Summary
Whatever age we are and whatever activities we undertake, transport and mobility play a fundamental role in our daily lives and routines. In the Netherlands, 70% of the trips made are shorter than 7.5 km. In the past decades, planning and transport policies have been predominantly focusing on the car. As a result, urban living drastically changed, levels of congestion and pollution increased, and cycling and walking as means of transport decreased. By the year 2015, cities are facing new challenges. Achieving lively, safe, sustainable and healthy cities has become a general rule and urgent desire and recently “Healthy urban living” is getting more and more attention. The current dominance of an inactive, car-oriented lifestyle directly threatens public health.

Stimulating active transport use not only influences the level of physical activity, but also has beneficial health effects due to reduced air pollution emissions, greenhouse emissions and noise levels. The effect on road safety is controversial: some claim an improvement, while others found that this effect depends on age and gender. Since active transport affects health through these different pathways it would be of value to combine the outcomes with respect to this different aspect into one overall health outcome that summarizes the aggregate impact on health by using a Health Impact Assessment (HIA). Main drawbacks of these HIAs are that, apart from the fact that these are theoretical exercises, much of the information needed for the assessment is unavailable or unknown, resulting in a relatively large number of assumptions. Therefore, more in-depth knowledge is needed in order to decide if the assumptions made in HIAs are a correct representation of reality and thus if the presented health effects are a reliable prediction of the outcome of this intervention in practice. To have correct information at ones disposal will result in HIA outcomes correctly representing current practice and in policy documents deciding where to put the money in order to most efficiently promote public health.

The aim of this PhD thesis was twofold:

1. to investigate the feasibility of policy measures and/or interventions aiming to induce a mode shift for car use to active transport; and

2. to provide in-depth information on the personal and environmental characteristics of short car and active transport (walking & cycling) trips associated with transport choice.

The research presented in this PhD thesis was conducted as part of the “ActiVE traNsport in Urban Environments” project which has a focus on national representative data of the Netherlands. An integrated approach has been used including the following domains: health, air pollution, noise levels, urban planning and traffic safety. In this project a combination of qualitative (focus groups, policy analysis) and quantitative methods (systematic literature review, questionnaire and (secondary) data analysis) has been used. In this thesis we only focused specifically on adults with an age of 18 years or older since in the Netherlands below this age people do not have a driver’s
license and therefore are not part of the primary target population for interventions stimulating a mode shift. To enhance the feasibility or measures aiming to induce a mode shift from car to active transport modes, car trips should not exceed a feasible walking or cycling distance. We decided to define short trips as trips up to 7.5 km considering both walking and cycling as alternatives for car use.

**Aim I: investigate the feasibility of policy measures and/or interventions aiming to induce a mode shift**

We investigated policy measures specifically implemented in the Netherlands. Despite the high proportion of bike use, our analysis showed that national transport policies did not target bicycles and health (apart from accident prevention policy) and was neither a formal transport policy goal nor a consideration in formulating transport policy (Chapter 3). We also conducted a systematic review in which we found four different types of interventions: work-place-based, architectural and urbanistic adjustments, bicycle-renting system, and population-wide interventions. Nearly all (16 out of 19) studies showed results in a positive direction suggesting that intervention tools were successfully implemented. However, in general, methodological quality was (very) poor, prohibiting any strong conclusion on effectiveness of such measures (Chapter 2). A closer look at the intervention tools used in the interventions included in our review shows that more than half used a combination of several tools. This raises the question which specific tool may be held responsible for the observed behavioural change.

**Aim II: provide in-depth information on the characteristics of short car and active transport trips associated with transport choice**

Based on secondary data analyses using data from Mobility Research Netherlands (2004-2009) we found that gender, age, education level and neighbourhood typology are important factors to take into account when planning an intervention. In addition, trip purpose was found to be associated with transport choice (Chapter 4). More specifically, special attention should be given to the groups using little active transport, namely a) men making short distance trips with the purpose of taking or bringing persons, b) women making short distance trips to sports facilities, c) persons belonging to the age group 25-44 years of age, d) persons with a primary school or lower general secondary education degree and persons with a high school or secondary school degree and e) persons living in rural or urban-green neighbourhoods.

In practice, transport choice for one trip often will be linked to another (combined trip purposes). Based on data from the questionnaire designed for the AVENUE project it was found that trips were more likely to be made by car if any primary trip purpose (shopping, commuting, sports, and public natural spaces) was combined with commuting, other shopping activities, visiting private contacts or medical care (Chapter 5). Another finding is the importance of individual perceptions
of the environment. We observed that, irrespective of objective accessibility, perceived accessibility is strongly associated with transport choice (Chapter 6). The same was true for perception of route characteristics for trips made to sports facilities (Chapter 7). Moreover, trip purpose was found to influence how someone experiences the route to a specific destination (Chapter 8).

The hypothesis that persons who generally use active transport would feel and be healthier than those generally taking the car held for perceived general health and having healthy body weight. However, we found no associations between transport choice and perceived psychological well-being (Chapter 9).

Transport and route choice were found to be highly influenced by habits. Though respondents were perfectly able to rationalize and justify their transport choice when confronted with their habitual behaviour. We expect that breaking daily routine will pose serious challenges (Chapter 8).

Implications for future policy, practice and research

In the final chapter (Chapter 10) four key messages were created based on the results obtained in the earlier chapters:

*Key message 1: Active transport has high potential to increase public health but it also strengthens aims of other policy domains, e.g. transport safety, congestion, accessibility etc.*

Recently, “Healthy urban living” is getting more and more attention. This represents among other things the notion that the neighbourhood could be designed in such a way that it stimulates healthy behaviour. However, although the issue is increasingly addressed in urban policy agenda’s and sometimes pilot projects are already being designed and implemented, (scientific) evaluation is often lacking. There is an urgent need to take action and create new urban coalitions and extend existing coalitions for creating a healthy living environment as a precondition for a habitual active lifestyle. Close collaboration between researchers, policy makers and urban planners would be beneficial. We found that none of the investigated policy measures were designed with the aim of stimulating health (Chapter 3). Therefore, since many of the policies and decisions related to the built environment are made outside of the health sector in areas such as urban planning and transportation, the public health sector must find effective ways of supporting those who are responsible for making decisions that affect the quality of urban life.

*Key message 2: For stimulating a mode shift there are two different pathways: contextual and individual.*
This thesis supports that for stimulating a mode shift there are two different pathways: contextual and individual. Several target groups are defined, indicating that there is no “one-size-fits-all” solution for stimulating a mode shift; tailored action is called for. Accessibility was also found to be one of the key characteristics with regard to transport choice. In this thesis, perceived accessibility encompasses more than just travelling from A to B. Perceived accessibility was, irrespective of objective accessibility, strongly associated with transport choice. This makes it clear that when stimulating a mode shift one should not only focus on characteristics of urban design like the presence of facilities but also on the individual perception of the environment.

*Key message 3: Transport choice and route choice are habitual behaviours. Interventions stimulating a mode shift should therefore take this into account.*

Whereas policy measures are often based on the assumption that persons make rational decisions, research shows that persons are not so rational as believed. The provision of information is not enough to stimulate persons to change their behaviour, especially since we know that persons do not process all information when making a choice. As a result of the fact that transport behaviour is habitual behaviour, persons may fail to detect new and better alternatives simply because their expectations reduce awareness of such information and these biases will reduce the impact of informational campaigns and help maintain existing behaviour patterns. For example, in *Chapter 8* we describe that environmental factors hardly influence transport choice, although it is generally well known that driving a car has negative environmental effects.

*Key message 4: It is possibly that a much larger group is eligible for a mode shift than the earlier assumed 10-12.5%.*

In *Chapter 2* we showed that many of the evaluated interventions did not explicitly analyze on an individual level a mode-shift in transport choices and behaviour. As a result, effectiveness is often reported at population level and we are unable to determine which population groups did change their behaviour and what caused this behavioural change (mode shift). Furthermore, results from our focus groups showed that trip purpose also influences how someone perceives the route taken, e.g. when respondents take the same route for different trip purposes they will experience this route differently due to the trip purpose. This poses a serious challenge to designing and evaluating interventions stimulating a mode shift. Designing a successful intervention not only requires adequate knowledge about factors (e.g. environmental factors, individual factors) that trigger the choice of active transport modes as an alternative to passive modes. It also requires insight into the proportion and composition of the population that would be willing to change their transport behaviour and under what circumstances they would do so. Therefore tailored interventions are needed. In previous studies estimating health effects of a mode shift, an impor-
tant assumption needed to be made was the proportion of short car trips that may reasonably be expected to be replaceable by active transport (willingness to change). Little to no research is available to support assumptions on the proportion of trips and their characteristics. In the earlier performed HIAs performed in the Netherlands the scenarios of the replacement of respectively 10% and 12.5% of the short-distance car trips by bicycle were calculated. We found that half of our study population used more than one transport mode for one or more trip purposes. This large proportion underscores the fact that walking and cycling are indeed alternative transport modes for these short distance car trips. Furthermore, it stresses that this group of people already alternates with different transport modes. It is therefore possible that a much larger group than 10-12.5% is eligible for a mode shift.