CYCLING WILL IMPROVE ENVIRONMENT AND HEALTH

Authors:
Christian Ege, Director, The Danish Ecological Council,
Thomas Krag, Director, Thomas Krag Mobility Advice

Contact-details:
christian@ecocouncil.dk, phone +45 33 15 09 77
tk@thomaskrag.com, phone +45 35 42 86 24

Organisation:
Det Økologiske Råd
Blegdamsvej 4B
DK-2100 København Ø

www.ecocouncil.dk

Thomas Krag Mobility Advice
Wilhelm Marstrands Gade 11
DK-2100 København Ø

www.thomaskrag.com

Summary

The Danish Ecological Council has carried out a comprehensive literature study on health, physical exercise and cycling. The resulting data has enabled the Council to make a cost-benefit analysis on cycling initiatives taking into account also the positive health aspects from cycling.

It is well known that cycling can improve the environment and reduce emissions of CO_2 as well as hazardous gasses like particles and NO_x. In usual cost-benefit calculations investments in cycling however comes out as a relatively expensive way of reducing emissions. A different picture appears when the health effects are taken into account. This was shown by a Norwegian study (Kjartan Saelensminde, Norwegian Institute of Transport Economics, 2002), and was confirmed by calculations made by the Danish Ecological Council as part of the study.

Another part of the study took a closer look into cities that have done something extra for cycling. It was found that several factors contribute to this, and that 'fiery souls' and special supportive funds are among the more important. Besides this cycling and air pollution, cycling accidents, barriers against cycling, action plans on exercise and cycling, infrastructure and the public role are dealt with by the study.

Background

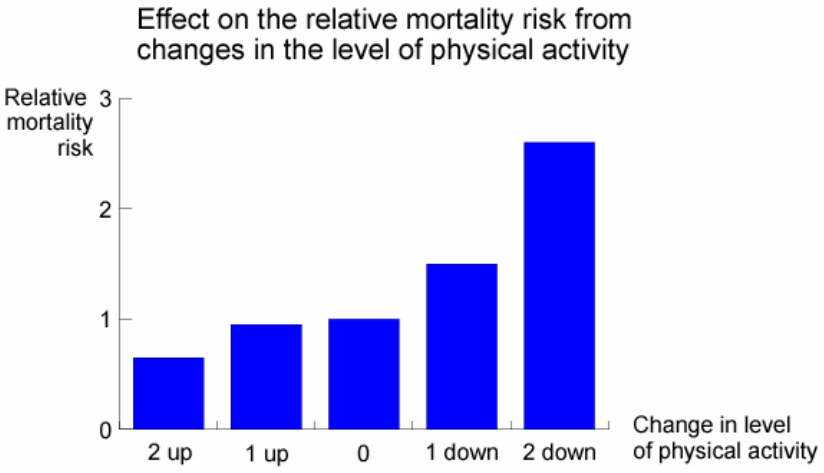
There is an increasing concern about obesity and the health risk of a sedentary lifestyle. The focus is not only on adults but also to a significant degree on children, as lifestyle habits are founded in the childhood and adolescence. The aim of the study of the Danish Ecological Council was: to quantify these risks to health; to assess the cost of physical inactivity; to quantify the potential savings from a physically active lifestyle; and to investigate to what degree the bicycle could play a role to prevent physical inactivity.

The approach taken was:

- to study numerous reports on the health impact of physical inactivity
- to take a special look on studies involving bicycle use
- to further investigate linkages between cycling and physical activity
- to collect knowledge about the impact of air pollution on cyclists' health
- to make an overview on the knowledge about traffic safety and cycling
- to collect basic knowledge about infrastructure and cycling
- to go through several reports and investigations about levers for bicycle use
- to stydy existing cost-benefit analysis of cycling, physical activity and health
- to make a cost-benefit analysis of a potential Danish bicycle promotion scheme
- to investigate European cities or regions where cycling has been prioritised
- to look into international targets for cycling
- to look into the present and perspective cycling promotion policies in Denmark.

Physical inactivity and health

There is overwhelming evidence that physical inactivity results in an increased risk of getting several diseases and that it is, on the contrary, possible to reduce the risk of the same diseases by increasing the level of physical activity.



There is a significant effect on health - measured as relative mortality - from changes in the level of physical activity. Ref: 1, page 18.

Discussions are still ongoing as for which types of diseases physical activity has an effect, and what the effect is between virtually no physical activity and moderate activity (typically half an hour per day). The table summarizes the findings.

Potential disease risk reduction by moderate exercise, in per cent					
Disease/report	*Denmark, 2003*	*Norway, 2001*	*WHO, 2003*	*Switzerland, 2001*	*Used later*
Hypertension		30		32	30
Cardiovascular disorders	40	50	33	46	40
Diabetes 2	>20	50		47	40
Osteoporosis	50			50	50
Breast cancer	50	20-30	20-25	28	40
Colon cancer	50	50		47	40
Gallstone	34				-
Depression				68	-
Back pain				26	-

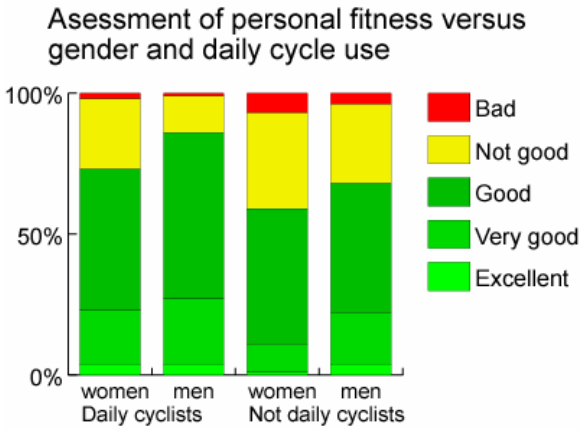
(See Ref. 1 page 21 for references).

Cycling and physical activity

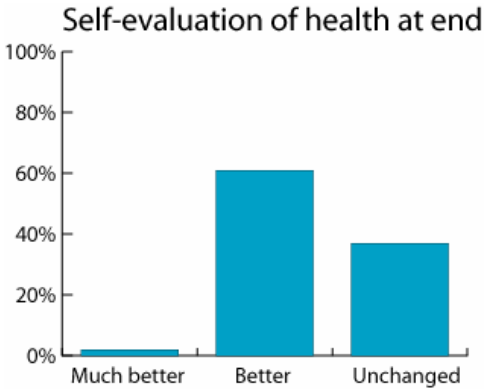
Cycling is known as a very energy efficient mode of transport. Cycling on a zero-slope with a constant speed can actually bring you far even with less expenditure of energy than what is recommended as the minimum of various health authorities. When, however, stops and slopes are taken into account, cycling will most probably be as energy demanding as e.g. brisk walking.

A study of Danish adults shows that cycling to work has a very significant effect on health. Even after adjustment for differences in terms of job, smoking, leisure time activities and body mass index people who cycle to work have a 28% lower mortality rate[2].

It is relevant to consider whether people who take up cycling will already be physically active, and whether cycling will mean that they become less physically active in other fields. No studies reveal this directly, but it seems not that there is any over-compensating effect. A study from Odense thus finds that those who regularly cycle are more active in other fields than those who don't cycle. And several studies find a positive correlation between cycle use and fitness or perceived fitness.

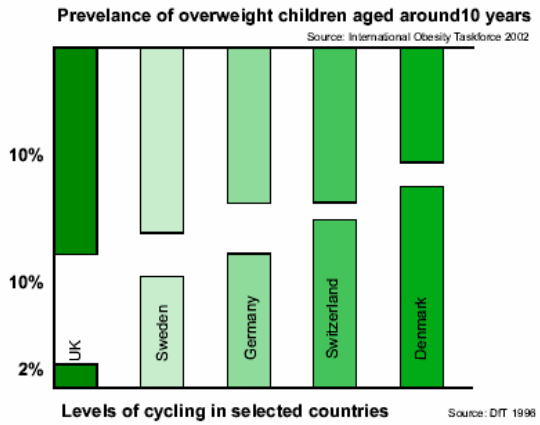


Results from a survey in Odense (ref 1, page 25).



Results from a test where non-cyclists took up cycling for a year (ref 1, page 26).

Finally, data from 5 different countries suggest a connection between overweight children and general cycle use.



Source: Sustrans, Ev 162

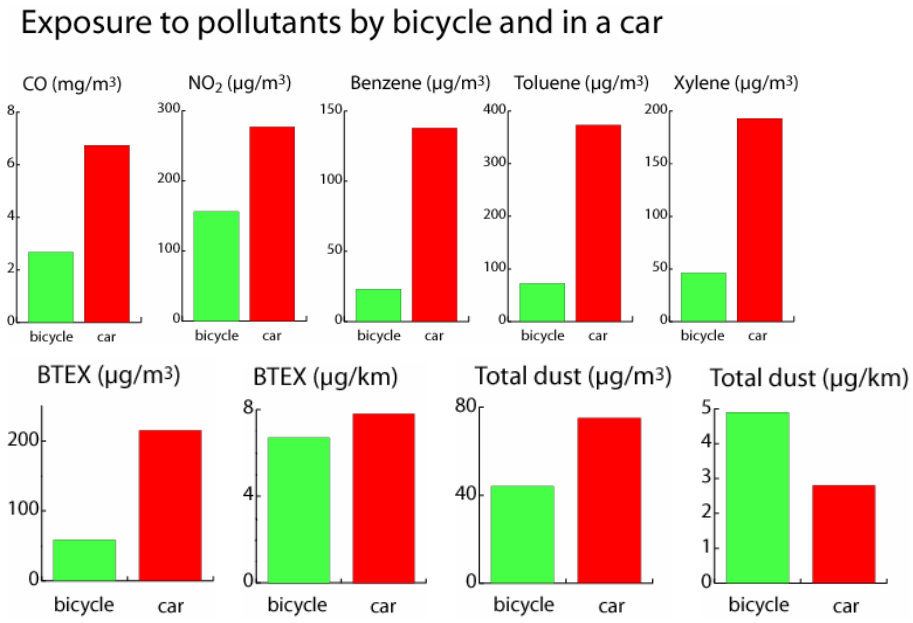
The share of overweight children and cycling use (ref 1, page 27).

Cycling and air pollution

It's obvious that it is less healthy to cycle in polluted air than in clean air. But should one not cycle because of the pollution? If there is a cleaner alternative the answer is yes, but if the alternative is to drive or go by bus, the bicycle will not necessarily be the worst alternative, if not even the best one.

Cyclists breathe more, so the exposure to pollutants at a given concentration is relatively higher. Studies however find that the concentration of pollutants at rush hours is substantially larger inside the cars than outside. The reason is that the air intake of the cars is close to the exhaust tube of the car in front.

Depending on relative speed and the relative volume of air taken in per minute cyclists may or may not be exposed to a higher amount of pollutants over the same distance. The difference is however not very big, and the bicycle will in any case be advantageous for passive cyclists like children in trailers or child seats.



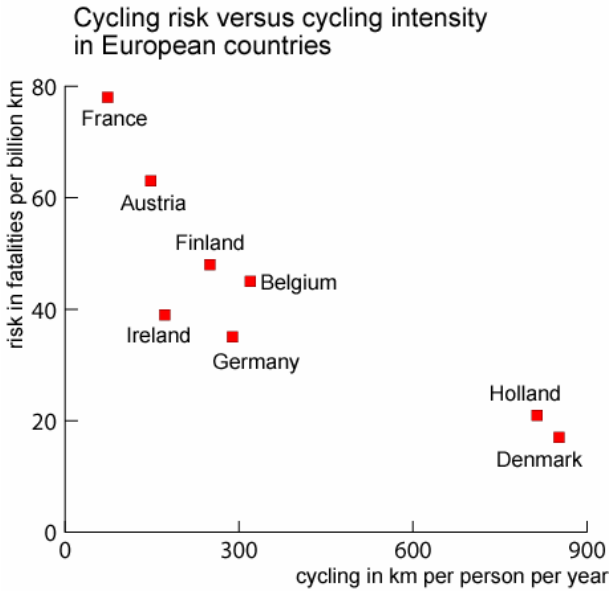
A Dutch study finds (top) concentration of dangerous fumes to be higher inside the car. A Danish study calculates the total exposure pr. km and shows the bicycle to be advantageous as far as the volatile compounds are concerned (ref 1, page 31).

In any case, pollution seems not to be an argument against cycling.

Safety and cycling

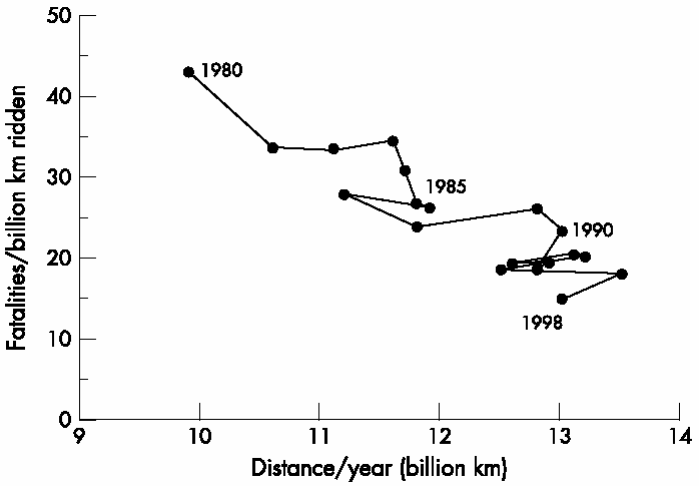
Safety has often been voiced as a concern in connection with cycling. This is quite relevant, as the risk of fatalities or injuries per kilometre is substantially higher for cyclists than for car drivers, who again have a substantially higher risk than the users of public transport.

One shall however be careful with risk comparisons, as it is not relevant to compare e.g. long car trips with short cycle trips. Furthermore, the risk is highly dependent of the city or country in question. A general tendency is that the risk of cycling decreases with cycle use.

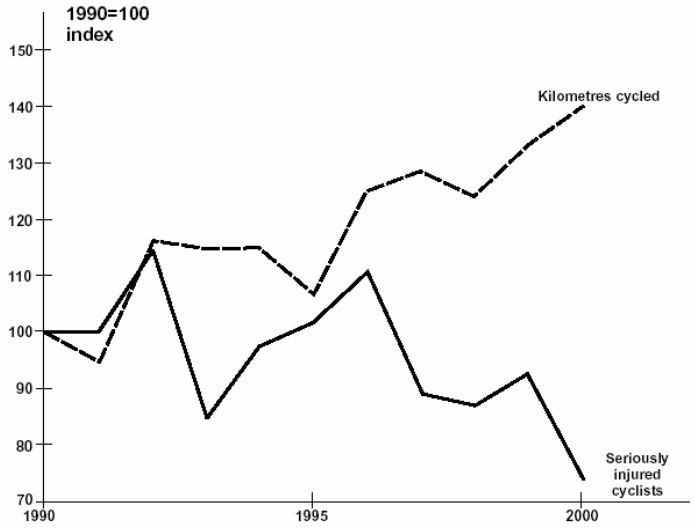


Risk of cycling tends to be smallest in the countries with the most cycling (ref 1, page 35).

Several examples show that it is possible to increase cycling levels without having an increase in accidents. "Risk" should thus not be considered as a law of nature, but as a quantity that varies considerable with cycling levels and cycling conditions.



Bicycling in Netherlands 1980-1998. A 30% increase in cycle traffic is associated with a two-third reduction in risk, e.g. a decrease of the total number of fatal cycling accidents (ref 1, page 36).



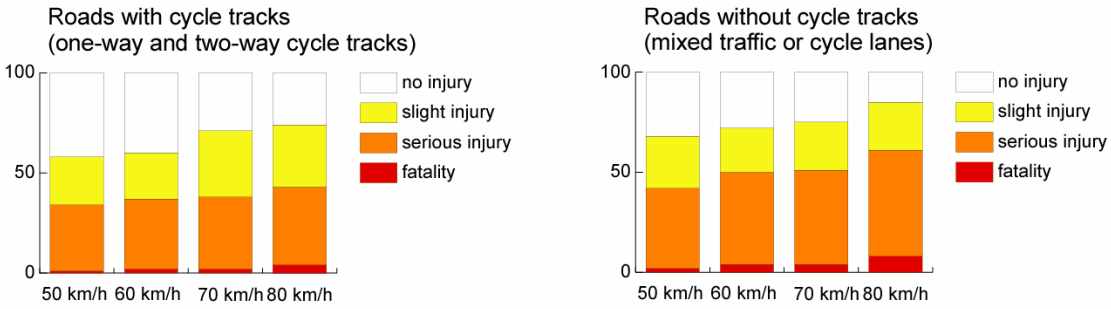
Copenhagen, Denmark, 1990-2000. The trend generally shows an increase of cycle traffic and a decrease in the number of seriously injured cyclists (ref 1, page 37).

Finally the health benefits should be taken into account. When comparing the negative health risk from cycling accidents with the positive health impact from exercise, one finds the latter to be far the most important. So cycling safety needs indeed to be improved, but there is no reason to stop promoting cycling for this reason.

Infrastructure for cycling

In Denmark major roads have traditionally been furnished with cycle tracks physically separated from the roadway as well as the pavement in order to improve the safety of cyclists. On minor roads usually no special provisions are made for cycling, though traffic calming is often employed in residential areas.

A lot of discussion has been going on whether to build cycle tracks or to use cheaper cycle lane solutions where painted lines is the only measure used. It seems however that a physical separation is beneficial for the safety, seen as the severity of the accidents, when high car speeds are involved. From a strictly safety point of view one can therefore choose any solution in urban areas where car speeds are moderate. Cycle tracks are however also popular because they increase perceived safety and comfort of the bicycle users..



Cycle tracks physically separated from the roadway give the best protection of cyclists at roads with a speed limit of 50 km/h or more (ref 1, page 42).

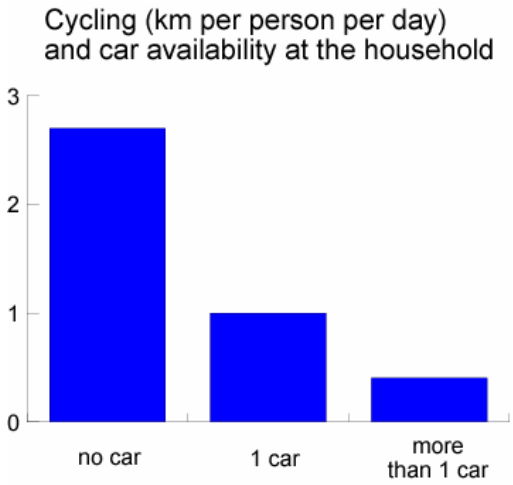
Totally separate track systems for cyclists and pedestrians have been built in housing areas in the 1960ies and the following decenniums. Such systems are good at daytime for the younger users, but give rise to social insecurity problems at night.

Moreover, they do not give the expected safety benefits, and are generally not recommended by planners today.

Motives for bicycle use

A considerable number of investigations of reasons to choose or not choosing the bicycle have been carried out in Denmark as well as abroad.

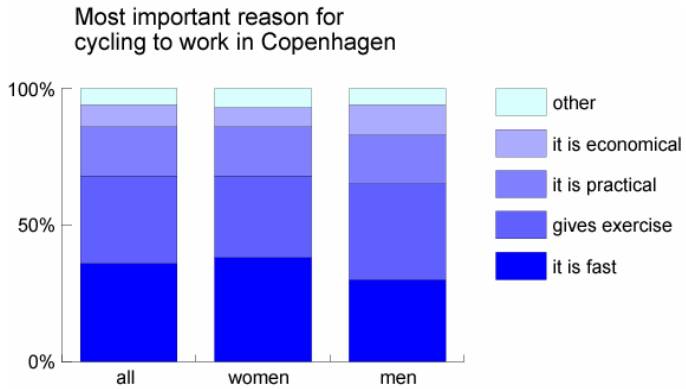
Availability of a car has a significant impact on cycle use. Very little cycling takes place in multi-car households.



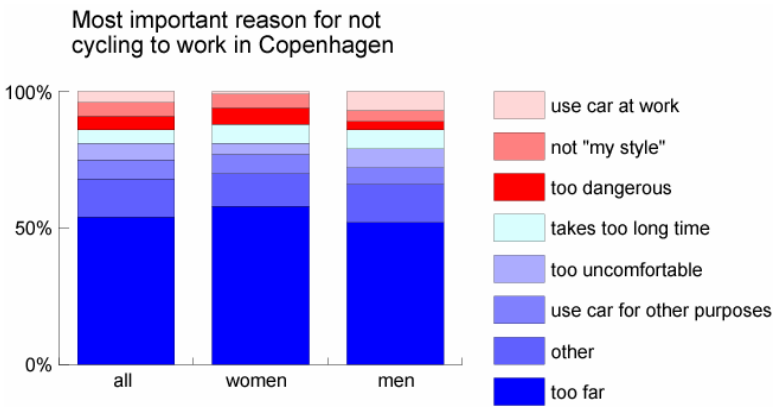
Cycling and car ownership, according to the national Danish travel survey (ref 1, page 47).

When asked for what could make people cycle more, more cycle tracks and more even roads are mentioned as the most important factors by people from two Danish cities.

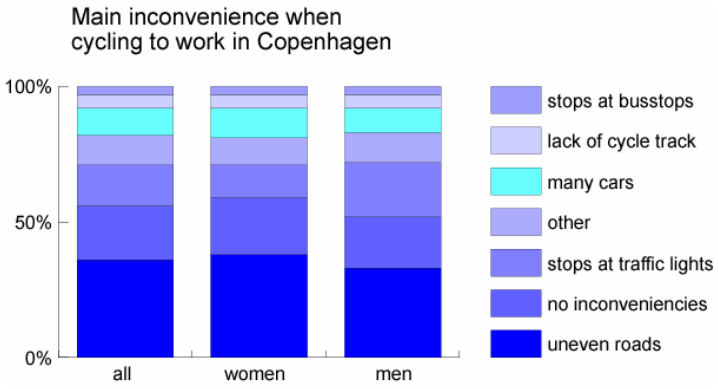
In Copenhagen distance and time are mentioned as the most important factors for cycling to work as well as not cycling to work. Several also mention exercise as their most important reason for cycling. Interestingly, moreover, is that lack of even roads and stops at traffic lights are mentioned as the most important inconveniences by those who are already cycling to work. Safety has a minor importance, both as an impediment and as a reason not to cycle.



Response to the question: "What is the most important reason for you to cycle to work?", (ref 1, page 49).

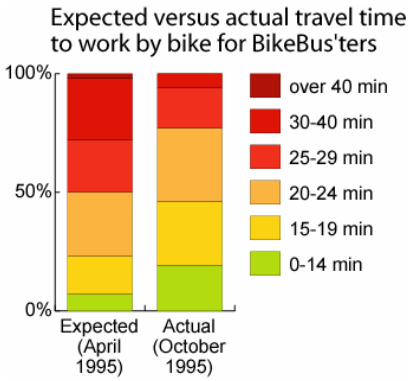


Response to the question: "What is the most important reason that you don't cycle to work?", (ref 1, page 50).



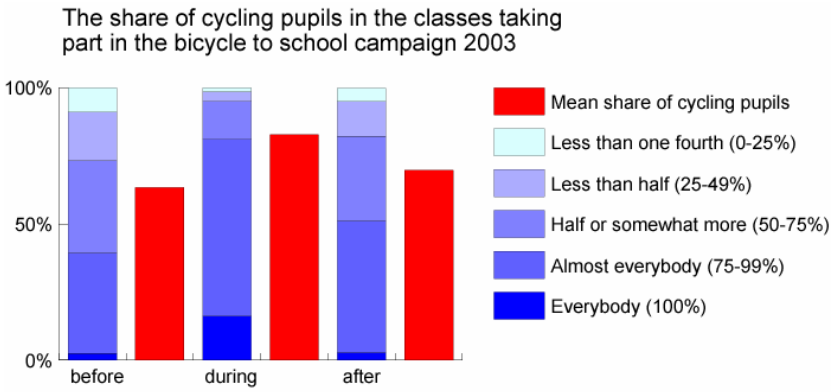
Response to the question: "What is the main inconvenience for you when cycling to work?" (ref 1, page 52).

The so-called BikeBus'ters project was carried out in the second largest Danish city Aarhus in 1995-96. 175 people got a free bicycle and free bus tickets against promising to avoid the car as much as possible. Getting exercise and wishes for more healthiness was the major motive for participation. The participants found the bicycle to be much faster than expected - 50% thought they would need at least 25 minutes to go to work, but 77% managed in practice to make the trip in less than that.



Expectations and experienced time expenditure for cycling to work for former non-cyclists taking part in the BikeBus'ters project (ref 1, page 48).

Campaigns and other sorts of publicity for the bicycle can be a major motivating factor. The annual Bicycle to Work campaign has about 100,000 participants. Another campaign directed towards schoolchildren had 70,000 participants in 2003. It was a good opportunity to discuss cycling with the parents - this happened in 59% of the participating classes. Evaluation data indicate that about 15,000 of the participating pupils did not cycle to school before the campaign, and that 5,000 continued to cycle after the campaign.



A bicycle to school campaign managed to give a permanent increase of the pupils cycling to school (ref 1, page 56).

The city of Odense managed to get a 20% increase of cycling through the project "Odense - the National Cycling City of Denmark". Infrastructure was already in place, and the substantial marketing elements of the project is the most probable explanation for the change.

Existing cost-benefit analysis of cycling, physical activity and health

In north America various assessments of the benefits of a physically active labour force have been carried out. Not only the number of days off work due to illness seem to be less for the physically active employees, their ability to take complex decisions and general productivity is also better than those who are physically inactive. Gains for the employer have been assessed to 3-400 Euro per physically active employee per year. WHO carefully suggests the improved productivity for physically active employees to be in the range 2-52%.

Until our project, only one specific cost-benefit analysis taking into account the health consequences of cycling and walking has been carried out. It was made by the Norwegian Institute of Transport Economics in 2002[3]. It concludes that investments in walking and cycling infrastructure will be more cost-effective than most other road building projects.

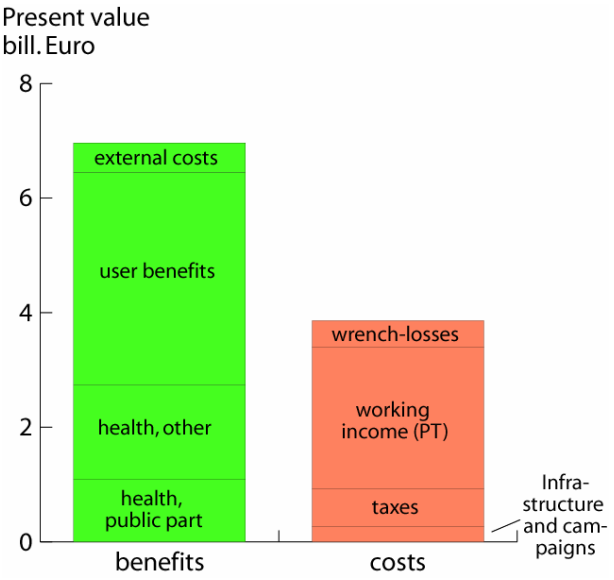
In a few countries calculations have been done assessing the cost of inactivity including medical treatment costs and to a varying degree production losses and loss of welfare. For Norway the result - used in the analysis mentioned above - is 980 Euro per person per year. A Swiss investigation comes to the result 564 Euro per person per year. In Finland the figure 1,200 Euro per year for a physically active person (compared to an inactive) has even been included in a manual for cost-benefit analysis of road infrastructure projects.

Cost-benefit analysis of a potential Danish bicycle promotion scheme

The report contains a new cost-benefit analysis of a Danish bicycle promotion scheme. It is assumed that it will be possible to achieve a 50% increase of cycling in Denmark, associated with a 30% increase in walking. The 50% corresponds to 1 billion kilometres more cycling per year. The target shall be reached in 12 years by improving infrastructure and making continued marketing activities. One half of the new cyclist and pedestrian kilometres are assumed to come from public transport and the other half from car driving.

Calculations have been done for a 50-year period (as prescribed in the official Danish manual for cost-benefit analysis in the transport sector). Costs of infrastructure and marketing have been up-scaled from experiences from Copenhagen and Odense. Conservative estimates of health benefits have been used, based on experiences from abroad, and overall quite conservative estimates have been employed.

The result is still very positive, and the overall present value of the project's net benefit is 3 billion Euro. Interestingly, main public costs are lack of income from public transport and car use (cars and gasoline are quite heavily taxed in Denmark), while the actual costs from infrastructure is just a minor part of the total expenditure. This means that even at much higher costs (or smaller behavioural effect at the same costs) the project will still be beneficial.



Cases from cities and regions

But why is it that cycling somewhere is basically ignored and elsewhere has a strong focus? To investigate this 9 cities and regions were chosen for further investigation. An overview of the cases is shown below.

Country	*city/region*	*population*	*city density (people/km^2)*	*keywords*
Denmark	Copenhagen	501,660	5,680	Many years systematic development, bicycle account, big cycle traffic increase, 34% bike to work.
Denmark	Odense	184,300	1,820	Many experimental projects, intensive PR and marketing, support from traffic fund, engaged planners, evaluation of health effects.
Denmark	Naestved	47,900	1,779	Big project with cycle and pedestrian bridge and roofed cycle parking, bicycle action plan, systematic development, support from traffic fund, fiery soul.

Norway	Trondheim	150,400	2,380	Big-scale extension, big part-financing from road tolls and state, big increase in cycling, engaged planners.
Norway	Sandnes	57,157	3,044	Traditionally "Norway's cycle city no. 1", thorough development, broad back-up and satisfaction, but no cycle traffic increase.
Norway	Kristiansand	75,280	2,109	Long term development, engagement in the administration, co-financing from the state, some cycle traffic increase, realistic targets.
Sweden	Stockholm	761,721	4,057	New cycle tracks and cycle lanes in the city centre, political demand with lots of controversies and debate, big cycle traffic increase.
Scotland	Glasgow	650,000	3,300	Single, health oriented project, decisive single individuals, health used as main argument in a quite cycle hostile environment.
Belgium	Flanders	5.7 mill.		Regional project with till now unseen financing opportunities, common guidelines for municipal cycle planning, mobility covenants with municipalities and provinces.

Health seems to be an argument of increasing importance. The situation is generally complex, and there will always be several of the elements and arguments shown below represented in a given city or region where cycle promotion takes place:

International targets for cycling

Several countries have national cycling strategies with specific targets for increased bicycle use. Only a few of them, however, seem to set aside the necessary resources to actually meet the set targets. Norway is such a country with high ambitions on state support for cities that want to improve cycling conditions in order to increase cycle use.

WHO has provided several papers pointing at the relevance for promoting cycling as a physically active lifestyle, with the 1999 London Charter on Traffic, Environment and Health as the most well known one.

EU has published some reports focusing on cycling as a positive phenomenon, but has not integrated it into the hard policies.

Present and perspective cycling promotion policies in Denmark.

Bicycling is seen as a normal activity in Denmark, and the road authorities at all levels have for many years integrated cycling in their activities. About 12% of the Danish road network (70,000 km) is furnished with cycle tracks, most of them found along municipal roads. The argument for providing cycle tracks has for far the most of them been cyclists' safety.

Special funds for provision of cycle tracks along the state roads were set aside and spent since the early 1980s. In the 1990s the so-called Traffic Fund was created, giving 50% state co-financing for municipal projects targeting environmental improvements, among this cycle promotional projects. Health did not have a high priority, but was taken into the evaluation of some of the projects that were carried out. Since 2001 the Traffic Fund, however, has been closed down, and the present government has not taken any cycle promotional initiatives. Cycling is slightly decreasing as an average, but cycling is increasing in some cities with special emphasis on cycling.

References

1. The report "Cykling, motion, miljø og sundhed" (Cycling, Exercise, Environment and Health; with a summary in English) can be downloaded from www.ecocouncil.dk (http://www.ecocouncil.dk/download/cykelrapport_2005.pdf). The report contains numerous references.

2. L.B.Andersen et al: All-cause Mortality Assiciated with Physical Activity During Leisure Time, Work, Sports, and Cycling to Work, Arch. Intern. Med., Vol. 160, June 12, 2000, p.1621.

3. Kjartan Saelensminde: Walking- and cycling track networks in Norwegian cities. Cost-benefit analyses including health effects and external costs of road traffic. Norwegian Institute of Transport Economics, report 567/2002 (with summary in English, available at www.toi.no).