. All recent studies found which examined the pattern of overall physical activity from childhood to adolescence, confirmed a decline in active behaviour, which starts at puberty and continues through to young adulthood. Longitudinal studies from the USA, the Netherlands and Finland reported that this decline was most marked between the ages of 12/13 and 15/16 (Bradley 2000, Kimm 2002, Van Mechelen 2000, Telama 2000). A large cross-sectional study from the USA, which involved over 50,000 subjects, also found a clear decline of activity levels from the 12- year-old age group through to the 18-year-old (Caspersen 2000).

Janz et al (2000) measured vigorous activity using a 3 day sweat recall with acceptable validity compared to accelerometry. They found some increase in vigorous activity from age 10 to 15, particularly in boys. This finding is supported by another survey (Telama 2000) which involved over 1500 subjects. The percentage of vigorously active adolescents increased from age 9 through to 21 after which time it decreased. However, in this Finnish study the percentage of vigorously and moderately active subjects together decreased throughout the study period from age 9 to 27. Another large cross-sectional study, on the other hand, found lower levels of moderate as well as vigorous activity from age 12 onwards (Caspersen 2000).

It can clearly be concluded that overall physical activity peaks at the age of 12/13 years, after which time a marked decline can be observed. Vigorous activity alone may peak as late as age 21 and decrease later.

3.4. Tracking of physical activity from adolescence to adulthood

A strong age-related decline in physical activity has been reported in several studies (Pate 1993, Pate 2002, Sallis 1999, Sallis 2000). The question of whether active adolescents remain active at adult age is of particular interest for the timing of intervention programmes that promote an active lifestyle. Therefore, a number of studies published in the last five years addressed the issue of tracking of physical activity from adolescence to adulthood. Tracking usually refers to the maintenance of an individual's rank relative to peers over a given follow-up period. We therefore need to consider that this measure only expresses whether a person remains more or less active than others in the same age group. It does not reflect, however, whether the age group as a whole changed their physical activity behaviour over time. The studies considered here all feature a follow-up of over 10 years measured in a longitudinal study design.

Tammelin et al. (2003) differentiated between different types of activity in their large study, which involved 7794 respondents who filled in a questionnaire at age 14 and age 31. The authors concluded that adolescent sports participation was associated with high levels of physical activity in later life. Adolescent participation in intensive endurance sports and activities that required diversified sports skills was most likely to be linked to active behaviour at adult age. The other studies measured physical activity as well as physical fitness and found better tracking for cardio-respiratory fitness parameters than for activity measured by questionnaire (Campbell 2001, Lefevre 2000) Twisk et al. (2000) calculated odds ratios for risk quartiles. Thus, a person who was in the lowest quartile for physical activity at age 13 was 3.6 times more likely than all others to be in the lowest quartile again at age 27. The corresponding odds ratios for cardiopulmonary fitness and neuromotor fitness were 4.4 and 14.2.

It can generally be said that these studies found low to moderate tracking of physical activity assessed by questionnaire. This confirms the findings in Malina's (2001) review where 4 earlier studies that addressed the same issue are reported. Tracking for physical fitness was moderate. Higher tracking for fitness is partially explained by its genetic component, but can also be due to the fact that fitness measurements tend to be more accurate than self-report questionnaires and could in some cases be an even more relevant correlate of physical activity than the data derived from questionnaires.

Motor skill development during childhood may significantly influence adult physical activity behaviour (Malina 2001). The high tracking of neuromotor fitness parameters (Twisk 2000) cited above may suggest that early adolescence is a crucial time for skill development. In a qualitative study (Thompson 2003) male participants stressed their motor skill performance as a major influence on their attitude towards physical activity and their participation in young years up to the present. However, most of the 16 men interviewed changed their ranking for physical activity as they became adults. Taylor et al. (1999) found a positive relationship between teen skill in physical activity (as

recalled at adult age) and adult exercise habits. Tammelin et al. (2003)'s finding - as reported earlier - undermine that skill attainment by the age of 14 may pave the way for more active behaviour in later life. An experimental study in Canada (Trudeau 1999) may partly support that notion. Women who had received 5 hours of physical education classes taught by a professional physical educator per week throughout their primary school years were more likely to participate in physical activity at adult age than controls who had received 40 minutes of physical education lessons during primary school. For men there was no difference between the experimental and control subjects.

While the influence of teen motor skill on adult physical activity participation cannot be quantified by the studies cited above, they clearly suggest that motor skill has a role to play, which deserves further attention.

3.5. Prevalences, time trends and development of transport-related physical activity

As in overall physical activity, no internationally accepted standards for the measurement of transport-related physical activity in children and no global estimates of children's physical activity exist. However, a number of studies in different countries have addressed the issue.

The journey to school is a potentially important opportunity for establishing daily physical activity (Sleap 1993), and many schemes have been introduced at governmental, national and local levels to promote active transport to school (Rowland 2003, Department 1999). Despite the enthusiasm for such approaches, there is little evidence for the magnitude of the contribution that active commuting to school might make to children's overall physical activity (Tudor-Locke 2001). Objective monitoring of physical activity provides one approach to investigating this relationship, and has recently been used to demonstrate that energy expenditure is greater in adolescents who use active commuting to school (Tudor-Locke 2003).

3.5. a The Swiss 2000 microcensus: data about children's travel

As part of the Swiss Microcensus project (Mikrozensus 2000) data was collected about children's travel behaviour in Switzerland, using questionnaires (Mikrozensus 2000). The sample size was large with 4100 children aged 6 to 17 years. Among the 6 to 17 years old population, the distance traveled per day is about 23 km for a mean duration of 79 minutes.

Regarding all mode of transports, children of 6-9 years of age show a number of trips per day (3 to 4) equivalent to that of the general population; however, the distance traveled (in kilometers) is much below the mean (Table 1).

Table 1: Number of trips per day, duration of the trip and distance travelled in children 6 to 17 years old (n = 4 100 children)

Age	Gender	Trips/day (n)	Distance traveled (km)	Mean duration of the trip (min)
6-9	Boys	3.6	17.7	84.8
	Girls	3.4	17.5	74.4
10-14	Boys	3.7	18.7	79.6
	Girls	3.8	23.4	85.4
15-17	Boys	4.1	34.4	106.2
	Girls	3.9	34.8	109.6

Children walk much more often that adults, and they use their bike, especially between 10 and 14 years (walking represents only 30 to 35% of all trips in adults before age 65). The proportion of trips traveled by car is quite high in children aged 6 to 9 (28%) (Figure 2). The car is used to go to school, to go shopping or to go to leisure time activities (Figure 3).

Figure 2: Modes of transport (% of all trips of the day)

(Marche=walking, Bicyclette= bicycling, Cyclomoteur, etc. = motorcycle, cars, Train= tain, Bus, tram, car postal= public transportation, Autres= others)

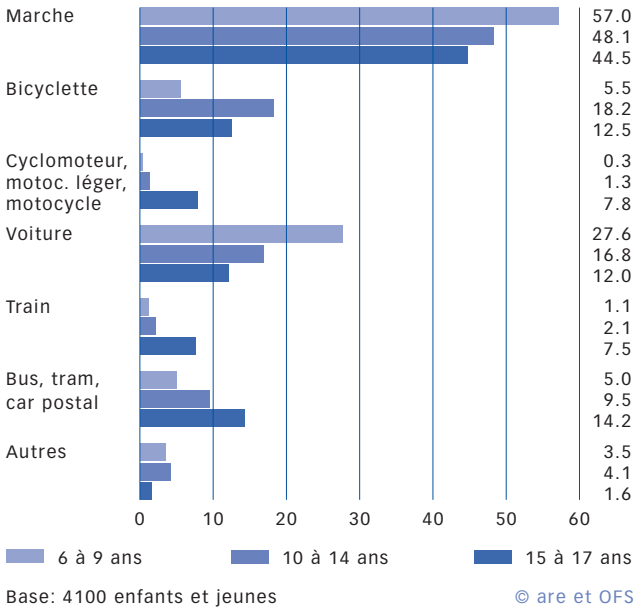
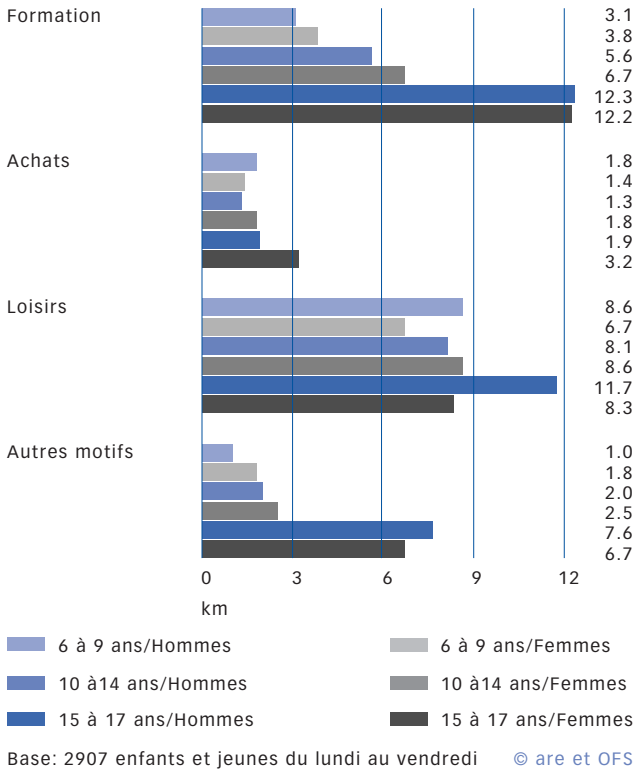


Figure 3: Purposes of journey (distance per working day in km)

(Formation= schools, Achats= shopping, Loisirs=leisure time activities, Autres motifs= other reasons)



Additional results are provided for the 3071 children aged 6 to 14 years in the tables below (Table 2 and Table 3).

Table 2 : Distance travelled per child aged 6-9 per year in 2000

Journey Purpose / Mode	school	personal business #	other
Walk	39.8%	8.8%	3.7%
Bicycle	4.4%	2.4%	0%
Car Passenger	31.1%	64.9%	22.8%
Bus; Train; Other Public Transport	20.8%	19.0%	72.8%
Other Private Transport	0.4%	2.7%	0.1%
	100%	100%	100%
TOTAL (n=9743*, 100%)	(495, 5.1%)	(5990, 61.5%)	(3258, 33.4%)

Distance travelled per child aged 10-14 per year in 2000

Journey Purpose / Mode	school	personal business #	other
Walk	19.2%	9.5%	1.8%
Bicycle	20.7%	5.2%	2.0%
Car Passenger	10.5%	57.1%	81.4%
Bus; Train; Other Public Transport	39.4%	22.6%	11.5%
Other Private Transport	6.5%	2.1%	2.4%
	100%	100%	100%
TOTAL (n=9044*, 100%)	(894, 9.9%)	(5899, 65.2%)	(2251, 24.9%)

Travel for shopping, religion, health, etc ; * There are some trips of unknown mode

The distance to go to school or to other formation place, only represents 5% to 10% of the whole distance travelled during the year. However, for this travel, walking is the major mode of transport (40%) in younger children aged 6-9, followed by private car (31%); walking is less used to go to school in 10-14 years old children (19%) who prefer bicycle (21%) or public transportation (39%). This may be partly linked with bigger distance in older kids. Walking is even less often used for personal business or other reasons to travel. Being a private car passenger or a public transport passenger is then the most usual mode of transport, in both age categories.

Results showing the mode of transport according to the number of trips made are provided in Table 3. They show that personal business is the main reason to move (62% and 63% of all trips) in both age categories, followed by going to school (32%). Walking and using a private car are the most used mode of transport when moving is needed, with an important use of bicycle to go to school in older kids.

Table 3 : Number of trips made per child aged 6-9 per year in 2000

Journey Purpose / Mode	school	personal business #	other
Walk	78.5%	38.1%	31.0%
Bicycle	4.0%	8.1%	1.7%
Car Passenger	8.9%	43.7%	55.2%
Bus; Train; Other Public Transport	6.7%	4.6%	8.6%
Other Private Transport	0.3%	2.4%	1.7%
	100%	100%	100%
TOTAL (n=1012*, 100%)	(327, 32.3%)	(627, 62%)	(58, 5.7%)

Number of trips made per child aged 6-9 per year in 2000

Journey Purpose / Mode	school	personal business #	other

Walk	50.4%	36.5%	28.8%
Bicycle	26.4%	19.1%	15.3%
Car Passenger	4.3%	31.1%	33.4%
Bus; Train; Other Public Transport	14.2%	6.2%	11.9%
Other Private Transport	1.4%	2.5%	5.1%
	100%	100%	100%
TOTAL (n=1095, 100%)	(345, 31.5%)	(691, 63.1%)	(59, 5.4%)

Travel for shopping, religion, health, etc ; * There are some trips of unknown mode

3.5.b other studies in Switzerland

Also in Switzerland, in the canton de Vaud, a survey about sports activity, physical activity and fitness in 9- to 19-year old teenagers (Michaud 1999) showed that, whereas most of the pupils use bicycle, roller-skates or walk to school (75% for grade 4), the percentage of respondents using these active means decreases after grade 8 (60% for grade 8, 30% for high school and apprenticeship teenagers).

3.5.c International studies

To examine modes of transportation to school for Georgia children, the Georgia Division of Public Health analyzed data from the Georgia Asthma Survey conducted during May-August 2000 (MMWR 2002). The results of that analysis indicate that less than 19% of Georgia school-aged children who live up to 1 mile from school walk to school the majority of days of the week.

Indeed, increasing car use is perceived as a significant contributor to reduced children's daily activity. In the United Kingdom for instance, the proportion of children under 16 years of age travelling to school by car increased from 16 to 30% between 1985/86 and 1997/98 (Department 2000). The National travel patterns of the children in Great-Britain (Department 2000) show that 38% of primary school children (5-10yr of age) are taken to school by car, with negligible levels of bicycle use. For 82% of the children the journey is <1mile. As children get older they become less active, raising the possibility that active commuting may be a more important contributor to daily physical activity in older children and adolescents.

In a recent study to be published, primary schools children from Bristol, England, were asked to wear an accelerometer during waking hours, for seven days (Cooper 2003). Daily travel to school was estimated using a questionnaire. Results show that, among the 114 children (59 boys, 55 girls; 10.4 ± 0.8 years) who took part in the study, on weekdays, those who walked to school (65%) were significantly more active than those who travelled by car (712.0 ± 206.7 vs. 629.9 ± 207.2 CSA counts per minute, p=0.05). At the weekend there were no significant differences between the two groups. There was a significant gender*travel interaction that revealed a large difference in activity levels between boys who walked or travelled by car that was not present in girls. The difference in physical activity was greater than accounted for the journey to and from school. Between 8am and 9am, when the children travelled to school, those who walked recorded approximately 50% more moderate to vigorous physical activity than those who travelled by car. There was no difference in physical activity during the school day (9am to 3pm) but hourly activity patterns demonstrated that boys who walked to school were more active after school and throughout the evening (3pm to 8pm) than car users. These results indicate that active transport may contribute to a more physically active profile, at least for boys. In Cooper's study, the boys who walked to school accumulated an extra 45 minutes daily of

>3METs physical activity which is equivalent to approximately 80kcal per day assuming a mean weight of 36kg (Cooper 2003). These effects are similar in magnitude to the 44.2kcal per day measured with the Caltrac accelerometer in adolescent male Filipino students who used active commuting (Tudor-Locke 2003).

The promotion of active commuting to school must be considered in the context of the parents' concerns for their children's personal and pedestrian safety. We certainly do not have a full understanding at this time of all the factors related to decisions about transportation mode, whether by child, parent, community, or school. Such information is necessary if successful and sustainable interventions can be implemented, important transport policy decisions can be made, and community and school designs can be modified. Such information can be obtained by questionnaires or by using the results of pilot programs and policies established in order to promote transport-related physical activity (Tudor-Locke 2001).

3.6. Predictors of overall physical activity and transport-related physical activity in children

3.6. a Parental activity / inactivity

Parental activity is a determinant of physical activity in obese and non-obese children (Kalakanis 2001, Trost 1997, Trost 2001). Parental participation in children's activities significantly predict levels of physical activity in their children (Klesges 1990).

Parental inactivity has been shown to be a strong and positive predictor of child inactivity in a cross-sectional study including 129 obese children and 142 normal-weight controls and their parents (Fogelholm 1999). Scores of parent activity were somewhat weaker predictors of child vigorous activity hours and total physical activity level. Hence, parents who want to reduce their children's inactivity have to pay attention to their own lifestyle. This information has been consolidated by the finding of a dose-response in a family intervention in the acquisition of positive knowledge and attitudes toward health habit changes (Nader 1996).

This parental effect may differ according to the age of the children, being more important in older children, but results on this issue are contradictory. In young children (aged 3-5 years), high activity levels in the child has been found to be associated with a low BMI in fathers (Finn 2002). On another hand, in a longitudinal project assessing the determinants of exercise among children, child's enjoyment of physical activity appeared as the only consistent predictor of physical activity during fifth and sixth grades (DiLorenzo 1998). In later grades, however, child's exercise knowledge, mother's physical activity, and child's and mother's friend modelling and support emerged as predictors for girls. For boys, child's self-efficacy for physical activity, exercise knowledge, parental modelling, and interest in sports media were important. The addition of information from fathers nearly doubled the explanatory power of the predictors for both genders.

Therefore, it is clear that socialization in the family unit exerts a tremendous influence on health-related behaviors such as exercise (DiLorenzo 1998).

3.6. b Sociocultural determinants of physical activity among children

Social learning variables appear to be important correlates of physical activity in children (Stucky-Ropp 1993). Salient predictor variables for boys include enjoyment of physical activity, friend and family support for physical activity, mother's perceived barriers to exercise, and mother's perceived family support for exercise. For girls, the major predictors include enjoyment of physical activity, number of exercise-related items at home, mother's perceived family support for physical activity, mother's perceived barriers to exercise, and direct parental modelling of physical activity.

Social-cognitive predictors were also estimated in a prospective study to identify the predictors of vigorous physical activity (> or = 6 METs) and moderate and vigorous physical activity (> or = 3 METs) among 202 rural, predominantly African-American children (Trost 1997). For girls, participation in community sports, self-efficacy in overcoming barriers, enjoyment of school physical education, race (white > black), and perception of mother's activity level (active versus inactive) were significant predictors of vigorous physical activity. For moderate and vigorous physical activity, participation in community sports and self-efficacy in overcoming barriers were significant predictors. For boys, self-efficacy in overcoming barriers was the only significant predictor of vigorous physical activity, while beliefs regarding activity outcomes and participation in community sports were significant predictors of moderate and vigorous physical activity.

These results have been confirmed more recently. An American national sample of 1,504 parents and children in grades 4-12 were interviewed by telephone (Sallis, Health Psychol 1999). Use of afternoon time for sports and physical activity, enjoyment of physical education, and family support for physical activity had strong and consistent associations with the child physical activity. In the 4th and 5th grades, children's preferences for physical activity and frequency of parents transporting children to activity locations explained significant proportions of variance for girls and boys (Sallis, Am J Prev Med 1999).

Compared to their non-obese counterparts, obese children report significantly lower levels of physical activity self-efficacy, are involved in significantly fewer community organizations promoting physical activity and are significantly less likely to report their father or male guardian as physically active (Trost 2001).

Few ethnic differences in childhood physical activity are observed once characteristics such as social class and single versus dual parent family background are controlled for. Indeed, children from single parent homes seem to have higher levels of television viewing and vigorous exercise, less physical education and, only in girls, lower habitual physical activity. Physical fitness was higher among boys, Caucasians, physically mature children (Lindquist 1999).

Students attending school in a less urbanised community have been found to be nearly twice more likely to use a bicycle for transportation (Willem Van Mechelens, personal communication 2003).

In Switzerland, no secondary analyses of the travel behaviour microcensus data to identify predictors of children's transport related physical activity have been performed so far. For the entire sample, the percentage of journeys travelled with human powered mobility was highest in the German speaking part of the country (48.8%), followed by the French speaking part (38.0%) and lowest in the Italian speaking part (36.5%) – even though the daily travel distances and times were highest among the German speaking population (Mikrozensus 2000).

3.6. c School Physical Education

The effects of the school have been demonstrated even in youngest ages. In a study with 214 children (aged 3-5 years) enrolled in 10 childcare centers who were monitored for physical activity with an accelerometer during 2 continuous days (48 hours), childcare center was found the highest individual predictor of activity (Finn 2002).

In the Bogalusa Heart Study (Myers 1996), although most physical activity occurred after school, children who reported no physical education class during school had less physical activity overall.

Many states in the US are experiencing a serious erosion of school physical education and community recreation programs. As a result, children's physical fitness levels may be decreasing and body fat measurements may be increasing in the near future, as it has been shown in Michigan where 38 percent of children are overweight compared to 25 percent nationally (Ezinga 1997).

In Switzerland, a federal law states that the cantons have to provide three lessons of physical education to full time students. However, not all cantons comply with this law. A secondary analysis of the data of the 15 to 24 year old in the Swiss Health Survey 1997 has shown, that in the cantons where the law is not fully implemented there is no compensatory increase in leisure time physical activity, but that leisure time as well as overall physical activity are lower than in the cantons that provide the three lessons per week (Lamprecht 2000). In women and in lower education individuals, two groups with particularly low activity levels, the differences in physical activity patterns were particularly pronounced between the two groups of cantons.

3.6. d Television viewing

A cross-sectional study was conducted among preschool children and primary schoolchildren in Ankara during March and April 1999 to detect the factors that affect TV viewing time (Songul 2002). The mean age for becoming a TV viewer is 2.7 +/- 1.6 years. Of all, 62% of children spent >/= 2h/day watching TV and 8.3% of children spent > 4 h. The TV viewing time of child was significantly and positively correlated with that of siblings, mother and father for both groups. Age and sleeping time of the child, age and the education level of mother, presence of TV in the child's room and the starting age watching TV did not affect the viewing time.

Cardiovascular fitness evaluated by the 1-mile run/walk was associated with both parental and child reports of the child's amount of TV viewing in a suburban California city (Armstrong 1998).

Television (TV) viewing has been associated with overweight, decreased physical activity, and unhealthy dietary behavior among children and adolescents, and may represent a modifiable cause of childhood obesity (Lowry 2002, Robinson 2003) :

- **In children**, there is a positive relationship between TV viewing and fatness (Grund 2001) even though increased TV viewing is not always found to be associated with reduced 24-hour energy expenditure as assessed by 24-hour heart rate monitoring or sub-maximal VO2. Increased TV consumption is associated with a low socio-economic status and poor diet. Indeed, in the Framingham Children's longitudinal study (Proctor 2003), 106 children were enrolled during preschool years (mean age 4.0 y) and followed into early adolescence (mean age 11.1 y). Television watching was an independent predictor of the change in the child's BMI, triceps, and sum of five skinfolds throughout childhood. Its effect was only slightly attenuated by controlling for the baseline body fat, level of physical activity (as measured repeatedly by Caltrac accelerometer), percent of calories from fat, total calorie intake, or the parents' BMI or education. By age 11, children who watched 3.0 h or more of television per day had a mean sum of skinfolds of 106.2 mm, compared with a mean sum of skinfolds of 76.5 mm for those who watched less than 1.75 h per day (P=0.007). Furthermore, the adverse effect of television viewing was worse for those children who were also sedentary or had a higher-fat diet. In conclusion, children who watched the most television during childhood had the greatest increase in body fat over time. Healthy lifestyle education designed to prevent obesity and its consequences should target television-watching habits of children.

- **In adolescents,** consistent findings are available. Data on moderate-to-vigorous and low-intensity physical activity, TV/video viewing, and video game/computer use were obtained from questionnaires in a US representative sample of 12,759 participants (6997 non-Hispanic whites, 2676 non-Hispanic blacks, 2185 Hispanics, and 901 Asians) in the National Longitudinal Study of Adolescent Health (1995 and 1996) (Gordon-Larsen 2002). Overweight prevalence was positively associated with high level TV/video viewing among white boys (odds ratio [OR] = 1.52; 95% confidence interval [1.08 to 2.14]) and girls (OR = 2.45 [1.51 to 3.97]). The odds of overweight decreased with high levels of moderate to vigorous physical activity. Predicted probabilities show lower overweight among adolescents who watched less TV per week combined with frequent moderate to vigorous physical activity than those who watched more TV per week combined with fewer bouts of weekly moderate to vigorous physical activity.

- Among American **high school students**, a recent study also examined these associations (data from the 1999 national Youth Risk Behavior Survey, N = 15,349 of US high school students). TV viewing on an average school day exceeded 2 hours/day among 43% of students; it was greater among Black (74%) and Hispanic (52%) than White (34%) students. Overall, 11% of students were overweight, 31% of students were sedentary (i.e., did not participate in moderate or vigorous physical activity at recommended levels), and 76% ate less than five servings/day of fruits and vegetables. Watching TV more than 2 hours/day was associated with being overweight, being sedentary, and eating insufficient fruits and

vegetables among White females, and with being overweight among Hispanic females. No significant associations were found among Black females. TV viewing was associated with being overweight and eating insufficient fruits and vegetables among White males. No significant associations were found among Hispanic males. Among Black males, TV viewing was associated with greater participation in physical activity. These findings suggest the presence of cultural factors to consider when developing interventions to promote physical activity, healthy eating, and healthy weight through reduced TV viewing among adolescents.

3.6. e Proportion of outdoor activity

More outdoor activity has been clearly associated with higher activity levels (Klesges 1990).

Already in 1993, the Baranowski's study showed that activity levels among young children may be increased by encouraging them to spend more time outdoors (Baranowski 1993). In this study, the level of physical activity of 3- and 4-year-old children was assessed in alternative physical locations by month and time of day and by age, gender, and ethnicity. Physical activity was assessed by direct observation for up to 4 days per year, for 3 consecutive years, with the Children's Activity Rating Scale (CARS) from 7:00 am to 7:00 pm. A tri-ethnic sample of 191 three- and four-year-old children was observed for up to four times in the course of a year. Activity was consistently higher outside than inside. The activity levels of boys and girls differed by time of year, particularly when outside. Outside activity levels were lower during the summer months, reaching the lowest level in July, the hottest month in the study's location. A model including gender, month, and location terms accounted for 75% of the variance in physical activity. There was no significant difference in physical activity by ethnic group.

In conclusion, TV/video viewing and video game/computer may reflect the proportion of time spent indoor, and therefore be related to inactivity while the proportion of time spent outdoor may reflect the proportion of moderate to high intensity activities in children.

4. Health Impacts of Physical Activity in Children

4.1. Direct Health Impacts in children

Regular exercise/physical activity provides substantial benefits in reducing morbidity and mortality from several chronic diseases in adults, particularly cardiovascular disease (Harsha 1995).

4.1. a Obesity and overweight

Physical inactivity is an important contributing factor in the development and maintenance of childhood obesity (Goran 1999). Data support that lower physical activity levels and sedentary behaviours are associated with a higher prevalence of obesity in children (Hill 2003, Steinbeck 2001, Fogelholm 1999) and may predispose children to the development of obesity and chronic disease in later life (Goran 2001, Boreham 1997).

In non-obese and obese sixth grade children (mean age of 11.4+/-0.6), obesity status was determined using the age-, race- and gender-specific 95th percentile for BMI from NHANES-1 (Trost 2001). Objective measurements of physical activity were collected over a 7-day period using the CSA 7164 accelerometer. Compared to their non-obese counterparts, obese children exhibited significantly lower daily accumulations of total counts, daily moderate (3-5.9 METs) physical activity and daily vigorous physical activity (> or =6 METs) as well as significantly fewer 5, 10 and 20 min bouts of moderate-to-vigorous physical activity (> or =3 METs). Also a significant relationship exists between childhood obesity and computer usage, television watching, total hours in sedentary behavior, and maternal BMI (Arluk 2003).

Exercise is today a method of treatment in pediatric obesity. By using the meta-analytic approach, LeMura and Maziekas (LeMura 2002) studied 30 investigations that addressed this issue and met their criteria for inclusion. Significant differences were found as a function of the type intervention groups (exercise vs exercise + behavioral modification; $P < 0.04$); body composition assessment methods (skinfold vs hydrostatic weighing, DEXA, and total body water; $P < 0.006$); exercise intensity (60-65%, vs >or= 71% VO2max; $P < 0.01$); duration (<or= 30 min vs > 30 min; $P < 0.03$); and mode (aerobic vs aerobic + resistance training; $P < 0.02$). Overall, exercise appear to be efficacious for reducing selected body composition variables in children and adolescents. The most favorable alterations in body composition occurred with 1) low-intensity, long-duration exercise; 2) aerobic exercise combined with high-repetition resistance training; and 3) exercise programs combined with a behavioral-modification component.

4.1. b Predictors of Cardiovascular Disease (CVD)

Although CVD becomes evident in middle-age and beyond, the development of the disease begins in childhood and adolescence (McGill 2000). Data from the Bogalusa Heart Study indicates that CVD risk factors track from childhood into adulthood (Nicklas 2002). It is therefore logical to attempt to limit the development of CVD in children and adolescents (Biddle 2004).

Some reviews addressing the effects of physical activity on CVD risk factors in children and adolescents, concluded that exercise had little, if any, influence on the CVD risk factors of healthy individuals (Armstrong 1994, Alpert 1994, Riddoch 1998, Tolfrey 2000). Although the evidence to date may not be convincing, it is clear that many of the studies in this area had methodological weaknesses including low sample size, inadequate exercise training volume and lack of control individuals (Armstrong 1994, Tolfrey 2000). Moreover, it is possible that most children and adolescents have normal lipid/lipoprotein and blood pressure profiles that cannot change via exercise. It may be more fruitful to focus on groups of children and adolescents who exhibit unfavourable CVD risk factor profiles.

On another hand, cardio-respiratory fitness has been found to be associated with activity levels (Boreham 1997). The relationships between fitness and cardiovascular risk factors in children are very similar to those in adults, Those children who perform better on standardized fitness tests have more favorable body composition and lipid profiles. Exercise training (stationary cycling for 30 min, 3

times.wk-1 for 12 wk) has favorable effects on the lipid-lipoprotein profile in pre-pubertal children (ET, N = 28) (Tolfrey 1998).

Physical activity may have an indirect association with serum lipid and lipoprotein values through its relationship with higher fitness levels and lower levels of fatness (DuRant 1993). In a cross-sectional and follow-up study, body composition, resting heart rate, and cardiovascular fitness variables and serum lipid and lipoprotein levels were measured at age 3 or 4 years (study year 1) and at age 4 or 5 years (study year 2), and day-long heart rate was measured and the Children's Activity Rating Scale was administered between study years 1 and 2. Year-1 waist/hip ratios were inversely correlated with total serum cholesterol (TSC) and low-density lipoprotein (LDL) levels. Mean activity level was inversely correlated with waist/hip ratios. The sum of seven skin-fold measurements was inversely correlated with the high-density lipoprotein (HDL) level, and with height and gender, explained 15.4% of the variation in triglyceride levels. These children's levels of physical activity were associated with higher fitness levels. Year-1 waist/hip ratios and year-2 sum of seven skin-fold measurements were positively correlated with the LDL/HDL and TSC/HDL ratios.

A recent randomised intervention study also demonstrated a beneficial effect of physical training on lipids and lipoproteins in a group of obese adolescents. In this study the participants with the least favourable baseline lipid/lipoprotein concentrations exhibited the most beneficial changes (Kang, 2002).

As Biddle have shown in his review, several recent studies have examined the influence of physical activity and physical fitness in adolescence on CVD risk factors later in life (Biddle SJH in press, Twisk 2002, Janz 2002, Boreham 2002, Hasselstrøm 2002, Lefevre 2002). The findings suggest that high physical fitness during adolescence and young adulthood is related to a ‘healthy’ CVD risk profile later in life but there is no direct proof that activity in childhood provides protection from CVD in adulthood (Rowland 2001).

4.1. c Diabetes Mellitus / Insulin resistance

In children, an emerging prevalence of type 2 Diabetes Mellitus has been noted (American Diabetes Association 2000). This is paralleled by increasing prevalence of childhood obesity.

The association between insulin resistance / metabolic syndrome and physical activity have been studied. The overall results show that low levels of physical activity appear to be a risk factor for insulin resistance. Indeed, decreases of fasting insulin level for increasing levels of physical activity have been demonstrated (Ramirez-Lopez 2001, Schmitz 2002, Kang 2002, Ritenbaugh 2003). However, most studies in this field have used questionnaires. Results may have been more evident with objective methods as for instance, it has been found an inverse relationship between insuline and VO2 max but not with physical activity recorded by questionnaire (McMurray 2000). In a very recent study conducted in Odense, Denmark, physical activity was assessed in randomly selected children (279 boys, mean age 9,6) using accelerometry. Results showed that in non-diabetic range of fasting serum glucose, physical activity is negatively correlated to the insulin resistance syndrome in children (Brage 2002). As the Diabetes Prevention Program Research Group reported (Diabetes Prevention Program Research Group 2002), a lifestyle intervention that incorporated increased physical activity

and moderate weight loss reduced the incidence of type 2 diabetes mellitus more effectively than metformin, a frequently prescribed oral antihyperglycemic agent.

4.1. d Osteoporosis

Osteoporosis is a major and increasing public health problem. Peak bone mass occurs at the conclusion of growth and is achieved in most people around the age of 20. It may be the most important factor for preventing osteoporosis since as much bone is accrued during the adolescent years as most individuals will lose during all of adult life. Peak bone mass appears to be largely under the control of genetic influences (Boreham 2001). However, the residual variance is under environmental influences: diet (calcium intake) and the amount and type of physical activity performed during childhood and adolescence. Since it is a behavior, physical activity is a potentially modifiable determinant of peak bone mass; therefore, understanding activity's impact on bone health is central to developing primary prevention strategies for osteoporosis (Janz K 2002).

In Khan et al review (Khan 2000), authors examined the evidence that childhood physical activity is an important determinant of bone mineral in adult years, and as such, may help to prevent osteoporosis. Animal studies provide strong evidence that growing bone has a greater capacity to add new bone to the skeleton than does adult bone (Khan 2000). Observational studies in children undertaking routine physical activity and cross-sectional athlete studies in young sports people both reveal that activity is positively associated with bone mineral density (BMD). Longitudinal studies in pre- and peri-pubertal gymnasts reveal BMD gains far in excess of those that can be achieved in adulthood. It is suggested that the BMD differences are clearly greater when bone is subjected to mechanical loading prior to the end of puberty and longitudinal growth of the body (in women, before menarche) rather than after it (Khan 2000). Tanner stage II and III appears to be the maturational stage when the association between exercise and BMD becomes manifest in most adolescents.

However, such studies permit only limited conclusions as they contain the potential for selection bias and can be confounded by other determinants of bone mineral (e.g. dietary and lifestyle factors). Thus, randomised intervention studies of physical activity and bone mineral accrual in normal children have proven to be extremely useful. They can confirm that childhood activity is strongly associated with bone mineral accrual. For instance, in a 16 month study of calcium supplementation (1000 mg Ca/d as carbonate) in 144 adolescent girls aged aged 16-18 y, the subjects were randomly allocated to an exercise (three 45-min exercise-to-music classes/wk during term time) or nonexercise group (Stear SJ 2003). Dual-energy X-ray absorptiometry of the whole body, spine, forearm, and hip was performed before and after intervention. Calcium supplementation significantly increased size-adjusted bone mineral content. Attendance at > 50% of the exercise sessions also significantly increased bone mineral content.

It is not clear how much of the adolescent bone gain may, at least partly, persist despite reduced adult physical activity. Bone mineral density has been found significantly higher in all age groups of both male and female athletes compared with that in non-athletic population (Gao P 2000, Khan 2000). Bone loss with age is less apparent in athletes than in controls (Gao P 2000).

On another hand, it was recently demonstrated that ice hockey training during childhood and adolescence may not prevent the development of osteoporosis of the femoral neck later in life if the activity is not maintained (Gustavsson A 2003).

In the Amsterdam Growth and Health Longitudinal Study, daily physical activity and fitness were monitored from age 13 to 29 years in a group of 182 males and females (Kemper HC 2000). At a mean age of 28 years, bone mineral density (BMD) was measured at three sites with dual X-ray absorptiometry (DXA). Physical activity was estimated from a cross-check activity interview taking in consideration all daily physical activities during the last 3 months. Physical fitness was measured with a neuromotor fitness test (composite of six strength, flexibility, and speed tests) and as cardiopulmonary fitness (maximal oxygen uptake). The physical activity and fitness scores were calculated over two age periods: during adolescence (13-16 years) and during adulthood (21-27 years). Weight, physical activity and neuromotor fitness during adolescence and in young adulthood were found to be significantly and positively related with the lumbar BMD (beta = 0. 11-0.40) and hip BMD (beta = 0.18-0.26), measured at the mean age of 28 years. This was not the case for cardiorespiratory fitness. No significant correlations at all were found with wrist BMD, a bone site that is less involved in physical activity and fitness. It was concluded that daily physical activity during adolescence and in the young adult period is significantly related to the BMD at the lumbar spine and femoral neck at age 28 of males and females. Only neuromotor fitness and not cardiopulmonary fitness during adolescence and young adulthood was related to the BMD of males and females at age 28 years.

Overall, it appears that physical activity during the most active period of maturity (with respect to longitudinal growth of the body) plays a vital role in optimising peak bone mass and that benefits may extend into adulthood.

4.1. e Psychological effects

In adults, physical activity has been showed to have a short term mood-enhancing effect (Honson 1993). For children and adolescents, several reviews found evidence that physical activity is related to higher self-esteem (Calfas 1994, Comacho 1991, Gruber 1986). Furthermore, emotional well-being appears to be positively associated with extent of participation in sports and vigorous recreational activity among adolescents (Steptoe 1996). Similar results were found by Hendry et al. (1989) in Scotland, also with a large cohort (n=5862).

Although, physical activity seems to promote self-esteem, no firm conclusions can be made on mental health.

Mutrie and Parfitt (1998) reviewed literature on young people and mental, social and moral health. They concluded that physical activity can have positive effects for mental health, most particularly for self-esteem, and those who are physically active are less likely to suffer from mental health problems. However, the evidence in this area is not extensive. Studies are largely cross-sectional, small-scale, and lack measurement consistency. In addition, while physical activity may enhance psychological well-being, it is likely that the prevailing psychological climate and social interactions inherent in such

settings will be more crucial than the physical activity itself. Unfortunately, such factors are rarely accounted for (Biddle SJH, in press).

The relationship between physical activity and cognitive, or academic, performance is unclear (Mutrie 1998). A recent study showed no effects of a health-related physical education program on academic achievement (Sallis et al., 1999). Many studies are not well designed and where effects have been reported, these cannot be attributed solely to physical activity.

4.2. Health effects through tracking

By assuming tracking of physical activity from adolescence to adulthood, it is perceivable that all health effects of physical activity in adults can be influenced by increasing and maintaining active behaviour in young people. Table 4 shows a list of these effects, details are described and references are given in the Topic Paper on Physical Activity of THE PEP.

Table 4. ***Overview of health effects of physical activity in adults.*** As there is a higher likelihood of physically active young people to be more active in later life as well (low to moderate tracking of physical activity), the health effects of physical activity in adults can be influenced by increasing and maintaining active behaviour in young people.	⇧ Life expectancy ⇩ Cardiovascular disease ⇩ Diabetes II ⇩ Obesity ⇩ Colon cancer ⇩ Breast cancer ⇩ (Prostate cancer) ⇩ (Pancreatic cancer) ⇩ Osteoporosis ⇩ Symptomatic gallstone disease ⇩ Depression ⇧ Stress tolerance ⇧ Independence in old age

In the Amsterdam Growth and Health Longitudinal Study (AGAHLS), a cohort of about 400 boys and girls (mean age 13 years) were followed over a period of 20 years (Kemper HC 2001). Over that period repeated measurements were done of body dimensions (height, weight, skinfolds), physical fitness (eight motor performance field tests: plate tapping, bent arm hang, 10 x 5 m sprint, arm pull, sit and reach, standing high jump, 10 leg lifts, 12-min endurance run, and one laboratory test to measure maximal aerobic power), and physical activity (by a cross-check interview). Three research questions were studied: (1) Is there a positive relationship between adolescent fitness (age 13-17 years) and adult physical activity (age 33 years)? (2) Do physical fitness and physical activity track from adolescence into adulthood? (3) What is the longitudinal relationship between physical fitness and physical activity? Multiple linear regression analysis showed that of the 9 physical fitness tests, only the 12-min endurance run and the maximal aerobic power during adolescence are significant ($P < 0.05$) predictors of adult physical activity. The effects are not influenced by biological age but by sex: only in females are the predictions significant ($P < 0.05$) Tracking over the period of 20 years estimated from stability coefficients showed values for physical fitness varying between 0.83 (plate tapping) to 0.38 (standing high jump and maximal aerobic power). Physical activity shows lower

stability coefficients (0.35-0.29). All physical fitness tests show positive and significant ($P < 0.05$) standardized regression coefficients with physical activity, but the explained variance is less than 1%. Only maximal aerobic power has a higher explained variance of 1.8%. It was concluded that: (1) Physical fitness in adolescence is only weakly related to adult physical activity; (2) between age 13 and 33 years, physical activity has low stability and physical fitness was higher stability; and (3) the longitudinal relationships between physical fitness and physical activity are only meaningful with maximal aerobic power.

4.3. Estimation of health effects on the population level

As only the first estimations of health effects of physical activity on the population level including all age groups exist, no specific models have been developed for children so far.

5. The effectiveness of interventions to increase physical activity in children

5.1. Effectiveness of interventions to increase overall physical activity

Our more sedentary lifestyle is thought to be related to an increased reliance on technology and labor-saving devices, which reduces the need for physical exertion for everyday activities. An example of an energy-saving device that has resulted in a decline in physical activity is the increased use of automated transport, elevators and escalators rather than walking, biking or climbing. In addition, the increased use of televisions and computers for entertainment and leisure activities also contributes to this trend. Data from the Heart Smart Superkids/Superfit exercise program (Harsha 1995) showed that comprehensive school-based health promotion and education interventions can improve fitness in children.

In the US, recommendations have been published for encouraging physical activity among young people so that they will continue to engage in physical activity in adulthood and obtain the benefits of physical activity throughout life (CDC 1997). These guidelines were developed by CDC and include recommendations about 10 aspects of school and community programs to promote lifelong physical activity among young people; policies that promote enjoyable physical activity and social environments that encourage and enable physical activity; physical education curricula and instruction; health education curricula and instruction; extracurricular physical activity programs that meet the needs and interests of students; involvement of parents and guardians on physical activity instruction and programs for young people; personnel training; health services for children and adolescents; developmentally appropriate community sports and recreation programs that are attractive to young people; and regular evaluation of physical activity instruction, programs, and facilities.

In 1998, the WHO published guidelines to promote active living in and through schools (WHO 1998). The statement emphasizes that schools provide a unique setting to provide physical activity to children and young people coming from different ethnic background and socioeconomic categories.

A recent review of the US CDC Task Force on Community Preventive Services has assessed the effectiveness of interventions to increase physical activity (Kahn 2002): prompts to encourage stair use, community-wide campaigns, school-based physical education, social support in community settings, and creation of or enhanced access to places for physical activity combined with informational outreach activities were among the interventions applicable to children deemed effective. For a number of interventions, evidence was insufficient to assess their effectiveness; among them were classroom-based health education focused on information provision, college-based health education and physical education, and classroom-based health education focused on reducing television viewing and video game playing.

A number of recent interventions directed at either increasing physical activity and/or decreasing sedentary behaviours, have shown encouraging results. Here are examples of these physical activity interventions.

- The Child and Adolescent Trial for Cardiovascular Health (CATCH) was a multicenter, randomized trial to test the effectiveness of a cardiovascular health promotion program in 56 intervention and 40 control elementary schools included 5106 initially third-grade students from ethnically diverse backgrounds in four states (California, Louisiana, Minnesota, Texas) of the USA (McKenzie 1996, Luepker 1996). For 2.5 years, randomly assigned schools participated in a third-grade through fifth-grade intervention including school food service modifications, enhanced physical education and classroom health curricula. Twenty-eight additional schools received these components plus family education. The standardized physical education intervention, included curriculum, staff development, and follow-up. Systematic analysis of 2,096 physical education lessons indicated that students engaged in more moderate-to-vigorous physical activity in intervention than in control schools (P = 0.002). Moderate-to-vigorous physical activity during lessons in intervention schools increased from 37.4% at baseline to 51.9%, thereby meeting the established Year 2000 objective of 50%. The intensity of physical activity in physical education classes during the intervention increased significantly in the intervention schools compared with the control schools (P<.02). Intervention children reported 12 more min of daily vigorous physical activity (58.6 minutes vs 46.5 minutes; P<.003) and ran 18.6 yards more than control children on a 9-min run test of fitness (P = 0.21). In conclusions, the implementation of a standardized curriculum and staff development program increased children's moderate-to-vigorous physical activity and improve physical activity behaviors in children during 3 school years.

- The “take 10” intervention (www.take10.net) included several sessions of 10 minutes, to be performed at school by primary school children. Clearly, the physical activity of participants was increased during the program.

- Kalakanis’study showed that programs to increase physical activity in obese children should structure the activity in short bouts and attempt to increase parental physical activity (Kalakanis 2001). The 51 8-12-year-old children seeking obesity treatment and wearing accelerometers for 3 or 4 days averaged 12.2 bouts of moderate-to-vigorous (= > 4.5 METs) physical activity per day that lasted an average of 4.2 min, while parents engaged in 3.9 bouts

of moderate-to-vigorous physical activity that lasted 4.2 min. Parent activity improved the prediction of obese children's activity levels and the number of bouts, but not the duration, of moderate-to-vigorous physical activity.

- An organized leisure-time program can increase physical activity in children (Kien 2003). If by middle school, many children lack the physical skills or self-confidence to participate in competitive physical activities, providing a summer and after-school program featuring non-competitive, outdoor activities such as gardening and adventure education, should lead to increased physical activity relative to habitual physical activities at home. To test this hypothesis, 2 experiments were conducted (Kien 2003). In the first, 4 children aged 12 years were evaluated while they participated in a summer recreation program for 2 hours and again while they watched a videotape. They wore an uniaxial accelerometer to assess physical movement, and we used a bicarbonate labeled with 13C tracer technique to assess energy expenditure. In a second experiment, 8 children (aged 10-12 years) were evaluated twice using uniaxial accelerometry only, once while they attended the after-school program for 2 hours and then during a similar period at home. The first study showed that the estimated energy expenditure was 60% increased during the program compared with watching a videotape (P =.02). Physical movement (accelerations per minute) also was significantly increased (P =.004). In the second experiment, movement was 95% increased during the program compared with the behavior at home (P =.005).

5.2. Effectiveness of interventions to increase transport-related physical activity

The journey to school is a potentially important opportunity for establishing daily physical activity (Sleap 1993), and many schemes have been introduced at Governmental, National and local levels to promote active transport to school (Rowland 2003, Duperrex 2002, Department 1999). Despite the enthusiasm for such approaches, there is little evidence for the magnitude of the contribution that active commuting to school might make to children's overall physical activity (Sleap 2001, Tudor-Locke 2001). Though a number of approaches exist to increase walking and biking to school, very few of them have actually been evaluated with respect to their effect on physical activity patterns.

In Udine, Italy, a project on the health of 0-14 years old children has consisted of piloting safe routes for walking to school, with the important support of volunteers, mostly parents themselves (www.comune.udine.it/cittas/home.htm). The project has not evaluated health effects nor behavioural outcomes in children.

In Hertfordshire, UK, a 3-year ongoing research has for objectives to evaluate the effects of car use on children's activity and health, their potential long-term car dependence, and to develop a framework to evaluate systematically the effects of travel-to-school initiatives (www.ucl.ac.uk/transport-studies/chcaruse.htm).

Long distances and dangerous motor-vehicle traffic pose the most common barriers to children walking and biking to school. Public health and community-based efforts that encourage walking and biking to school should address these barriers (MMWR 2002). In the promotion of walking, cycling

and all kind of other physical activities in young people, safety is a central issue (Roberts 1996). This document does not include a systematic revue of the risks of different activities in young people, put particular emphasis should be put on the use of bicycle helmets (Coffman 2002, Coffman 2003, Macpherson 2002), road safety in walking and at bus stops (Lightstone 2001, Unger 2002). It is also to be noted that the risk of sports injury increases not so much with age but with exposure to specific sports and with pubertal development (Michaud, 2001). Indeed, in Switzerland, only a few sports, not including running nor bicycling, are highly related to injury occurrence.

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TRANSPORT RELATED HEALTH IMPACTS - COSTS AND BENEFITS WITH A PARTICULAR FOCUS ON CHILDREN

Transnational Project and Workshop Series of Austria, France, Malta, Sweden, Switzerland and The Netherlands

POLICY AND STRATEGY DOCUMENT FOR THE PROMOTION OF CYCLING AND WALKING WITH A PARTICULAR FOCUS ON CHILDREN

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(to find the Annexe go to: www.hepa.ch/gf/mat/thepep/documents/)

1. Context and Executive Summary

THE PEP

In 1999 at the Ministerial Conference on Health and Environment which was held in London, the Charta on Traffic, Environment and Health was signed off. Main issues are inter alia:

Economic aspects of transport, environment and health

Special care of groups at high risk

The Pan-European Program on Transport, Health and Environment, THE PEP, was adopted at the second High-level Meeting on Transport, Environment and Health (Geneva, July 2002). THE PEP consolidates and focuses the UNECE and WHO/Europe activities on three key priority areas selected from the UNECE Programme of Joint Action on Transport and the Environment and the WHO Carter on Transport, Environment and Health:

integration of environment and health aspects into transport policy

demand of side management and modal shift

urban transport

Within the framework of THE PEP under *demand of side management and modal shift*, the promotion, implementation and review of policies designed to internalize the health and environmental externalities (external costs) generated by transport activities are intended.

The aim of the project is to provide a review on the state of the art on transport related health impacts, costs and benefits as well as to develop recommendations on political implementation strategies and also to contribute to the development of WHO-Guidelines for the economic valuation of transport related health effects.

Physical activity within THE PEP

The importance of physical activity for health is well established. Walking and cycling for transport purposes can contribute significantly to overall physical activity both in children and in adults. Physically active transport may thus result in transport related health benefits.

In most European countries however, motorised transport is predominant. There is little awareness on the important contribution physically active transport could make to the health of the population. Land use and transport planning, urban design and transport infrastructure are dominated by the needs of motorized transport.

As a contribution to THE PEP, three background documents on physical activity have been prepared:

- a Topic Paper on Physical Activity (in Adults)
- a Topic Paper on Physical Activity in Children
- a Policy and Strategy Document for the Promotion of Cycling and Walking with a particular Focus on Children

In the Policy and Strategy Document presented here, the rationale for the importance of physical activity in general and in children in particular is summarized in chapters 2 and 3; they are based on the respective Topic Papers mentioned above where all the specific references can be found. In chapters 4 and 5, policy and strategy directions are suggested to enhance the awareness on the importance of transport walking and cycling and to improve infrastructure and facilities for walking and cycling. The document "Promotion of Transport Walking and Cycling in Europe: Strategy Directions" developed by The European Network for the Promotion of Health-Enhancing Physical Activity HEPA in 2000 and its structure have been used as the basis of chapter 5. To illustrate the different political processes that can be used for these purposes, initiatives from Switzerland from different sectors and levels are presented.

The following paragraphs summarise the main points of chapters 2 to 4.

Why promoting walking and cycling?

The importance of regular physical activity for health is well established. Positive health effects have been demonstrated for life expectancy, cardiovascular disease, diabetes II, obesity, colon cancer, breast cancer osteoporosis depression, stress tolerance and independence at old age. However, levels of inactivity in industrialized countries are alarmingly high and physical inactivity is a major public health problem. The global estimations of WHO indicate that physical inactivity causes about 10–16% of cases each of breast cancer, colon and rectal cancers and diabetes mellitus, and about 22% of ischaemic heart disease, resulting in 1.9 million deaths and 19 million DALYs (disability-adjusted life years). There is a growing number of interventions to increase physical activity among the inactive, and – particularly in otherwise physically inactive individuals - transport-related physical activity has a great potential in the promotion of overall physical activity. Current research questions are the quantification of changes in behavioural patterns and in health outcomes that can be expected in traffic interventions.

Why promoting walking and cycling among children?

Direct health impacts of physical activity in children have been shown for obesity, diabetes type II, osteoporosis, psychological effects and predictors of cardiovascular disease. By assuming tracking of physical activity from adolescence to adulthood, it is perceivable that all health effects of physical activity in adults can be influenced by increasing and maintaining active behaviour in young people. Studies from different countries indicate high levels of inactivity in populations of young age and a tendency towards declining activity levels over age and time. There are indications that transport-related physical activity can make an important contribution to overall physical activity in children, but unfortunately active modes of transport in children – in particular for going to school – are increasingly substituted by motorised transport. A considerable number of interventions to increase physical activity in children have been developed, but there are only limited evaluation results. Current research questions are the development of specific interventions and the assessment of their effectiveness.

Policies to increase walking and cycling

There is a growing wealth of evidence for the importance of physical activity for health in both adults and children and for the important contribution transport-related physical activity can make to overall

physical activity. Though a number of research questions are still unanswered, the alarming prevalence of physical inactivity in all industrialized countries and the declining trends in transport-related physical activity make clear that the time for action has come.

Three levels of policy interventions are suggested:

- *Walking and cycling within a sustainable transport policy:*

  A policy to promote walking and cycling should be embedded into a policy to achieve sustainable transport and land use in general. Without a strong commitment for sustainable mobility as the guiding principle in transport and land use planning, it will be difficult to increase cycling and walking systematically and successfully.

- *Collaborations between sectors and different political levels:*

  The promotion of walking and cycling involves a considerable rage of sectors (transport, land use and urban planning, health, physical activity and sports, environment, energy, education sector) and institutions on the national, regional and local levels. It is essential to define conditions and create a climate where collaborations between sectors and different political levels are possible and become the standard.

- *Consideration of vulnerable groups' perspective and making a special case for children:*

  The needs of vulnerable groups like children, the elderly an people with special needs have to be included in decision making processes regarding transport infrastructure. When focusing on children, their basic rights according to the WHO Convention on the Rights of the Child may serve as a guideline: Children have the right to live, the right for health, to right to play and the right for a optimum development also of their physical potential. Industrialized countries have to recognize that a physical environment dominated by motorized transport can severely restrict these rights and that an effort for the case of the children must be done.

Strategies to increase walking and cycling

In European countries, short stages up to 5 km make up more than two thirds of all trips but the vast majority of these trips is covered by car. These figures indicate that there is a potential for a relevant modal shift from motorized to active transport. However, there are many perceived and real obstacles for walking and cycling such as insufficient or poorly maintained infrastructure, safety considerations or a low social status of active transport.

A strategy to promote walking and cycling has to go through the following steps:

- *Identifying strategic objectives and defining targets:*

  Urban design and land use and traffic planning are key elements in ensuring that journeys are possible on foot or by bicycle. When focusing on children, urban design and traffic planning have to ensure that ways to school can be travelled actively, that parks and open spaces are provided and that connections between places where children live, go to school and play are safe, attractive and enjoyable. Measurable targets must be defined.

- *Establishing consensus between parties and obtaining funding:*

  The key parties have to be involved in developing local plans . The educational system and parents are important parties when focusing on children. Funding on the local level is crucial. It

is suggested to secure a fixed proportion of the annual infrastructure budget for walking and cycling.

- *Taking action:*

  Action programmes must be developed on two levels: 1) creating a pro walking and cycling culture with communication campaigns targeting road users, professionals and transport providers as well as incentives and regulatory measures to make walking and cycling a more competitive mode of transport compared to the car 2) Improving infrastructure. Promoting walking and cycling without improving the respective infrastructure and facilities is meaningless.

- *Monitoring, evaluation and development of knowledge base:*

  Evaluation must be linked to defined measurable targets. A prerequisite is nationally available data on overall and transport-related physical activity in the different age groups. One way of achieving this is to include basic statistics on walking and cycling and data regarding children's travel behaviour in national travel surveys.

  In order to further advance the field, not only the overall patterns of physical activity and the effectiveness of interventions should be studied. Other important fields of research include the development of internationally standardised questionnaire instruments for both overall and transport-related physical activity in all age groups, the use of objective measurements like accerelometry for physical activity, the systematic integration of data from the health and from the transport sector, the quantification of the independent health effects of transport related physical activity, and the development of more sophisticated economic models.

- *Advocacy and lobbying:*

  Persistent lobbying is necessary in order that all involved parties understand the importance of active transport for health and environment. A special case must be made for the children's needs.

2. Why Promoting Walking and Cycling?

2.1. Health impacts of transport-related physical activity

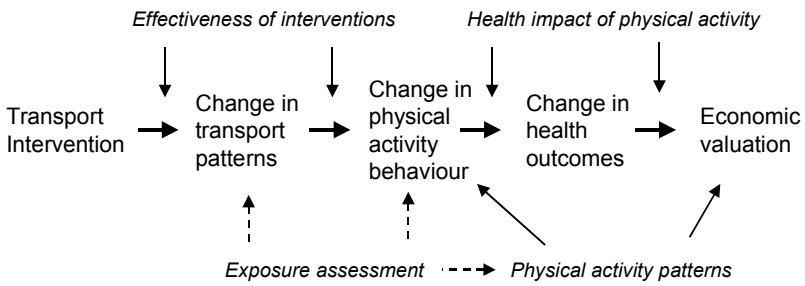

Figure 1. Overview of the chain from trans-port intervention to economic valuation of the health effects of transport-related physical activity. Though quantification and statistical modelling still represent some several challenges, the overall causal relationship (indicated by the bold arrows) is well accepted.

The importance of regular physical activity for health is well established. There is evidence for the effectiveness of a growing number of interventions in increasing physical activity among the inactive, and transport-related physical activity has a great potential in the promotion of overall physical activity. Though this overall rationale is well accepted (figure 1), the quantification of the relationships and effects remains difficult, mainly due to the need for an internationally agreed definition and measure of physical activity on the population level, the lack of data for the contribution of transport related physical activity to overall physical activity and therefore to health. The need for realistic estimations of effects of transport interventions on transport patterns (modal shift) is essential not only for the health effects of physical activity, but also for other transport related factors like air pollution or noise.

The following summaries address the specific issues indicated in figure 1, they are explored in more detail in the respective chapters of the Topic Paper on Physical Activity of THE PEP.

2.2. Health Impacts of Physical Activity

- ⇧ Life expectancy
- ⇩ Cardiovascular disease
- ⇩ Diabetes II
- ⇩ Obesity
- ⇩ Colon cancer
- ⇩ Breast cancer
- ⇩ (Prostate cancer)
- ⇩ (Pancreatic cancer)
- ⇩ Osteoporosis
- ⇩ Symptomatic gallstone disease
- ⇩ Depression
- ⇧ Stress tolerance
- ⇧ Independence in old age

Table 2. Overview of health effects of physical activity

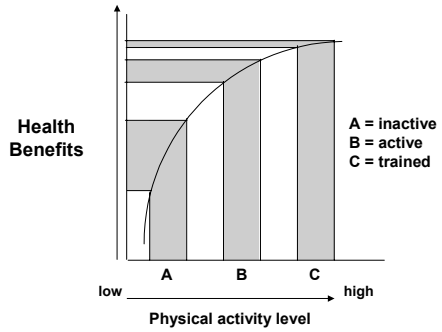

Figure 2. Dose-response relationship for physical activity and health

The importance of physical activity has been well established over the last decades and a wealth of different endpoints has been identified (table 2).

A dose-response-relationship could be demonstrated for most of these endpoints, most clearly for overall mortality and cardiovascular morbidity (figure 2). While most of the studies have studied the associations with overall physical activity, only very few have been able to study the independent effects of transport-related physical activity.

First estimations of health effects on the population level have been made, but remain to be refined once greater standardisation in measurement methods is achieved. Depending on the assumptions made about the actual level of inactivity in the population, current estimations vary between 1.4 and 1.9 million cases of disease, 2’000 and 2’700 deaths and direct treatment costs of 1.6 and 2.2 billion Swiss francs (1.1 and 1.5 billion Euro) caused by physical inactivity in Switzerland.

The global estimations of WHO indicate that physical inactivity causes about 10–16% of cases each of breast cancer, colon and rectal cancers and diabetes mellitus, and about 22% of ischaemic heart disease, resulting in 1.9 million deaths and 19 million DALYs (disability-adjusted life years)

2.3 Physical activity patterns

The World Health Report 2002 reports summary statistics for physical activity, though indicating that they are derived from a number of direct and indirect data sources and a range of survey instruments and methodologies: “The global estimate for prevalence of physical inactivity among adults is 17%, ranging from 11% to 24% across subregions. Estimates for prevalence of some but insufficient activity (<2.5 hours per week of moderate activity) ranged from 31% to 51%, with a global average of 41% across the 14 subregions.”

Physical inactivity is a worldwide public health problem. Though methodological issues still restrict the possibilities to quantify this problem in absolute terms and to carry out intercultural and international comparisons, subgroups with particularly low activity levels and changes over time can be documented. A systematic integration of data from the health and from the transport sector has not yet taken place.

The availability of epidemiological data is an important element in the political process leading to a better recognition of the importance of health-enhancing physical activity on the national and international level and the current attempts for standardised measurement procedures will play an important role in this process.

2.4 The effectiveness of interventions to increase physical activity

In general, most experience regarding design and feasibility of intervention studies and the effects of these programs is available for interventions on the individual and group level. There is good evidence that interventions on these levels can increase physical activity among the inactive. There is also good evidence that interventions in the worksite setting are effective to increase physical activity.

So far, there are very few studies assessing the impact of interventions targeting transport policies and environmental changes on physical activity. Current research questions are the quantification of changes in behavioural patterns and in health outcomes that can be expected in specific interventions. In particular, traffic interventions should be identified that are most likely to increase health-enhancing physical activity and to reach physically inactive population groups.

3. Why Promoting Walking and Cycling among Children?

3.1 Health Impacts of Physical Activity in Children

Health Impacts of physical activity in children exist on different levels (figure 3). Direct health impacts of physical activity in children have been shown for obesity, diabetes type II, osteoporosis, psychological effects and predictors of cardiovascular disease. By assuming tracking of physical activity from adolescence to adulthood, it is perceivable that all health effects of physical activity in adults can be influenced by increasing and maintaining active behaviour in young people. Some estimations of the health effects of physical activity on the population level including all age groups have been carried out; the development of specific economic models for children is a challenge for further development in the field.

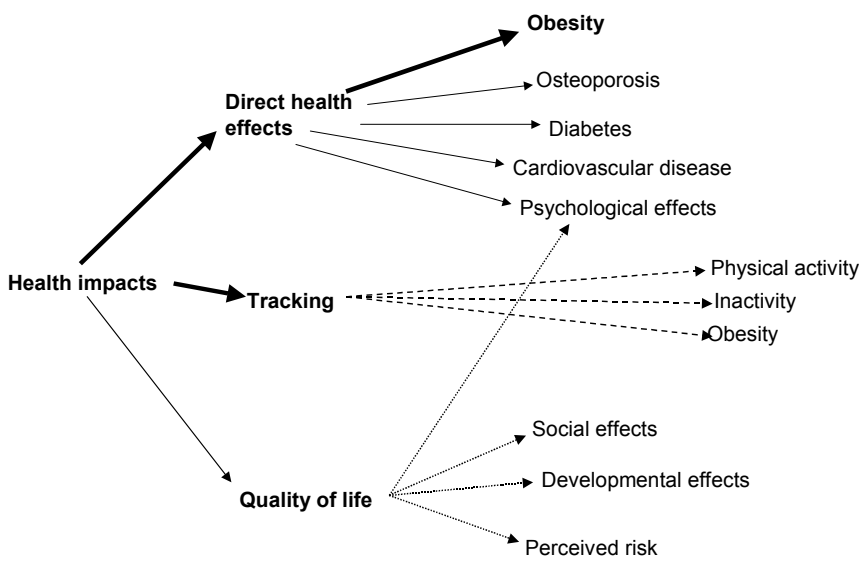

Figure 3. Model for the health effects of physical activity in children on three levels. Direct health effects are are clearest and most easily quantifiable for obesity. Tracking exists for physical activity, inactivity and obesity and can engender all health conditions associated with these in later life. Developmental effects are plausible, but are still difficult to measure and quantify.

3.2 Physical activity patterns in children

Though internationally accepted standards for the measurement of physical activity in children still have to be developed, a number of studies in different countries have addressed the issue of physical activity patterns in children.

In general, they indicate high levels of inactivity in populations of young age and a tendency towards declining activity levels over age and time. All recent studies which examined the pattern of overall physical activity from childhood to adolescence, confirmed a decline in active behaviour, which starts at puberty and continues through to young adulthood. There is a higher likelihood of physically active young people to be more active in later life as well (tracking of physical activity), and though the number of studies is limited, there are indications that transport-related physical activity can make an important contribution to overall physical activity in children.

Levels of activity are correlated with a number of socio-cultural parameters. The contribution of school-based physical education seems to be particularly important in groups with low activity levels.

A wealth of data exists on overweight and obesity which are also influenced by other factors, but can be seen, to a certain extent, as a correlate of physical activity behaviour. The prevalence of both conditions is high and rising in most of today's societies.

3.3 The effectiveness of interventions to increase physical activity in children

Many interventions to increase physical activity in children have been developed, but only a few of them have had their effectiveness evaluated. Currently, prompts to encourage stair use, community-wide campaigns, school-based physical education, social support in community settings, and creation of or enhanced access to places for physical activity combined with informational outreach activities can be deemed effective. For a number of other interventions evidence remains insufficient to assess their effectiveness. There is a clear need to develop more interventions to increase physical activity and more specifically transport-related physical activity and to assess their effectiveness.

4. Policies to Increase Walking and Cycling

Though some quantitative aspects are still under study, there is a growing wealth of evidence for the importance of physical activity for health in both adults and children and for the important contribution transport-related physical activity can make to overall physical activity, particularly in children. In view of the existing data on the alarming prevalence of physical inactivity in all industrialized countries and of the declining trends in transport-related physical activity, the time for action has come. This document wants to give an overview of the possibilities for action on different levels and wants to provide an opportunity for individual countries to select their priorities among those possibilities.

Levels of action can be policies, strategies, action frameworks and single action elements. A policy can be defined as an agreement or consensus on a range of issues, goals and objectives which need to be addressed. The term strategy usually refers to a series of broad lines of action intended to achieve a set of goals and targets set out within a policy or programme [50].

4.1 Walking and cycling policy within sustainable transport policy

A policy to promote cycling and walking should be embedded into a policy to achieve sustainable transport and land use in general. Without a strong commitment to sustainable mobility as the guiding principle in transport and land use planning, it will be difficult to increase cycling and walking systematically and successfully.

In Switzerland, a mission statement to achieve sustainable mobility as one element of sustainable development is being elaborated. However, the document is not yet available and currently work on it has been suspended. The following two available policy documents are examples from Switzerland:

National Research Program "Transport and Environment. Interactions Switzerland/Europe" (NRP41)

The programme was conducted by the Swiss National Science Foundation from 1995 to 2001. In a final synthesis for policy makers, scientists have integrated the perspectives of transport policy, transport research and the implementation of transport policy measures for sustainable mobility in 41 suggestions, organised in eight fields, [51].

Six out of these eight fields can be relevant for transport related physical activity.

- *strive for sustainable mobility*
- *improve institutions and framework conditions*
- *keep people mobile*
- *use the potential of technology and telematics*

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50 World Health Organisation. Health Impact Assessment: Glossary of terms used. Available at www.who.int/hia/about/glos/en/index2.html. Accessed November 26, 2003.

51 Transport and Environment. Interactions Switzerland/Europe. National Research Programme NRP41. Bausteine für eine nachhaltige Mobilität: Gesamtsynthese des NFP41 „Verkehr und Umwelt" aus Sicht der Verkehrspolitik, der Wissenschaft und der Umsetzung. Available at www.nfp41.ch. Accessed November 26, 2003.

- *reinforce both environmental an spatial planning*
- *investigate in transport statistics and research*

A complete list of all suggestions can be found in the appendix.

The programme consisted of several projects. In one of them ("strategies for the promotion of pedestrian and cycle traffic – obstacles to implementation"), existing data and experiences were used to estimate the potential of walking and cycling. In conclusion, the following main obstacles were identified:

- *Biased perception of everyday mobility and traffic problems: the majority of traffic problems is caused by short-distance everyday mobility in urban areas and not – as perceived by the public - by long-distance trips on national motorways.*
- *Lack of funding mechanisms which are available for other transport modes.*
- *Insufficient institutionalisation of pedestrians' and cyclists' concerns in governmental bodies.*
- *Inadequate distribution of tasks, possibilities and responsibilities between different political levels.*

Mission Statement for Human Powered Mobility

A draft of a mission statement for Human Powered Mobility [52] was developed by the Federal Department of Environment, Transport, Energy and Communications under the guidance of the Federal Roads Authority. The order for the mission statement was issued in May 2001; it will be discussed in parliament in summer 2004 and it is planned to start with the implementation in 2005.

The aim of the mission statement is to strengthen the position of human powered mobility in the traffic and land us planning processes and decisions within an integrated transport policy. The vision of the statement is that all forms of transport – human powered mobility, public transport and individual motorised transport – are treated equally. The focal points are:

- *Taking full advantage of the government's existing scope for action*
- *Closing financial, organisational, institutional and technical loopholes*
- *Examining action of the public sector with regard to its compatibility with human powered mobility*
- *Supporting other sectors and establishing collaborations with public and private companies for promoting human powered mobility*
- *Facilitating combined mobility by linking infrastructure at public transport interfaces*

Based on eight expert reports, five basic strategies were defined:

[52] Federal Roads Authority. Mission Statement for Human Powered Mobility Available in German and French at www.langsamverkehr.ch. Accessed November 26, 2003.

- *New services and infrastructure*
- *Evaluation, monitoring and communication*
- *New collaborations and responsibilities*
- *A new financial basis for human powered mobility*
- *Launching of a kick-start programme*

The complete German and French versions of the mission statement can be found at the website indicated in the references.

4.2 Collaborations between sectors and different political levels

The promotion of walking and cycling involves different sectors: transport sector, land use and urban planning sector, health sector, physical activity and sports sector, the environment, energy and educational sectors. It is therefore essential to create a climate and conditions where collaborations are possible and become the standard. Such collaborations may start with informal networking, but they must result in a well established consensus regarding policy and decision making, and they must result in common projects and budgets in both research and practice.

In Switzerland, the promotion of walking and cycling has been adopted by several initiatives of different sectors on the national level, and there is a well established network between the different partners. It is possible to co-finance smaller projects by different units of the federal administration. Currently, an extremely complex national project is under development (*SchweizMobil*, see below) and possibilities and limits of collaboration are being explored.

The following examples illustrate different levels of collaborations between sectors and different political levels:

- ***Legislation level:***

  Urban traffic programmes

  In Switzerland it is being recognized, that urban traffic is not only a problem of local or regional, but also of national importance. In order to be able to co-finance traffic infrastructure within conurbations with federal money, it is planned to add an amendment to the Swiss constitution to enable specific revenue from the tax on petroleum and the motorway permit sticker to be channelled not only into national road and rail investment, but also into urban traffic areas. In order to be eligible for national funding, conurbations will have to present holistic traffic and land use planning and urban design concepts, and it is suggested that a given percentage of their infrastructure budget (e.g. 10%; reflecting the percentage of person-kilometres travelled by walking or cycling currently) must be invested into infrastructure for

cycling and walking. There will be a national poll on this change of the constitution in summer 2004 [53].

A similar constitutional amendment is stipulated in a federal decree of October 2003 on the reform of financial equalization and task allocation between the Federation and the Cantons.

- ***Policy level:***

  The Swiss Federal Government's Concept for a National Sports Policy

  The Concept [54] was accepted by the federal government in December 2000. The first goal of the Swiss Sports Policy is to increase the proportion of regularly physically active individuals in the population. One of the numerous measures is the promotion of human powered mobility, by:

  - *networking and collaborating with the transport and the energy sector, the land use planners, the health, environment and tourist sectors on the national level*
  - *accumulating scientific evidence on knowledge, attitudes and behaviour regarding transport-related physical activity, particularly among those who are inactive*
  - *supporting and evaluating pilot projects.*

- ***Strategy level:***

  Strategy leisure traffic

  The strategy is currently developed by the Federal Office of Spatial Development [55].

  Today, half of Switzerland's total volume of passenger traffic is leisure-related, and socio-economic trends indicate that this proportion will continue to rise. To date, however, transport policy and planning strategies have not paid sufficient attention to specific aspects of leisure travel.

  Objectives

  The strategy is intended to set out how leisure travel can be made more sustainable and what role the Swiss federal government should take. The strategies pursued are the following:

  - Shift to the modes of transport for leisure travel that display the greatest comparative advantage.

  - Encouragement to the alternative use of public and non-motorized transport in the interests of a sustainable transport policy.

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53 Federal Office for Spatial Development. Urban traffic. Available at http://www.are.admin.ch/are/en/verkehr/aggloverkehr/index.html?von=quer&bereich_von=Agglomerationspolitik. Accessed November 26, 2003.

54 Federal Office of Sports. Politque du Sport. Available in French at www.baspo.ch/f/politik/spopol/spopol.htm. Accessed November 26, 2003.

55 Federal Office for Spatial Development. Strategy leisure traffic. Available at www.leisure-traffic.ch. Accessed November 26, 2003.

- Reduction in the growth of leisure traffic volumes – especially private motorised transport – without jeopardising economic growth overall.

- Shorter journeys (attractive destinations close to residential areas, combined mobility).

- Attractive, competitive and commercially viable leisure travel services.

The objectives should be achieved primarily through incentives and attractive offers, rather than through orders and bans.

In the strategy development, besides the other sectors of the federal administration, different parties are consulted: Cantons, research institutions and universities, leisure travel providers, associations and project-management organisations.

A first public draft of the strategy should be published in summer 2004.

- ***Action Framework level:***

  Swiss Environment and Health Action Plan (EHAP)

  The Swiss Environment and Health Action Plan [56] of the Federal Office of Public Health focuses on three main topics, one of these is mobility. Some of the targets are:

  - by 2002, 80% of the population will know about the interactions of motorized traffic, emissions and adverse impacts on human health
  - *by 2007, the proportion of journeys by bicycle will have doubled for commuting (1996: 7%), shopping (1995: 5%) and leisure (1995: 7%)*

  This should be achieved through the following measures:

  - *promotion of greater public awareness of mobility-related issues of safety and health,*
  - *reassignments of roads and improvement of road traffic flow to promote bicycle and pedestrian traffic*
  - *creation of incentives to transfer commuter, shopping and leisure traffic to public transport and bicycle*

  The revision of the EHAP (2007 at the latest) will increasingly aim towards the needs of children.

- ***Implementation Level:***

  Coordination of the federal administration regarding human powered mobility

  Under the guidance of the Federal Roads Authority, all sectors of the federal administration (traffic, public transport, spatial development, environment, health, sports, economy and tourism, statistics) that are involved in some aspects of sustainable transport and/or human powered mobility meet twice a year to exchange information on current or planned projects and to allow for synergies or collaborations.

[56] Federal Office of Public Health. Environment and Health Action Plan Available in French and German at www.apug.ch. Accessed November 26, 2003.

- ***National Project Level:***

  SchweizMobil

  The nation-wide project SchweizMobil [57] is currently under development. It will be an expansion of the successful project "Cycling in Switzerland" [58] which offers a nation-wide network of touristic cycle routes, along with coherent sign-posting, guide books, maps, information on facilities to eat and sleep and cycle transport, as well as package deals. It is planned to develop also "Hiking in Switzerland", Skating in Switzerland" and "Paddling in Switzerland" and to integrate these new networks into the existing "cycling in Switzerland" program. The different routes will be well coordinated with public transport interfaces and the entire network will be linked within a nation-wide and standardized information platform, along with information on public and private transport and combined mobility.

  The project is developed by the foundation "Cycling in Switzerland" and by "Switzerland Tourism". It shall be realized in a public-private-partnership between the federal and cantonal administrations, transport, sport, environment and tourist associations and private partners. Originally, it was planned that the federal authorities should play a key role and that financial support of the different sectors should contribute to a common global budget. However, for legal reasons, such a form of collaboration within the federal administration is not possible and the different sectors may only contribute to those well defined elements of the entire project, which are within their existing scope of action. There are concerns that this policy may result in additional administrative effort and therefore loss of financial resources for the project itself, and that it may become difficult to get funding for some elements of the project which are necessary but are not clearly within the scope of any sector.

4.3 Systematic consideration of vulnerable groups' perspective

One of the conclusions of the National Research Program "Transport and Environment. Interactions Switzerland/Europe" [2] NRP41 is that the acceptance and implementation of measures to achieve sustainable transport has to be secured by reinforcing the public debate as well as through new models of participation. This must particularly be true for transport policies and strategies which always affect the health in particular of vulnerable groups like children, the elderly, or people with special needs in either a positive or negative way. The perspective of these groups has to be considered systematically in health promotion, transport and land use planning, urban design, transport and health related research and monitoring as well as advocacy and lobbying. The respective findings and conclusions have to be communicated and debated in public. It took decades to realize and eventually accept that a gender perspective has to be considered in policy and decision making and public health, in research and the field of practice. It is about time to start doing this likewise for children, the elderly and people with special needs.

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57 SchweizMobil. Available in German at www.schweizmobil.ch. Accessed November 26, 2003.

58 Cycling in Switzerland. Available at www.cycling-in-switzerland.ch. Accessed November 26, 2003.

Furthermore, a climate and conditions have to be created where their needs, ideas and preferences can be taken into account in decision making processes affecting their health, needs and interests in the fields of health promotion, transport and urban planning.

4.4 Making a special case for children

In the context of the Convention on the Rights of the Child[59], which entered into force in 1990, WHO advocates to make a special case for children, because:

- Children are individuals and have equal status with adults in the human family
- Children start life as totally dependent beings and are therefore especially vulnerable. Unfavourable living conditions may jeopardize their health
- The healthy development of children is crucial to the future of well-being of any society
- The actions – or inactions – of governments impact children more strongly than any other group in society
- Many changes in society are having a disproportionate – and often negative – impact on children
- Children's views are rarely heard and rarely considered in the political process

At a first look, there may be no obvious connection between the Convention on the Rights of the Child and transport related physical activity. However, at a closer look some articles of the convention can well be applied to the field of transport, environment and health:

- *Article 3*: In all actions considering children, the best interest of the child shall be a primary consideration.

  >> transport policies and urban planning indeed affect the interests of children.
- *Article 24*: The child has the right to the enjoyment of the highest attainable standard of health. State parties shall take appropriate measures to diminish child mortality.

  >> In industrialized countries, dying from an accident – half of them are traffic accidents - is the most prevalent cause of death in 1 – 14 year old children [60]
- *Article 29:* The child has the right to get an appropriate education to develop also physical abilities to his or her full potential.

  >> Without any doubt a good education plays a key role in the development of children. However, if their physical environment does not provide the proper facilities but is unfavourably dominated by motorized traffic, the possibilities of educational programs to develop physical abilities are clearly limited.
- *Article 31*: The child has the right to play and engage in recreational activities.

59 Unicef. WHO Convention on the Rights of the Child. Full text of the convention. Available at www.unicef.org/crc/fulltext-frameset.htm. Accessed November 26, 2003.

60 Unfälle – häufigste Todesursache von Kindern in industrialisierten Ländern. Unicef Magazin 1/2001

>> For many children, their possibilities to play outdoors are severely restricted by motorized traffic.

5. Strategies to Promote Walking and Cycling

A strategy to promote cycling and walking should be related to an overall strategy to achieve sustainable transport.

> *In Switzerland, the strategy of the Federal Department of Environment, Transport, Energy and Communications and the main objectives and principles of the different departmental sectors [61] are in line with the concept of sustainable development. To strengthen and increase transport walking and cycling is one among many elements of the departmental strategy. A strategy to promote walking and cycling has not yet been taken at hand, but will be developed starting from the mission statement for Human Powered Mobility (see page 8).*

On the European level, a strategy document for the promotion of cycling and walking has been developed by The European Network for the Promotion of Health-Enhancing Physical Activity HEPA in 2000 [62], practical experience was drawn in particular from the Dutch Bicycle Master Plan [63]. The strategy document and its structure have been used as the basis of this chapter of the report, current information, experiences and material from Swiss documents have been added.

This HEPA-strategy document focuses on general – not child-specific – strategies and measures for action to encourage cycling and walking. To start from these general strategies seems appropriate, because:

- Every strategy and measure to promote and facilitate cycling and walking is potentially also beneficial for families and children.
- Measures increasing cycling and walking which simultaneously reduce motorized transport (thus result in a modal shift) have the potential to improve conditions for child pedestrians and cyclists.

The section is structured in eight strategy elements; each element is then further differentiated or extended, focussing specifically on the needs of children:

1. What's the issue?
2. Identifying strategic objectives
3. Defining targets

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61 Department of Environment, Transport, Energy and Communications. DETEC Strategy. Available at www.uvek.admin.ch/imperia/md/content/gs_uvek2/e/2.pdf. Accessed November 26, 2003.

62 Oja P, Vuori I. Promotion of Transport Walking and Cycling in Europe: Strategy Directions. Tampere: The European Network for the Promotion of Health-Enhancing Physical Activity, 2000.

63 Directorate-General for Passenger Transport. The Dutch Bicycle Master Plan: description and evaluation in a historical context. The Hague: Ministry of Transport, Public Works and Water Management, 1999

4. Establishing consensus between parties
5. Taking action
6. Obtaining funding
7. Monitoring, evaluation and development of knowledge base
8. Advocacy and lobbying

5.1 What's the issue?

Travel patterns and potential for modal shift

Scientific evidence indicates that major health benefits can be attained by common activities such as walking and cycling that take place frequently and are moderate in terms of the required effort. For European countries, current transport patterns demonstrate that car use is by far the dominant transport mode. In Switzerland for example, short stages up to 5km account for more than 70% of all stages, but half of these trips is made by car. Knowing such distributions of the length of journeys, transport modes and attitudes among the population suggests that physically active transport can substantially be increased by appropriate strategies and measures. It is important to accumulate comparative national travel data and to communicate the data within the nations and Europe.

Walkers and cyclists in a car culture

The car is the first choice of transport for many people for many reasons. In this prevailing car culture there are many obstacles, real and perceived, for walking and cycling. The needs of motor traffic dominate land use, transport infrastructure and traffic regulations. Integration of walking and cycling with public transport is often poorly developed. There is the danger of accidents to walkers and cyclists with motorized road users and facilities such as quality parking and bicycle transport in public transport are insufficient. The social status of walking or cycling are low in comparison to driving a car. Perceived obstacles such as long distances or bad weather prevent many from walking or cycling even if the travel distances and routes were suitable. Walking and cycling routes are often maintained carelessly and are not enjoyable to use.

> Focusing on children

Children are a particularly vulnerable group in traffic: the proportion of stages travelled by foot is higher than among young and middle aged adults and they are involved in accidents more often than this group.

Children use roads and public space not only for transport but also for play and are severely restricted in doing so by motorized traffic in a car-centred society.

5.2 Identifying strategic objectives

Physically active transport is part of a sustainable transport strategy. Urban design, land use and traffic planning are key elements in ensuring that journeys are possible on foot and by bicycles. Design measures can also reduce traffic speed to encourage walking and cycling. Land use planning can reduce the need to travel in general and good traffic planning makes these modes desirable by providing safe and convenient access to schools, jobs, facilities etc. The creation of an environment in which walking or cycling is more attractive than using a car is the key for sustainable travel patterns. To achieve a modal shift from motorized travel to active travel, changes are required which will result in a reduction of car-dependency and a reflection of the full costs of the car. Possible strategic objectives are:

- Ensure that full external costs of the car are paid by the user
- Use urban design and land use planning to shorten the length of trips and reduce the need to travel by car (restrict urban sprawl, instead favour urban compacting)
- Use urban design and land use planning also to create attractive and enjoyable routes for walkers and cyclists
- Design communication programmes to enhance the perceived positive aspects of walking and cycling such as enjoyment and health
- Give high priority to local accessibility in location decisions for jobs, shopping, schools, public and private and public facilities (mixed land use).
- Have a coordinated safe and reliable public transport systems, also allowing combined mobility by providing information and facilities at transport interchanges

> Focusing on children

- ensure ways to school that can be travelled by foot or bicycle
- design child-friendly areas around schools
- provide open spaces and parks for play near areas where children live and go to school
- ensure safe and attractive connections for walking and cycling between places were children live or go to school and play areas
- Enhance the prestige of non-motorized transport already at child age

Be aware that children are not a homogenous group: needs and interests of children at preschool or at school age are different. The quality of public space is important in particular also for adolescents, because this age group uses public space not only to travel or to play, but also to socialize with peers. Additionally, a walking and cycling friendly environment may prevent an adolescent child from shifting to motorized transport by buying his or her first motor bike.

5.3 Defining targets

The strategic targets should be defined in quantitative and measurable terms reflecting the will and possibilities of the respective country, region or town.

- Headline targets: increase of the proportion of walking/cycling stages by a given percentage within a given time period.

  In Switzerland for example, the headline target of the Mission Statement for Human Powered Mobility is to increase the percentage of stages travelled on foot or by bicycle by 15% from currently 47% to about 54% percent within ten years [3].

- Supplementary targets: can be set regarding infrastructure, facilities and promotional activities.

> Focusing on children

Defined and measurable targets must also include children's transport and physical activity behaviour. In order to be able to do so, basic routine statistics must also include this target group and the behaviours under discussion among children.

5.4 Establishing consensus between parties

The key parties in developing local plans and measures are the authorities responsible for urban planning, transport, land use, health, education and sport. Other important collaborators are transport operators, traffic safety authorities including the police, the bicycle and the health care industry. Voluntary and consumer organisations promoting exercise, recreational activities, sustainable transport and environment are also important partners.

> Focusing on children

Integrating the educational sector and involving parents are key issues. These two parties have to work together in particular.

5.5 Taking action

Strategic measures for the development of walking and cycling fall into two broad areas:

- Creating a pro-walking and cycling culture
- Improving the infrastructure. Promoting walking and cycling without improving the respective facilities is meaningless.

The structure and the suggested actions in the following table have been drawn to a large extent from the strategy document of European Network for the Promotion of Health-Enhancing Physical Activity. This collection has been slightly adapted and extended and actions focusing particularly on children have been added.

Creating a pro-walking and cycling culture	
Communication programs	• Use theoretical model (e.g. social marketing)

	Messages • Offer alternatives to car-dependent lifestyle • Highlight advantages of walking and cycling • Repeat frequently in different ways and different channels Target groups • Road users (motorists, transport drivers, walkers and cyclists): understand and accepts rights and responsibilities towards other road users • Transport providers: comprehend significance for health and environment of shifting dominant car-culture towards walking and cycling • Professionals (transport, environment and health): include evidence and need for modal shifts in their basic education • Journey generators (worksites, shops educational institutions, leisure providers etc): consider needs of walkers and cyclists and provide respective support. • Road users that travel for different purposes (work, leisure, shopping …) To be effective, communication programs need to be carried out along with parallel changes in the social and the physical environment!
Incentives	Incentives aim at making walking and cycling more competitive transport modes compared to the car, eg.: • Tax benefits, Health insurance benefits • Salary bonuses, ecobonuses • Free bicycles, other material awards Culturally acceptable incentives have to be developed through experimentation and research
Regulatory, economic and legal measures	Possible measures are: • Promotion of worksite-specific travel policies • Car parking regulations • Taxation of commuting to work by car • Road pricing
Improving infrastructure	
Land use and transportation planning	• Encourage multiple use development in urban planning (mixed land use) • Encourage development patterns which ensure that short and direct trips are possible on foot or by cycle • Incorporate pedestrians and cyclists safely in overall traffic schemes • Link foot and cycle path to public transport

	• Facilitate bicycle transport by public transport • Restrict car parking provision • Avoid unsegregated shared use of space by pedestrians and cyclists, particularly in dense urban areas to avoid conflicts between pedestrians and cyclists
Speed reduction	• Use traffic calming measures • Use 30km/h maximum speed in living areas and areas dense with pedestrians and cyclists • Use *meeting zone* concepts for places dense with pedestrians (20 km/h speed limit and pedestrian priority)
Highway design and transport engineering	• Improve pedestrians' and cyclists' safety and give them higher priority in terms of access and journey time • Ensure that changes to the highway infrastructure or new developments do not sever existing or proposed cycle/pedestrian routes, do not reduce accessibility or increase danger for pedestrians or cyclists • Establish best practice design and construction standards regarding walking and cycling infrastructure facilities • Modify traffic rules to give priority to pedestrians and cyclists in motor traffic intersections • When building safety improvements, avoid keeping people from walking and cycling because of longer, less convenient or less secure routes
Walking and cycling networks	• Prepare a detailed proposal for a safe, coherent and convenient walking and cycling network across major trip generators such as large shopping centres, job, education and leisure facilities as well as public transport interchanges • Take into account the type of user group most likely to make increased use of specific areas of the walking and cycling network • Provide on-road and whenever possible off-road alternatives to radial and orbital roads • In local areas, provide networks of short roads from residential areas to trip generators • Provide links to nearby (countryside) recreational areas
Public transport infrastructure	• encourage multi-modal journeys by easy and safe access to public transport interfaces and by adequate storage facilities for bicycles. • Provide facilities for the transport of bicycles in trains, trams and buses
Cycle parking	• Provide quality cycle parking at educational institutions, leisure facilities, major trip generators and public transport interchanges • Encourage public and private enterprises to provide cycle parking near their premises for staff, customers and visitors

Traffic signals and signs	• Adopt traffic signals to cater for pedestrian and cyclists' flow and speed • Design urban road signs not only for drivers but equally for pedestrians and cyclists with easy-to-read signs and appropriate distances
Road lighting and other conditions	• Consider not only the drivers but also the needs of pedestrians and cyclists in the design of lighting in streets and areas dense with walkers and cyclists • Use lighting effectively to make pedestrian and cycle routes safe, inviting and pleasurable • Keep pedestrian and cycle ways clean of dirt, rubbish, snow and ice by upgrading their maintenance status
Vehicle design	• encourage vehicle design that permits cycle transport • discourage the design of heavy duty vehicles and cars with aggressive bull bars conducive to increased accident risk of pedestrians and cyclists
Walking and cycling audit	• Establish auditing procedures for walking and cycling to ensure that the needs of pedestrians and cyclists are considered at key stages of all land use, highway and other development schemes

Some of the examples for child-specific actions in the following chart have been drawn from a current review on physical activity in children [[64]].

> Focusing on children

Creating a pro-walking and cycling culture	
Communication programmes	Communication programmes outlined above should consider that: • Authorities from traffic and urban planning, the health, education and environment sectors, have to know about the importance of physical activity for children's health and development • Messages to road users should promote coexistence with, and consideration for vulnerable groups • When using role models, also models attractive for children have to be chosen Educational programmes within the school setting: • Teachers and other parties working with children have to know about

[64] Biddle SJH, Gorley T, Stensel DJ. Health –enhancing physical activity and sedentary behaviours in children and adolescents. Journal of Sports Sciences, *in press*

	the health benefits of regular physical activity and the important contribution active transport can provide • Schools have to actively enable young people to take part in physical activity for the recommended time, both in the regular curriculum, but also during the way to school or at other occasions • the concept of health promoting schools should be promoted and include the physical activity topic • Schools should develop programs to involve parents to help them to realise the importance of physical activity and active transport to school • Parents should be encouraged to support walking or cycling to school • Parents or other adults should be encouraged to actively support walking or cycling to school with groups of children, e.g. with walking-buses or cycle-buses, if these approaches enable more children to travel actively to school. • To educate children to be able to travel safely in today's car-dominated traffic is important. However, these programmes must be extended towards an education targeting sustainable mobility
regulatory and legal measures	• Measures like wearing bicycle helmets to become compulsory, particularly for children, must be discussed
Improving infrastructure	
Planning and providing facilities	The table above giving a overview of actions to promote walking and cycling in general is also valid for the promotion of walking and cycling among children. When planning and realising all those measures, a particular focus has to be put on: • safe and enjoyable ways to school • attractive surroundings of schools • parks and open spaces for play • safe and direct connections between places, where children live, go to school and play, in order that also smaller children can reach these places without being accompanied by an adult person • residential areas where children live: use traffic calming measures or meeting zones concepts which will allow children to also use roads and sidewalks to play. Conditions to include children, their perception and creative potential into planning processes have to be developed.
Safety	• a particular focus has to be put on safety aspects to prevent children from being involved in accidents with motorized traffic. • Streets, parks and play areas that children use have to be in safe neighbourhoods.

5.6 Obtaining funding

Developing and maintaining an pro-walking and cycling infrastructure requires sufficient funding and budgets of national and local authorities. Local funding is critical in order to provide the proper facilities in the places where people live, work and spend their leisure time. It is suggested to secure a fixed and significant proportion of the total annual infrastructure budget for the development and maintenance of walking and cycling facilities.

5.7 Monitoring, evaluation and development of knowledge base

Monitoring and evaluation procedures must be integrated into a walking and cycling strategy and be closely linked to the strategic goals with measurable target indicators. Monitoring and evaluation provide evidence to assess the effectiveness of the interventions regarding the main outcomes, cost-effectiveness and feasibility of the adopted strategies and actions.

A prerequisite is nationally available data on overall and transport-related physical activity in the different age groups. One way of achieving this is to include basic statistics on walking and cycling and data regarding children's travel behaviour in national travel surveys.

In order to further advance the field, not only the overall patterns of physical activity and the effectiveness of interventions should be studied. Other important fields of research include the development of internationally standardised questionnaire instruments for both overall and transport-related physical activity in all age groups, the use of objective measurements like accerelometry for physical activity, the systematic integration of data from the health and from the transport sector, the quantification of the independent health effects of transport related physical activity, and the development of more sophisticated economic models.

Details about the need for research are outlined in the two Topic Papers.

> Focusing on children

All strategies and measures in traffic and land use planning and in health promotion must be systematically evaluated on their impact on children's physical activity and health. Again, the statistical data base must be improved and also include specific data on children.

5.8 Advocacy and lobbying

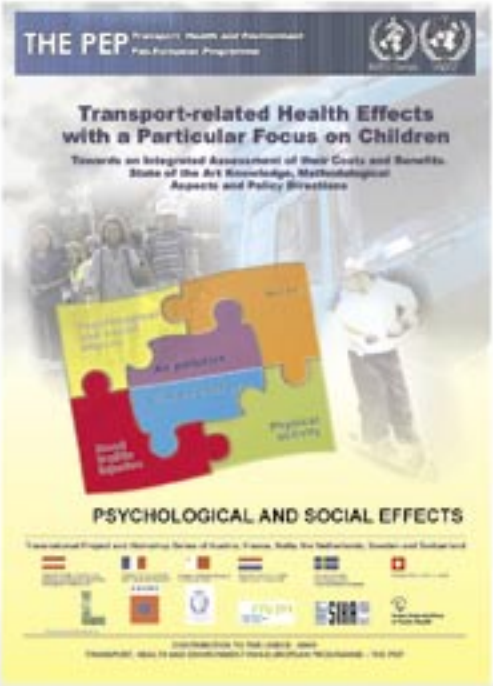
In order for all involved parties to understand and accept the significance of transport walking and cycling, persistent lobbying and advocacy is needed by key parties:

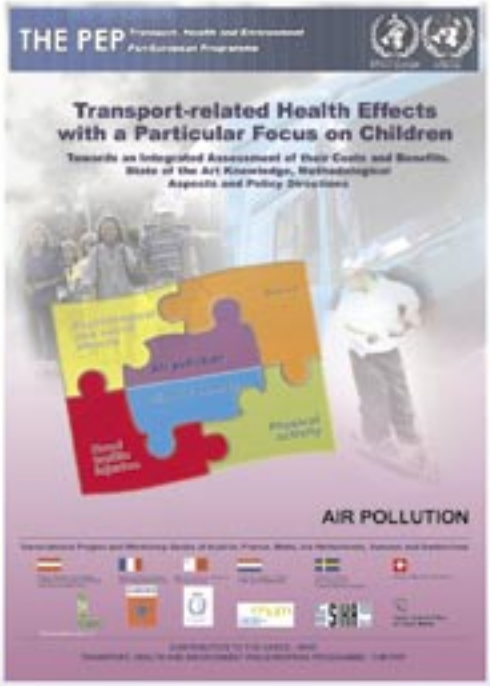
- Advocacy and lobbying need to be part of the political sphere
- Successful lobbying needs a network of collaborating partners
- The media are a major force in influencing peoples attitudes

- Pro-walkers and cyclists need to penetrate into all sectors of life
- The case for walking and cycling must be based on reliable research evidence

>Focusing on children

Children don't have a strong lobby yet. Advocacy and lobbing for the children's case must be entrusted seriously by all involved parties.


THE PEP
Transport-related Health Effects with a Particular Focus on Children
Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions
PSYCHOLOGICAL AND SOCIAL EFFECTS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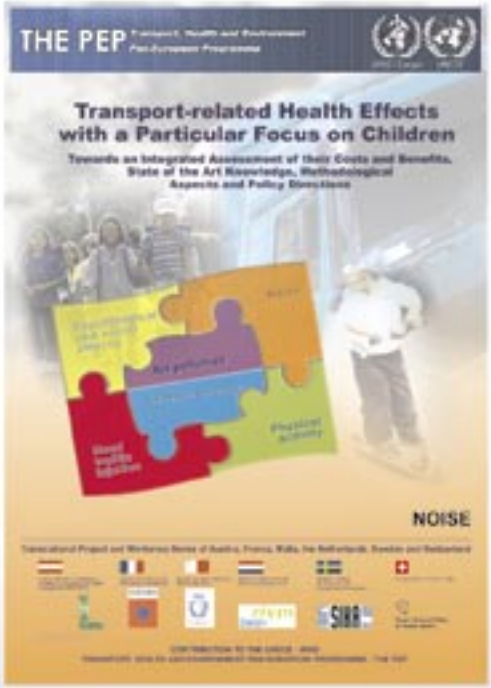
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NOISE


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Transport-related Health Effects with a Particular Focus on Children
Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions
PHYSICAL ACTIVITY


THE PEP
Transport-related Health Effects with a Particular Focus on Children
Towards an Integrated Assessment of their Costs and Benefits. State of the Art Knowledge, Methodological Aspects and Policy Directions
ECONOMIC VALUATION