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Healthy and **sustainable mobility** for **healthcare workers**

What encourages cycling, walking and the use of public transport?

RIVM letter report 2026-0037
N. van der Vliet et al.

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Colophon

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Synopsis

Healthy and sustainable mobility for healthcare workers

What encourages cycling, walking, and public transport use?

The healthcare sector should reduce its CO_2 emissions and support the health of its workforce. A large part of the emissions comes from healthcare workers commuting to work. RIVM has investigated which measures encourage healthcare workers to commute in a more physically active manner – not by car, but by bike, on foot or by public transport. The advantage of these measures is that they not only reduce CO_2 emissions, but also improve health.

It turns out that little research has been carried out so far into measures that encourage active commuting among healthcare workers. However, research in other fields shows a number of promising measures, such as making active commuting more financially appealing than commuting by car. This can be done, for example, by reimbursing the costs of active commuting or setting up financially appealing schemes for the lease or purchase of e-bikes. Other potential measures include introducing paid parking and installing parking facilities for bicycles. A combination of measures that reinforce each other is likely to be most effective.

In addition, RIVM conducted interviews with healthcare organisations to discuss their practical experiences with successful measures. An example is the availability of loan bicycles at different locations of a healthcare organisation.

Above all, the investigation shows that active commuting should be made as convenient and appealing as possible. RIVM also recommends examining carefully what fits the healthcare sector and adapting measures accordingly. Among the issues to consider are that healthcare workers work in night shifts, keep irregular working hours and may have to work at multiple locations. Given that active commuting among healthcare workers has not been studied much, it is important to investigate whether the measures are effective in a healthcare setting.

A further recommendation is to involve the entire organisation in active mobility plans, from workers to the Works Council and from the purchasing department to the board. Lastly, it is essential to work together with parties responsible for public transport and cycling infrastructure, such as transport providers, municipalities and provinces.

Although the effects of promising measures may be small at the individual level, they can make a big difference if many organisations take part. That is why it is vital that the entire healthcare sector joins in.

Keywords: active mobility, interventions, healthcare sector, health, environment, sustainability, commuting, cycling, public transport, CO_2 emissions, policy

Publiekssamenvatting

Gezonde en duurzame mobiliteit voor werknemers in de zorg

Wat stimuleert fietsen, wandelen of ov-gebruik?

De zorgsector moet minder CO_2 uitstoten en zich inspannen voor de gezondheid van medewerkers. Een groot deel van de uitstoot komt door woon-werkverkeer van mensen die in de zorg werken. Het RIVM onderzocht welke maatregelen stimuleren dat zorgmedewerkers op een actieve manier naar hun werk gaan. Dus niet met de auto, maar met de fiets, lopend of met het openbaar vervoer. Het voordeel is dat deze maatregelen niet alleen voor minder CO_2-uitstoot zorgen maar ook gezonder zijn.

Er blijkt nog weinig onderzoek te zijn naar maatregelen die in de zorgsector een actieve manier van reizen stimuleren. Wel beschrijft de wetenschappelijke literatuur maatregelen die buiten de zorg veelbelovend zijn, zoals actief reizen financieel aantrekkelijker maken dan reizen met de auto. Dat kan bijvoorbeeld door kosten van actief woon-werkverkeer te vergoeden, of met aantrekkelijke regelingen om een e-bike te leasen of te kopen. Andere mogelijkheden zijn betaald parkeren en de aanwezigheid van bijvoorbeeld een fietsenstalling. Een combinatie van maatregelen die elkaar versterken lijkt daarbij het meeste effect te hebben.

Het RIVM interviewde ook zorgorganisaties over succesvolle ervaringen in de praktijk. Een voorbeeld daarvan is dienstfietsen aanbieden, verspreid over de verschillende locaties van een zorgorganisatie.

Het onderzoek laat zien dat actief reizen vooral zo makkelijk en aantrekkelijk mogelijk moet worden gemaakt. Verder beveelt het RIVM aan goed te kijken wat bij de zorgsector past en maatregelen daarop te laten aansluiten. Zo hebben zorgmedewerkers bijvoorbeeld nachtdiensten, wisselende werktijden, en werken zij op verschillende locaties. Omdat actief woon-werkverkeer in de zorg nog weinig is onderzocht, is het ook belangrijk na te gaan of de maatregelen hier werken.

Een andere aanbeveling is de hele organisatie bij de plannen te betrekken, van medewerkers, de ondernemingsraad tot inkoop en het bestuur. Verder is het belangrijk samen te werken met partijen die verantwoordelijk zijn voor openbaar vervoer en fietspaden, zoals vervoerders, gemeenten en provincies.

Effecten van veelbelovende maatregelen zijn per persoon klein, maar kunnen veel verschil maken als veel organisaties eraan meedoen. Het is daarom belangrijk dat de hele zorgsector hiermee aan de slag gaat.

Kernwoorden: actieve mobiliteit, interventies, zorgsector, gezondheid, milieu, duurzaamheid, woon-werkverkeer, fietsen, openbaar vervoer, CO_2-uitstoot, beleid

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Summary

The healthcare sector is responsible for about 7% of national CO_2 emissions. It has been agreed that the healthcare sector must reduce its CO_2 emissions and must also commit to improving the health of its workers. Transport has a substantial environmental impact in the healthcare sector, with commuting accounting for the majority of carbon emissions (21-28%). Encouraging active mobility (cycling, walking and using public transport) rather than travelling by car has a double benefit: it reduces CO_2 emissions and improves health. To achieve the potential of active mobility, it is essential to have an understanding of the interventions that work to effectively encourage active mobility.

This letter report, commissioned by the Dutch Ministry of Health, Welfare and Sport as part of the Sustainability and Health programme (*Duurzaamheid en Gezondheid*), answers the question: what interventions to promote active mobility among healthcare workers are effective and promising? The letter report is intended for healthcare policymakers and professionals who work on sustainability, mobility and corporate social responsibility. This will also be of interest for other sectors that work on active mobility.

What works?

A 'What Works' document has been compiled based on a literature review. The What Works document provides information on the effectiveness of various interventions to promote active mobility. The literature review shows that there is insufficient healthcare-specific evidence to conclude that any of the interventions would be effective in the healthcare sector. However, there are a number of promising interventions, the majority of which have been studied in sectors other than healthcare. Examples include workplace programmes, financial incentives, gamification, facilities and amenities (such as e-bike loan schemes and bicycle parking facilities), tailored travel advice and parking policies. Other examples include suitable, safe and supportive cycling and walking infrastructure and high-quality, frequent and reliable public transport. The effectiveness of some other interventions such as providing information only, isolated communication campaigns or social initiatives such as cycling buddies, is still unknown or uncertain.

Insights from practice

The report also provides insights from interviews with healthcare organisations about the use of interventions for active mobility. These experiences from practice and success factors serve as inspiration and supplement the findings of the What Works document.

Conclusions and recommendations

- The effects of interventions on travel behaviour are usually small per person, but even small effects can have a **substantial social impact** when implemented on a large scale and over a long period of time.
- Long-term behavioural change calls for **a coherent package of structural interventions.**
- **Combine** incentives to action for active mobility with interventions that make car use less normal.
- **Embed this integrated approach in policy**, with sufficient resources and central coordination.
- **Cooperation with local authorities, regions and public transport providers** is essential to enable the prerequisites for infrastructure and public transport to be achieved.

Recommendations for the practical implementation of mobility policy

- **Take advantage of promising moments** when new travel habits are being formed. This might include new or recently relocated workers, or the opening of a new location.
- **Actively involve workers.** Involvement and trust are prerequisites for support, particularly in the case of interventions that discourage car use.
- **Know your target group and provide tailored solutions.** Appropriate mobility policy calls for an understanding of the needs of the target group and healthcare-specific circumstances. One might consider irregular working hours, night shifts, working at multiple locations and outpatient care.
- **Ensure monitoring and evaluation.** Implement and evaluate promising interventions in healthcare to determine whether and how they may work there.
- **Measure effects on both active mobility and car use**, before and after the introduction of interventions, preferably also in the long run.
- **Develop and study interventions for visitors and patients**, who also account for a significant proportion of traffic to and from healthcare organisations.

1 Introduction

There are major challenges in the field of health and the environment. Many people exercise too little, for example, and a large proportion of the population is overweight, which results in an increase in chronic diseases such as diabetes and cardiovascular diseases (Afshin et al., 2019; Katzmarzyk et al., 2022). At the same time, our current lifestyles, the way we exercise and our eating habits have a great impact on the environment, partly due to high greenhouse gas emissions, which contribute to climate change (Gerlofs-Nijland et al., 2021; Lee et al., 2023). This dual challenge calls for solutions that facilitate good health as well as reduce the burden on the environment. This letter report focuses on promoting active mobility in the healthcare sector as active mobility creates a win-win situation for both sustainability and health (World Health Organization, 2022). Our definition of active mobility is self-powered travel, such as cycling and walking. This report also included public transport use as this generally also involves active movement. This might include cycling or walking to the bus stop or the train station and transferring from the bus to the train. Active mobility can take place to all kinds of destinations, including the workplace or a medical appointment. It does not therefore include cycling or walking for recreational purposes. In this report we mainly focus on active mobility to and from work (active commuting).

Who is this report for?

This report is for healthcare professionals and other professionals who develop and implement policy related to sustainability, corporate social responsibility (CSR) and mobility. The professionals include sustainability and mobility coordinators, advisers and programme managers but also researchers and other interested parties.

The role of the healthcare sector

The Dutch healthcare sector is a significant contributor to greenhouse gas emissions, accounting for about 7% of national CO_2 emissions (Steenmeijer et al., 2022). This means that an important goal is sustainable healthcare with negligible greenhouse gas emissions. One of the strategies for reducing the environmental impact of healthcare is to minimise travel and transport (both the transport of goods and passengers) (Braithwaite et al., 2024). Commuting is the transport category that appears to have the greatest environmental impact for all types of healthcare organisations (Milieu Platform Zorg, 2025; Steenmeijer et al., 2022). Figure 1 shows the average environmental impact of various sources for different types of healthcare organisations (Milieubarometer, 2024). Specifically for hospitals, commuting accounts for about 19% of the total environmental impact. This makes it the second largest contributor after electricity consumption (38%) (Milieubarometer, 2024). For hospitals, visitor traffic accounts for 13%; how much other healthcare organisations account for is unknown. See Figure 2 for an overview specifically for hospitals, which also includes the contribution by visitor traffic.

The healthcare sector also has specific additional challenges: for example, workers often work in shifts and night shifts, which means that cars are an appealing transport option, partly for safety reasons. There are also organisational bottlenecks, such as work pressure and staff shortages, which affect the feasibility of mobility policy. This might include, for example, limited change capacity and limited implementation capacity among teams with high workloads and additional administrative burdens. At the same time, there are great opportunities in this sector: due to the size of its workforce and its exemplary role in society in the field of health and sustainability, the sector can make an important contribution and play a leading role.

Figure 1 Overview of the average environmental impact of various sources for different types of healthcare organisations in 2024. Source: (Milieubarometer, 2024).

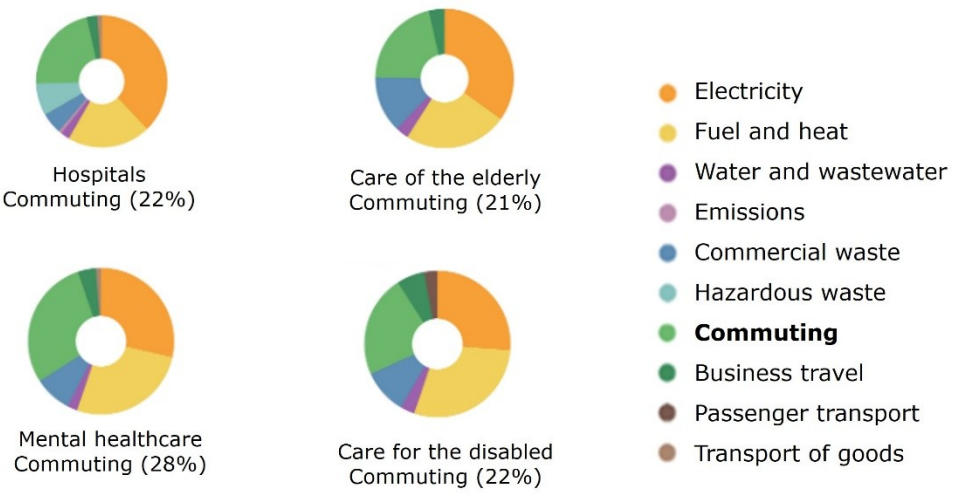

Figure 2 Average environmental impact of various sources at hospitals in 2024, including the contribution by visitor traffic. Source: (Milieubarometer, 2024).

Towards CO_2 reduction in the healthcare sector

As part of the Sustainable Healthcare Green Deal 3.0, various parties in the Netherlands have agreed to work in a results-driven manner on five themes (health promotion, knowledge and awareness, CO_2 reduction, circularity and medicines) for the period 2023-2026. One of the goals of this Green Deal is a 55% reduction in direct CO_2 emissions by 2030 compared to 2018 and climate neutrality by 2050. Starting in 2023, in

addition to the Green Deal, all organisations with more than 100 employees, including healthcare providers, must document the CO_2 emissions of staff transport movements. In 2026, the Ministry of Infrastructure and Water Management (IenW) will check whether the CO_2 emissions from work-related passenger mobility of all employers in the Netherlands combined have remained below the CO_2 emission ceiling. If the emission ceiling is exceeded, employers will become subject to a maximum CO_2 emission level. This will then be the maximum value for each employer and will force employers who exceed this limit to take action. Employers must comply with this level by 2030 at the latest. One of the agreements under the Sustainable Healthcare Green Deal is that parties must also draw up a mobility plan after this registration of CO_2 emissions. This plan must include targets and measures for reducing these CO_2 emissions and making these transport movements more sustainable. Where possible, the participating healthcare providers should include the transport movements of patients/visitors in this plan (Rijksoverheid, 2022). The Sustainable Mobility for Inpatient Care Procedure Manual outlines various ways in which to approach promoting sustainable mobility in healthcare, such as reducing the number of kilometres travelled (through e-health or working from home), alternative transport, economical and clean driving and maintaining and renewing the vehicle fleet (Milieu Platform Zorg, 2025). Another objective of the Green Deal is increasing the efforts to foster the health of healthcare workers so that they stay in good health for longer (Rijksoverheid, 2022). This makes the focus on active mobility even more relevant, as it can result in both CO_2 reduction and health benefits.

Trends in passenger mobility and the impact of COVID-19

In 2023, Dutch commuters travelled approximately 49.8 billion kilometres to and from work, which is 9% less than in 2014 (Kennisinstituut voor Mobiliteitsbeleid, 2025). The number of kilometres travelled for other purposes, such as shopping and leisure activities, remained largely unchanged over the years. An important factor in the decrease of commuting distances is the increase in working from home on an ongoing basis since the COVID-19 pandemic. In 2024, 42% of the working population worked from home for at least one hour per week, which is significantly higher than the pre-pandemic level of approximately 30%.

It is unknown how commuting within the healthcare sector in particular has developed over time. However, it doesn’t go without saying that the national trend is also evident within the healthcare sector as the physical presence often remains necessary for certain professional groups in the healthcare sector. There are no recent national figures available for healthcare visits in the Netherlands that show how many people travel by car, bicycle or public transport. Although the number of healthcare visits may have decreased due to the increase in online consultations, there is no reliable information available on this.

Active mobility as 'win-win' for health and environment

Health benefits
Active mobility, such as walking and cycling, provides direct health benefits. It provides extra physical activity with all kinds of health benefits, both physical and mental. People who choose active modes of transport are more likely to meet the exercise guidelines (Kenniscentrum Sport en Bewegen, 2026). Furthermore, they are at lower risk of cardiovascular diseases, cancer and premature death and they experience greater mental health and wellbeing (Dinu et al., 2019; Dutheil et al., 2020; Pearson et al., 2025). These health benefits can also be promoted by interventions that encourage active mobility in the workplace. Interventions aimed at active mobility among workers, for instance, show positive health effects, such as improved physical fitness (Rijs et al., 2024). A shift from motorised transport to active modes of transport can yield benefits not only for the environment and health but also for road safety, the economy and transport quality (Ding et al., 2024). In addition, active mobility also contributes indirectly to health as the reduced use of motorised transport also reduces the emission of air pollutants and greenhouse gases as well as noise pollution. This improves the living environment and health.

Active mobility in this report does not only include walking and cycling but also travelling by public transport. This is in line with international academic literature, which generally includes public transport as using public transport also provides health benefits (Patterson et al., 2019). Research has shown that the use of public transport is associated with lower obesity and depression rates among the elderly (Dilian et al., 2024) and is also related to increased physical activity, such as walking to a bus stop or train station (Rissel et al., 2012).

Environmental and sustainability benefits
More active mobility also has significant environmental and sustainability benefits. Research has shown that adding an extra bike ride to existing travel behaviour is associated with an average CO_2 reduction of about 14%, while avoiding a car journey completely can lead to a reduction of about 62% (Brand et al., 2021). Permanently replacing one daily car journey by a bicycle ride can result in a CO_2 reduction of approximately 0.5 tonnes per person per year (Brand et al., 2021). Environmental benefits are not only reflected in lower CO_2 and other greenhouse gas emissions but also in a reduction of air pollutants and noise pollution as a result of less motorised traffic. This contributes directly to a cleaner and healthier living environment. A permanent reduction in car use means that active mobility will contribute to lower dependency on fossil fuels, more efficient use of scarce urban space and a living environment that is healthier and more sustainable in the long run and is more resilient to climate and health challenges. In this way, active mobility supports not only environmental goals but also broader sustainability objectives.

Focus of this study

This study was commissioned by the Dutch Ministry of Health, Welfare and Sport (VWS) and is part of the Sustainability and Health programme running from 2022 to 2026. The study addresses interventions that

encourage active mobility among workers. The focus is on interventions that can facilitate both better health and a lower environmental impact. There are, of course, also other ways in which the environmental impact of mobility in healthcare can be reduced, including travelling less or travelling more cleanly. This can include working from home, digital healthcare (e-health), electrification of the vehicle fleet or car sharing, which can also reduce CO_2 emissions. Although these measures are vital in an integrated mobility plan, this report focuses on active mobility because of the unique 'win-win' opportunities that it offers for both health and the environment. The emphasis is on the interventions that healthcare organisations can use to promote active mobility and, in particular, active commuting. There is much to be gained in terms of CO_2 emissions within the healthcare sector. The report provides an understanding from literature on promising interventions to encourage active mobility, particularly active commuting to and from healthcare organisations. Furthermore, the report includes the practical experiences of healthcare organisations that are already working on active mobility policies.

Leaflet

In addition to this letter report, a practical leaflet has been designed in which the most important insights from this report have been adapted into key messages and inspiring practical examples. The leaflet is intended as a guide for healthcare professionals who want to start promoting active mobility within their organisation. The leaflet can be downloaded from rivm.nl/duurzamezorg.

Primary research question

The primary research question of this literature review was: what interventions to promote active mobility among healthcare workers are effective and promising? In addition, the report also addresses two other aspects:

- An understanding of travel behaviour;
- Practical aspects associated with implementing sustainable mobility policies in healthcare organisations.

Outline

- Chapter 2 describes the methods used for the literature review and interviews.
- Chapter 3 answers the main research question in *What Works in practice*. These are the interventions found in literature, classified into categories of effectiveness: what works in practice, what is promising and what is uncertain or unknown. First of all, a summary is provided and this is followed by an explanatory note for each intervention.
- Chapter 4 provides a brief overview of factors that influence travel behaviour and the resulting approaches for action for mobility policy. It also discusses prerequisites and aspects of the practical implementation in structuring mobility policy.
- Chapter 5 gives a number of practical examples of healthcare organisations that have developed mobility policies and implemented measures based on these policies. In addition, overarching findings are described.

- Chapter 6 reflects on the findings from the previous chapters. Points to consider in the interpretation of findings and methodological limitations of both the literature found as well as the current research are addressed.
- Finally, Chapter 7 describes the conclusions and recommendations.
- Appendix 1 gives a detailed description for each promising intervention of the reviews and studies that were the basis for the conclusions in *What Works in practice*. A detailed description is only given for a select number of the interventions with an uncertain or unknown conclusion.

2 Method

2.1 Literature review

This review did not examine the extent of the effects of individual interventions on specific outcome measures such as the reduction of greenhouse gas emissions or changes in healthy weight. It did, however, look at studies that investigated how active mobility can be effectively encouraged and which interventions have been proven to be effective, appear to be promising or for which the effectiveness is still uncertain or unknown (this is explained in more detail in the *Classification of the interventions* section).

The information on which *What Works in practice* is founded is based on academic literature. Grey literature, such as pilot studies or central government policy documents, have not been included. A search for academic literature was conducted in four databases (Embase, Scopus, Web of Science and PsycINFO) early in 2025.

The search strategy consisted of various combinations of the following terms: *commuting, transport, travel, active transport, workplace, walking, cycling, public transport, healthcare, hospital, intervention, programme, trial and policy.*

Because it was believed that the literature on interventions in the healthcare sector would be limited, the search included studies in both the healthcare context and a general context. In addition, interventions aimed at commuting and active mobility to other destinations were included in the search. The available literature was mainly focused on commuting in general or on active mobility in other contexts (such as grocery shopping or leisure activities). These studies provide valuable insights but their suitability for use for healthcare workers and their commuting behaviour may vary. It was not specifically ascertained whether studies had been conducted during the COVID-19 pandemic.

Inclusion criteria
Studies were included if they met the following criteria:

- Study design: primary intervention studies, systematic reviews, umbrella reviews (review of reviews) or meta-analyses;
- Publication year: 2015 to (and including) 2025;
- Language: Dutch or English;
- Full text available;
- Context: conducted in countries with a context similar to that of the Netherlands;
- Research design: studies designed to allow statements about causality, such as pre-measurements and post-measurements, natural experiments or randomised controlled trials (RCTs). Cross-sectional and qualitative studies were excluded;
- Outcome measures: behavioural change (e.g. change in transport behaviour), both self-reported and objective measures. Studies that only reported attitudes or intentions were excluded;

- Population: adults (≥18 years), commuters or healthcare-related target groups (healthcare workers, patients or visitors);
- Context: general, commuting or healthcare organisations;
- Intervention: aimed at encouraging active mobility (cycling, walking, public transport) or reducing car use;
- Methodological transparency: clear description of methods, target group, intervention, control group if relevant, statistical analyses and outcome measures. Reviews also had to include a transparent description of the search strategy and inclusion criteria.

Results of intervention literature
The search strategy in the databases yielded a total of 1,138 publications after having removed duplicate publications. These publications consisted of studies that focused on determinants of travel behaviour and interventions of travel behaviour. The publications were screened by two researchers on the basis of title and abstract. An additional search, specifically focused on interventions by employers in a general context, generated a further 280 publications. These publications were also screened by two researchers on the basis of title and abstract. After the selected publications had been screened and read in full, a large number of studies were excluded because they were found to be irrelevant or they did not meet the inclusion criteria. Publications were excluded, for example, if the outcome measures used were not active mobility or car use (e.g. when intentions rather than actual behaviour were measured) or if the description of method or intervention was missing or inadequate. In the end, what remained were 12 reviews focused on intervention research and 13 primary intervention studies.

In addition to the literature search, the snowball search method was used. This is a method in which the bibliography of the studies included are reviewed for additional relevant intervention studies or reviews. The same was also done for publications in which these studies were cited. Furthermore, a search for recently published literature was carried out in mid-2025, which resulted in a few additional reviews. An additional eight reviews and 13 primary intervention studies were found using the snowball search method and the search for recently published literature. This brought the total number of included reviews to 20 and the total number of primary intervention studies to 26.

Some reviews contain intervention studies that have been included in *What Works in practice* as primary studies because of their relevance. To avoid double counting, these studies have not been taken into account again in the conclusion.

Of all the literature included, three primary intervention studies focused specifically on active commuting among healthcare workers. No intervention studies or reviews were found that focused on encouraging active mobility of patients and visitors to and from healthcare organisations. However, a few healthcare-specific studies were found that focus on the practical implementation of mobility policy. These are described in Chapter 4.

Determinant studies
As it was expected that the number of intervention studies within the healthcare sector would be limited, a search for determinant studies was also carried out. This type of study does not investigate the efficacy of interventions, but it determines the correlation between certain factors and travel behaviour. Cross-sectional research was also included for determinant studies. All the determinant studies found in the search that examined which factors are correlated with travel behaviour were screened by two researchers on the basis of title and abstract. No suitable determinant studies specifically related to the healthcare sector were found. However, a selection of 14 academic studies and three reports on areas outside the healthcare sector were used to supplement this report with insights into factors associated with active travel behaviour.

Classification of the interventions
Two researchers independently reviewed the results of the interventions and classified them into the categories listed below. Any differences were jointly agreed upon. The results of review studies were given greater weight than the results of individual studies in this classification. The following classification was used:

- **What works in practice**: a significant majority (>75%) of at least four studies showed that the intervention works in the healthcare sector to encourage active mobility.
- **What is promising**: a significant majority (>75%) of at least four studies (as primary studies or within a review) showed that the intervention works outside the healthcare sector and could possibly also be applied to the healthcare sector, or the majority (>75%) of the studies found within the healthcare sector showed that the intervention works but only a few studies were found.
- **What is uncertain or unknown**: no studies or very few studies have been conducted on the intervention (within or outside healthcare) to be able to draw a conclusion, or the results of the studies that were available are inconclusive (<75% found an effect).

Details about the interventions
Appendix 1 provides a brief description of the examined interventions for each study and review. The level of detail is inadequate to be able to apply these interventions one-to-one to healthcare. For an understanding of the exact content, context and prerequisites for implementation, it is recommended to consult the original publications.

Effect size
What Works in practice occasionally refers to a small effect of a particular intervention on active mobility or car travel. The effect size indicates how large the effect of an intervention is. Small, for example, means that the intervention resulted in a limited average change per person. The classification into small, medium or large effect sizes is based on statistical calculations. This involves examining the size of the difference caused by an intervention in relation to the variation between people. Researchers use standardised effect size measures, such as Cohen's *d* or similar statistical measures, to indicate the size of an effect. There are widely accepted rules of thumb for what is considered a

small, medium or large effect. Standardised effect sizes cannot be directly transposed to a specific percentage change. It is important not to assess effect sizes in isolation or to dismiss an intervention because of a small effect size. Especially in the case of interventions that reach a wide audience or are used over a long period of time, small effects per person can result in substantial health and environmental gains at population level.
The meta-analyses in the reviews report effect sizes, while some reviews mainly describe these effects qualitatively ('this type of intervention has a small effect on average'). If effects sizes are mentioned, these are described in Appendix 1. For the sake of readability, not all effect sizes in *What Works in practice* have been described using statistical data.

2.2 Interviews

Inclusion and exclusion criteria were drawn up for the collection of examples from practice. Inclusion criteria included were, for instance, that examples had to be long-term projects or mobility policies within healthcare in which a combination of interventions had been implemented. These had to involve both healthy and sustainable mobility. Examples of exclusion criteria were examples from practice that focused solely on sustainability (e.g. electrification of the vehicle fleet) or isolated initiatives, such as setting up a 'cycle to work day' or 'e-bike campaign'; these were not included. The aim was to obtain a varied overview of examples from practice from different healthcare environments, such as hospitals, mental healthcare (GGZ), care for the disabled (GHZ) and nursing home care (VVT sector (nursing, care and home care)).

The organisations were selected and contacted through trade associations, the sustainable mobility working group of MPZ (national network for sustainability in Dutch healthcare), the Sustainable Healthcare Green Deal 3.0 working group, the Dutch Ministry of Health, Welfare and Sport (VWS) and existing contacts.

An online interview was conducted with an employee from each organisation who is involved with the development and/or implementation of sustainability and mobility policy or projects. During the interviews, the interviewees were asked about their objectives and target group (workers and/or visitors and patients), the process and the division of roles in the design of the policy or project. The interviews then focused on interventions that the organisation uses to increase the use of bicycles, walking and public transport by workers, patients and visitors and to discourage car use. Finally, the interviewees were asked for tips and success factors that the organisation would like to share with other healthcare organisations that are working on this theme or want to start doing so. The interviews were then transcribed into web texts and checked for any factual inaccuracies by the organisations involved.

3 What Works in practice: active mobility interventions in the healthcare sector

Multiple interventions that can contribute to active mobility in healthcare were found in the literature. If the effect of an intervention on active commuting was specifically investigated, this was stated in *What Works in practice* under the intervention. If the literature did not specify whether it was related to commuting, it has been stated as active mobility. Sometimes the effect of an intervention on more specific outcome measures such as cycling, walking, use of public transport or car use was examined in the literature. In such cases, this was also specifically stated. Interventions are classified into categories of effectiveness: what works in practice, what is promising and what is uncertain or unknown. Below is a summary of *What Works in practice*. Section 3.2 provides background information for each intervention. All underlying studies and reviews for each intervention are discussed in more detail in Appendix 1.

3.1 Summary of *What Works in practice*

What works in practice?

- There are currently no interventions that can be conclusively proven to encourage active mobility among healthcare workers. This is because too little research has been conducted on active mobility interventions in healthcare.

Interventions outside the healthcare sector have therefore been used as indirect evidence and have been described in the following categories.

What is promising?

- **Workplace programmes and policies** appear to be able to lead to small increases in cycling to work. This is also the case in the healthcare sector. This might include combinations of interventions such as cycle to work campaigns, interactive seminars, bicycle facilities or car parking policies. Discouraging parking policies appear to be a valuable tool to reduce car use.
- **E-bike loan schemes** can encourage electric cycling (including commuting) and could also reduce car use. It is recommended that a structural intervention be put in place to ensure long-term use of e-bikes.
- **Subsidies to purchase e-bikes** are also promising to encourage active mobility.
- **Providing financial incentives** can lead to small increases in active mobility (including commuting). This might include rewards for travelling by bicycle. Little is known about the long-term effects, but here too there is a risk that the effect will fade away as soon as the reward is stopped, which calls for permanently incorporating rewards.
- **Gamification, integrating game design elements** in an intervention, such as challenges, is promising for facilitating active mobility (including commuting). A combination of

gamification and rewards seems particularly promising. This gamification is often built into an app and offered as a service.
- **Personalising an intervention**, such as tailoring travel plans or providing customised feedback to travel behaviour, shows great promise in encouraging active mobility (including commuting) and reducing car use.
- **Self-monitoring**, keeping track of your own behaviour, including, for example, how much you cycle, also seems to be promising for fostering cycling in general.
- **Interventions aimed at discouraging car use** (push interventions) are promising for reducing car use. This might include discouraging parking policy or financial incentives that make car use more expensive, as well as focusing on social, cultural and moral norms related to car use.
- **A multi-component strategy** involves combining different elements in an intervention or combining different types of interventions in a package. This can facilitate active mobility (including commuting).
- **Combining the encouragement of active mobility with discouragement of car use** (push and pull interventions) is promising for facilitating active mobility. A combination is more effective than simply encouraging active mobility. Restrictive car parking policies for workers are a promising intervention.
- **Adding facilities**, such as bicycle parking facilities, seems promising for fostering active mobility.
- **Good cycling and walking infrastructure and high-quality, frequent and reliable public transport** are promising for facilitating active mobility. This is beyond the direct sphere of influence of healthcare organisations and calls for cooperation with the province/region to improve infrastructure and accessibility through active modes of transport. This makes it easier for workers as well as visitors and patients to travel by active mobility.

What is uncertain or unknown?
For some interventions, it is not or still not clear whether they work, are promising or do not work. These interventions have not yet been adequately examined to be able to draw a conclusion, or the existing evidence occasionally finds effects on active mobility and at other times does not. Future research is needed to draw a conclusion on their effectiveness in encouraging active mobility.
- **Free travel by public transport** (by providing a public transport card). The evidence is mixed, with about half the studies finding no significant effect. It should, however, also be noted that these were mostly temporary free public transport cards that had often not been tested by an employer and long-term effects were not fully examined.
- **Other types of intervention to encourage the use of public transport**. In addition to interventions in which free public transport cards were provided, a limited number of other studies were found on interventions attempting to increase the use of public transport, particularly for commuting.
- **Sending messages and providing information**. Mixed evidence was found outside the healthcare sector and no

evidence was found in the healthcare sector to prove that sending messages promotes active mobility. There is evidence that raising awareness is not enough to promote active mobility but that it can be supportive in other types of interventions. This might include providing information on easier public transport routes and the safest and most pleasant cycling routes. This could be promising as part of a multi-component strategy. No studies were found that focused specifically on commuting.

- **Which interventions work for the target groups of patients and visitors?** The three intervention studies found that focused on the healthcare sector were all aimed at healthcare workers. No intervention studies were found that focused on the target groups of patients and visitors.
- **The effect of workplace interventions on reducing car use to commute** had only been studied to a limited extent. Active mobility is mainly considered as an outcome measure, but it is also important to investigate substitution: will people replace car journeys with active mobility?
- **Social aspects**, such as social norms, buddies, use of role models. Little research has been conducted on this. Social aspects are included in workplace mobility interventions but the effects specifically on active mobility are still unknown.

What doesn't work?

- **Cycling training.** The literature showed that cycling training has not been proven to effectively promote active mobility. This includes training sessions in which participants are taught to cycle safely by way of instructions, practice sessions or demonstrations. Cycling training may be effective for certain target groups (in combination with other interventions).

3.2 Background information per intervention

This section provides background information on the interventions described in Section 3.1. A brief description is given for each intervention of what the intervention entails (What is it?), followed by a summary of the literature found (reviews and primary studies) in which the intervention was examined (What did we find?), followed by the conclusion for *What Works in practice* (conclusion). Appendix 1 contains a more detailed description of each review and study found in which the effectiveness of the intervention was investigated.

What Works in practice on active mobility interventions in the healthcare sector does not include a 'what works in practice' category. This is due to the limited intervention research that has been conducted in healthcare (three intervention studies; two on workplace programmes and one on sending messages). This does not, however, mean that there are no effective interventions for promoting active mobility; convincing evidence has been found for this outside the healthcare sector. But due to the limited evidence in the healthcare sector, there are no interventions that can be conclusively proven to encourage active mobility in the healthcare sector.

Push and pull interventions
This document titled *What Works in practice* focuses on interventions aimed at encouraging active mobility: these are 'pull' interventions (making active mobility appealing to people). Furthermore, there are also 'push' interventions that aim to make car use less attractive (and therefore push people away from cars).
Push interventions focus on discouraging car use by, for example, restrictive car parking policies or higher costs for driving a car. Pull interventions encourage active mobility by, for example, improving facilities and providing support, such as good bicycle parking facilities, travel allowances or facilities specifically for cyclists.
As shown in *What Works in practice*, a combination of both push and pull interventions is often more effective than only push or only pull interventions.

3.2.1 Promising interventions

Although the effects are often small and context-dependent, the interventions discussed in this section meet the criteria for 'promising'. This means that they do not or not yet meet the criteria for 'what works in practice' in the healthcare sector. It is therefore important to carefully monitor and measure the effects on travel behaviour when applying them in healthcare.

Workplace programmes and policies
What is it?
Organisations employ a variety of strategies in workplace programmes and policies to encourage workers to travel to work actively. The main objective is quite often to bring about a shift from passive (by car) to active mobility (such as walking, cycling or using public transport). This can consist of a combination of campaigns (including cycle to work campaigns), information sessions, facilities for cyclists, parking policies, personal travel plans, targets and monitoring, rewards, buddy schemes and social marketing. Intervention components contain various behaviour change techniques.

What did we find?
We found two intervention studies that examined workplace programmes on active mobility in a hospital setting ((Petrunoff et al., 2015; Petrunoff, Wen, et al., 2016). The programmes focused on workers at various hospitals in Australia. They included mobility policies such as schemes for paying for public transport via the salary sacrifice arrangement (reduces the taxable income) as well as facilities such as showers and changing rooms for cyclists and marking parking spaces for car sharers. There were also behavioural change programmes aimed at encouraging cycling and walking. Both studies found an increase in cycling to work. One of the two studies investigated the effect of adding discouraging parking policies and found that this resulted in a much greater reduction in car use than when these parking policies were not in place.

Furthermore, multiple reviews outside the healthcare sector were found (Petrunoff, Rissel, et al., 2016; Roaf et al., 2024; Stewart et al., 2015). Roaf et al. (2024) reported that these types of interventions can make a

small difference in encouraging active commuting if no changes were made to infrastructure. Based on three pre- and post-measurement studies, Stewart et al. found mixed evidence for the effectiveness of workplace interventions (including one 'cycle to work' day intervention) to encourage active commuting (Stewart et al., 2015). Petrunoff et al. (2016) investigated behavioural change programmes (by providing information in individual or group sessions at work), in which no further changes were made to policy or environment (Petrunoff, Rissel, et al., 2016). They concluded that most studies showed an increase in active commuting in the intervention groups as compared to the control groups. The authors did not describe the average size of the effects found.

A number of primary intervention studies were also found outside the healthcare sector (Cleland et al., 2023; Winters et al., 2017). The workplace programmes studied ranged from short campaigns and comprehensive workplace programmes to communication campaigns with mobile applications. Four of the five studies showed an increase in active mobility (particularly cycling) to work. A six-week workplace intervention resulted in an average of 8.9 minutes more active travel time per day among participants in the intervention group, along with perceiving and experiencing more social support and self-regulation (Walsh et al., 2021). Another programme, the Cycle Nation Project, resulted in an average increase of 43 minutes of additional cycling per week (three extra trips per week) and also had a positive effect on motivation and wellness (Connell et al., 2022). A university-wide app and campaign-based intervention led to a significant increase (from 49.2% to 64.2%) in active mobility among students but not among staff (Bopp et al., 2018). A thirty-day cycle to work campaign resulted in a substantial decrease in car use (from 26% to 11%) and an increase in cycling (from 57% to 74%), of which part of the effect was still evident three months later (Olsson et al., 2021). The only study that found no effect examined a 10-week intervention aimed at walking to work; this did not result in walking more or less car use, despite focusing on intention formation, goals and self-monitoring (Audrey et al., 2019). Replacing the car by walking is not always feasible because of the large difference in distances that can be covered.

Conclusion? Promising
Workplace programmes and policies with multiple, coordinated components appear to be a promising strategy for encouraging active mobility. This is particularly true for cycling to work. The effects found are generally small but consistently positive, particularly when interventions combine behaviour change techniques with practical facilities and social support. The evidence is more limited for walking to work and the effects remain less apparent. It also appears to be necessary to introduce additional mobility policies to achieve a reduction in car use. These policies must discourage car use, such as car parking policies.

Free loan scheme and purchase subsidies for e-bikes
What is it?
There are schemes that allow the temporary free leasing of e-bikes or subsidies that make the purchase of e-bikes cheaper. If e-bikes replace

the use of cars, they offer benefits for both health and sustainability. In the Netherlands, e-bikes mainly replace regular bikes. In commuting, e-bikes also replace cars (Rijs et al., 2024). E-bikes allow people to cover greater distances than they would on regular bikes (Kennisinstituut voor Mobiliteitsbeleid, 2023). However, research has shown that the health effects vary greatly for different target groups (Rijs K et al., 2026). For certain groups, e-bikes can be a negative development because they exercise less intensively than they did before. This is particularly true for younger people for whom switching from a regular bike to an e-bike can lead to a reduction in physical activity. On the other hand, e-bikes offer potential health benefits for older people (those over 50, who are currently the largest user group) and for people with disabilities, severe obesity or a chronic condition. The electric assistance reduces the reluctance to cycle for this group, allowing them to be physically active more often and over longer distances. E-bikes sometimes also replace public transport. The effects of this on health are unknown.

Another point to consider when loaning e-bikes is the limited possibility of permanent behaviour change. When e-bikes have to be returned at the end of the lease period and individuals do not buy an e-bike themselves, many people will stop cycling to work on an e-bike (Ton & Duives, 2021). Ideally, a more permanent loan system should be introduced (where loaning is affordable or free), so that access to e-bike loaning is maintained.

What did we find?
No studies on the use of e-bike loaning in the healthcare sector were found. We found three reviews (of which two included meta-analyses) in which e-bike interventions were examined, such as loan and purchase schemes (Chevance et al., 2025; Pearson et al., 2025; Roaf et al., 2024). The reviews concluded that there were positive effects on bicycle use. These effects were found in intervention studies that focused on both commuting and active mobility in general.

We also found three intervention studies, two of which were in a work setting (Cairns et al., 2017; Ton & Duives, 2021) and one that focused on active mobility in general (Söderberg Andersson et al., 2021). These intervention studies investigated the effect of loaning e-bikes to people who regularly or primarily use cars. The period during which the e-bike was loaned varied from five to eight weeks. One intervention provided the option of purchasing the e-bike after this period at a reduced price. The three studies found positive effects on e-bike use as well as on regular bicycle use. Furthermore, a reduction in car use was shown. In addition, two intervention studies were found in which the effect of purchase subsidies for e-bikes (500 euros) on the use of e-bikes in general was investigated (Sundfør et al., 2024; Sundfør & Fyhri, 2022). Both studies found positive effects on the share of e-bike use within the total transport options for active mobility (not specifically for commuting).

Conclusion? Promising
Schemes relating to e-bikes, such as free loaning and purchase subsidies, are promising for an increase in e-bike use, both for commuting and for active mobility in general. Car use also appears to

decline. The effects were, however, measured in the short to medium term; the long-term effects are unknown.

Loaning regular bicycles
One review (outside the healthcare sector) was found in which four intervention studies that investigated the effect of the loaning of regular bicycles (including bicycle-sharing programmes) on active mobility was examined (Roaf et al., 2024). Based on the four intervention studies, it was concluded that the loaning of regular bicycles is particularly effective for people who sign up for such programmes themselves or for those who have very limited access to other means of transport. This is evidence for an effect within motivated groups or groups where people have restricted transport options, but at the same time it limits the generalisability to broader populations.

Financial incentives
What is it?
Financial incentives are interventions that use money or monetary benefits to influence travel behaviour. They can be either positive (rewards) and negative (penalties). Examples include rewards per kilometre cycled, vouchers or points, subsidies for active modes of transport, or additional costs for car use. The desired behaviour often disappears once the external financial incentive is stopped, as was the case with e-bike loaning. An experiment (conducted before the COVID-19 pandemic) on avoiding rush hour traffic showed that as soon as the reward (between 3 and 7 euros) was stopped, participants went back to driving during the rush hour (Ettema et al., 2010). This calls for the permanent incorporation of these types of financial incentives.

Some intervention studies combine financial incentives with gamification, adding game design elements such as challenges or reward systems. For more information, see the intervention description of *Gamification*.

What did we find?
One review with meta-analysis was found (Petrunoff, Rissel, et al., 2016; Winters et al., 2017; Xiao et al., 2022), which examined the effect of financial intervention measures on active mobility. This means that they looked at the mechanisms by which interventions changed travel behaviour. The meta-analysis showed that financial intervention measures did have a statistically significant negative effect on car use and a positive effect on cycling, but no statistically significant effect on active mobility (cycling and walking combined) and use of public transport.

Four primary intervention studies investigated the effect of financial rewards on cycling, electric cycling or use of public transport. Two studies focused on commuting, two on active mobility in general. The four intervention studies showed that financial rewards are promising for encouraging cycling and electric cycling to work (de Kruijf et al., 2018; Máca et al., 2020), as well as cycling (Huang et al., 2021) and the use of public transport in general (Tsirimpa et al., 2019). One of the four studies found evidence that, particularly under very active app users,

there was a lasting behavioural change with an increase in cycling and decrease in car use (Huang et al., 2021).

Conclusion? Promising
Financial incentives are a promising way of encouraging active mobility in the healthcare sector, whereby it is important to focus on permanent embedding due to the risk of the desired behaviour fading away if the financial incentives are stopped.

Gamification
What is it?
Gamification involves adding game design elements to an intervention to encourage desired behaviour. This can be done, for example, using challenges that earn points or cash prizes, collecting badges, achieving milestones, competing on leaderboards, achieving group goals or receiving feedback and social comparison. Mobile apps or online platforms are the most common ways of using gamification.

What did we find?
One review outside the healthcare sector examined the effect of gamification on active mobility (Bassanelli et al., 2025) and one review examined the effect on commuting (Reindl et al., 2023). The reviews report positive effects, especially when gamification was combined with financial incentives and particularly in the short to medium term. One review specifically looked at 'cycle to work' days, which can be considered as a kind of challenge (Larsen et al., 2024). A small increase in cycling to work was reported as well as an increase in the number of people actively travelling to work on the campaign day.
Three intervention studies outside the healthcare sector put gamification into practice using an app to encourage active mobility among commuters (Kazhamiakin et al., 2015; Máca et al., 2020) or cycling in general (Huang et al., 2021). These studies reported positive effects on active mobility. One study looked at the effect of adding certain behaviour change techniques via an online platform, including gamification (in addition to other techniques such as encouraging the drawing up of action plans and providing information on the health benefits of cycling and walking) and compared this with the effect of simply providing a free public transport card (Lieberoth et al., 2018). This study found no effects on public transport use, merely on intentions to use public transport.

Conclusion? Promising
Based on the reviews and studies found outside the healthcare sector, the use of gamification appears to be promising for encouraging active mobility (particularly cycling) in the healthcare sector, especially when combined with rewards. One study found no evidence of an effect on public transport use. More research is needed in this area. Gamification without additional extrinsic incentives can sometimes have little effect on actual behavioural change. Literature also shows that the long-term effects are often unknown.

Personalised interventions

What is it?

Personalised interventions are interventions that are tailored to an individual and are often based on personal travel data, preferences and behaviour. This might include personalised travel advice, feedback based on individual travel patterns and setting individual goals with the monitoring of personal progress. In the field of active mobility, such interventions can focus on the routes and distances travelled by an individual and the modes of transport that they use.

What did we find?

Three reviews from outside the healthcare sector found evidence for an effect of personalised travel plans. More specifically, two reviews reported a small negative effect on car use and one review found evidence for a positive effect on cycling to commute (Bamberg & Rees, 2017; Larsen et al., 2024; Okraszewska et al., 2024). Two reviews, including a meta-analysis, concluded that personalised interventions have positive effects on encouraging sustainable travel in general and on cycling (Pan & Ryan, 2024; Pearson et al., 2025). Two reviews found evidence for a positive effect of personalised feedback on two outcome measures: the use of sustainable modes of travel and public transport (Pan & Ryan, 2024; Zarabi et al., 2024).

One intervention study tested the effect of tailor-made environmentally friendly travel plans on active travel behaviour. The travel plans contained information on the positive effects on both health and the environment (Ahmed et al., 2020). The study found a small increase in active mobility and a small decrease in car use in a post-measurement compared to a pre-measurement.

Conclusion? Promising

Travel plans and feedback that are personalised or tailored to the individual appear promising in encouraging active mobility in the healthcare sector. The effects are small and they appear to be more effective if personalised feedback is linked to goals and monitoring.

Self-monitoring

What is it?

Self-monitoring, i.e. keeping track of your own behaviour such as how much you cycle, appears to be promising for encouraging cycling. Self-monitoring can also be combined with other self-regulation techniques such as setting goals and making action plans.

What did we find?

One systematic review with meta-analysis looked at the effect of specific behaviour change techniques in interventions to encourage cycling (Doğru et al., 2021). Based on four studies, the researchers concluded that interventions that used self-monitoring of behaviour (e.g. asking participants to use a smartphone app to track the cycling distance or frequency) were significantly more effective in facilitating cycling than interventions that did not encourage self-monitoring.

Conclusion? Promising
When choosing different components for a multi-component strategy, self-monitoring may be an interesting option.

Interventions aimed at reducing car use
What is it?
In addition to interventions that encourage active mobility (pull interventions), there are also interventions that actively discourage care use, known as push interventions. These are important supplemental intervention types because various studies have shown that an increase in active mobility does not automatically lead to a decrease in car use. Push interventions are therefore an important addition to achieving the actual substitution of car journeys. Commonly mentioned interventions include discouraging car parking policies (such as limiting the number of parking spaces or introducing parking fees), financial incentives that make driving more expensive and interventions that are responsive to social, cultural or moral norms concerning car use.

What did we find?
Three reviews with meta-analysis (outside the healthcare sector) were identified. They examined different types of interventions to reduce car use, both inside and outside the work setting (Okraszewska et al., 2024; Semenescu et al., 2020; Xiao et al., 2022). In addition, we found one review of reviews (Winters et al., 2017). Xiao et al. examined intervention functions, the mechanisms by which interventions changed travel behaviour. They reported that interventions focused on improving access showed a small but insignificant decrease in car use. Financial interventions were associated with a larger, statistically significant decrease. Spatial interventions also showed a statistically significant decrease. Interventions focused on convenience resulted in a small, statistically significant decrease. These effects were related to car use in general, not specifically to commuting. The other reviews reported small negative effects on car use. Discouraging car parking policies and financial interventions appear to be promising strategies for reducing car use.

One intervention study (outside the healthcare sector) was found that specifically looked at the effects of car parking policy on car use to and from work (Knott et al., 2019). This study showed that when restrictive car parking measures were introduced, there were shifts from cars to alternatives, but this was not statistically significant. If car parking facilities were made available (free or paid), this was statistically significant: it was associated with a increased share of car journeys and a decrease in active mobility.

Conclusion? Promising
Interventions to discourage car use, such as discouraging car parking policies or other financial incentives, are promising both inside and outside the work setting. The available reviews (including meta-analyses) conclude that there are small but significant negative effects on car use.

Integrated approach and the combination of encouragement and discouragement

What is it?
Interventions consisting of multiple components or those combining multiple interventions could be more effective than isolated interventions. Interventions can reinforce each other because they address different aspects of behaviour (e.g. including changes in the environment as well as rewards for active mobility and information on schemes and cycle routes).
One specific combination is that of encouraging active mobility interventions and interventions discouraging car use (the push and pull interventions). A number of the other intervention studies in *What Works in practice* showed that although active mobility increased, car use did not necessarily decrease. Active mobility does not replace car use in these cases, although this is often the goal. This calls for combining the discouragement of car use and the encouragement of active mobility.

What did we find?
We did not find any interventions in the healthcare sector, except for the workplace programmes discussed earlier, which were tested in two studies in the healthcare sector and also consisted of multiple components (Petrunoff et al., 2015; Petrunoff, Wen, et al., 2016). Furthermore, we found a number of reviews outside the healthcare sector, all but one (Doğru et al., 2021) of which concluded that using multiple components is effective in promoting active mobility (Cleland et al., 2023). Xiao et al., for example, reported that each additional intervention function within combined carrot-and-stick interventions was associated with an increase in cycling. The aim here is not to use as many components as possible but to find the right combination (for example, both behavioural and infrastructural interventions) and encouraging active mobility as well as discouraging car use. Two reviews concluded that this combination of encouraging and discouraging is effective (Pearson et al., 2025; Piatkowski et al., 2019; Xiao et al., 2022). Combined rewarding and discouraging interventions were more effective in decreasing car use when they were engaged in the workplace and when they ran for longer periods of time. In addition, a greater effect on cycling was associated with the number of functions included in such interventions (Xiao et al., 2022).

Conclusion? Promising
Firstly, it seems promising to include multiple components in an intervention to encourage active mobility. Secondly, it appears to be promising to combine the discouragement of car use and the encouragement of active mobility. This has not been specifically investigated for commuting.

Facilities

What is it?
Facilities for encouraging active mobility are facilities at the workplace that are supportive to active mobility, such as bicycle parking facilities, showers and lockers. These interventions make it more practical and comfortable to cycle or walk to work. Providing facilities is in line with a recent European policy development, the revised Energy Performance of

Buildings Directive (EPBD IV), which requires Member States to provide sufficient bicycle parking spaces and charging points for light electric vehicles, including e-bikes, in new buildings and after major renovation work. Bicycle parking facilities are already firmly embedded in the infrastructure of the Netherlands, but electric charging could be given a boost by this directive.

What did we find?
A review with meta-analysis describes the positive association between facilities at the end of a journey and cycling (in general, not specifically to work) (Doğru et al., 2021). The conclusion was that the seven intervention studies that added objects to an environment, such as bicycle storage racks or shared bicycles, were statistically more effective in encouraging cycling than the 41 interventions in which these facilities were not made available (Doğru et al., 2021).

Conclusion? Promising
Facilities at the workplace or at the end point of a journey are promising and show a positive effect on cycling.

Improving cycling and walking infrastructure and public transport
What is it?
Infrastructure interventions include modifications to the physical environment, such as building or improving cycling and walking networks, enhancing road safety, improving the connectivity of routes and the accessibility of public transport stops.
A large proportion of the interventions in this report concerned soft interventions in which there are no modifications to the physical infrastructure. However, many studies showed that it is changes to the infrastructure that play an important role in encouraging active mobility. Good, safe and accessible cycling and walking facilities as well as reliable public transport are crucial prerequisites for promoting cycling and walking. This is a relevant prerequisite for active mobility not only for workers but for all visitors to healthcare organisations. This is beyond the direct sphere of influence of healthcare organisations and calls for cooperation with public authorities and transport providers.

What did we find?
The infrastructure in the Netherlands is of high quality, which is important for adapting the findings. Much of the research that we found was conducted outside the Netherlands, including in countries where the infrastructure is different to that of the Netherlands. We did not find any healthcare sector reviews. A total of eight reviews were found. The reviews focused on different outcome measures, including cycling (in general and to commute), walking, active mobility (walking/cycling combined), public transport use/accessibility and sometimes also car use.

A review with meta-analysis found that improvements in accessibility, spatial arrangements and safety were positively associated with active travel, especially cycling (Xiao et al., 2022). An umbrella review based on various reviews concluded that safe, well-connected infrastructure is essential for active mobility, especially separate cycle lanes and good

access to public transport (Winters et al., 2017). A review reported that new cycling infrastructure increases the number of cyclists (Mölenberg et al., 2019). Another review reported that behavioural interventions are more effective if the environment supports cycling and walking (Roaf et al., 2024). And yet another review with meta-analysis reported mixed results: physical interventions were found to be less effective than psychosocial interventions in encouraging cycling, but the review recommended combinations of both (Doğru et al., 2021). A review with meta-analysis concluded that physical redevelopment (such as separate cycle lanes) is most effective in increasing active mobility (Pearson et al., 2025). Another review also found small but positive effects of large-scale infrastructural changes on cycling to commute (Stewart et al., 2015). A third review found one study that showed that proximity to a new bus line, along which a cycle lane and footpath had been built along almost the entire length of the bus line, increased the likelihood of active mobility (Petrunoff, Rissel, et al., 2016).

Conclusion? Promising
Although infrastructure interventions largely fall outside the direct sphere of influence of healthcare organisations, the scope and consistency of the evidence outside the healthcare sector meet the criteria for 'promising', particularly as a prerequisite for the effectiveness of other interventions. Good and safe cycle lanes and walking paths as well as reliable public transport connections and accessibility can enable and encourage active mobility. Lack of cycle lanes will restrict the encouragement of the use of bicycles. The importance and effectiveness of these kinds of interventions calls for cooperation with central and local government authorities and transport providers.

Encouraging trip chaining by improving cycling infrastructure and public transport
Trip chaining (also called multi-modal transport) means combining multiple transport modes in a single journey. A trip-chain journey in which the greater part of the journey is made by public transport, by bicycle or on foot is a healthier and more sustainable alternative to the car. This might include a journey by public transport combined with cycling or walking the last part. The aim is to reduce car use and increase active mobility, particularly over longer distances. Trip chaining is considered to be a promising alternative to travelling by car. The Netherlands Institute for Transport Policy Analysis (KiM) has in the past conducted research to gain an understanding of the factors that are important in encouraging chain mobility (Kennisinstituut voor Mobiliteitsbeleid, 2020).

This research identified three factors to focus on:
- High-quality and reliable public transport, supplemented by good connection options, such as sharing systems and bicycle facilities, supports trip chaining.
- Well-equipped, safe connection points and an attractive cycling and walking infrastructure.
- Travel information, including information on arrival and departure times and any delays (with immediate updates).

Many of these interventions are beyond the direct sphere of influence of healthcare organisations and are linked to improvements to and good connections between the cycling infrastructure and public transport. This calls for cooperation between healthcare organisations, public authorities and public transport providers. The importance of interventions aimed at trip chaining and cooperation between employers and public authorities has also been mentioned in a recent report by the Travelling Differently Coalition (Anders Reizen, 2025).

3.2.2 *Uncertain or unknown*

Sending messages and providing information

What is it?

Brief messages purpose-designed for the target group that can address various aspects. This might include the attitude towards travelling, social norms, belief in one's own capabilities, but also raising awareness through information on the benefits of active mobility or routes. Messages can be shared with the target group using various channels, such as text messages or e-mails but also using physical flyers and posters.

What did we find?

A review with meta-analysis (Xiao et al., 2022) concluded that raising awareness (by providing information) did not have a statistically significant impact on cycling, walking, active mobility, use of public transport or car use. Another review concluded that the use of messages via a social marketing strategy on the benefits of active mobility can have a positive impact on active mobility (including commuting) (Roaf et al., 2024). It also concluded that these types of interventions were more effective if they took place in a cycling and walking friendly environment.

Two intervention studies in which the effect of messages was investigated were also found. One experiment focused on commuting in the healthcare sector (via short text messages or e-mail) (Blake et al., 2017). The messages resulted in a slight increase in active mobility among hospital staff, although this effect was only marginally significant (p = 0.064[1]). E-mail messages proved to be slightly more effective than text messages. Only the message which addressed social norms proved effective via text message ("*Physical activity can be fun and it's even better if you do it with someone. Share some active quality time with friends/family/colleagues this week*"). The other study was a field experiment in Rotterdam that focused on the use of public transport in general. Bus use saw a statistically significant increase here among the group of travellers who received free public transport cards together with a social responsibility message (compared to the group who received public transport cards without a message). The message on the card holder read: "Of course I use public transport. During the week or at the weekends you clearly travel sustainably" (Franssens et al., 2021). Although the average effect was small (1.18 extra trips per day), this is a relevant result at population level.

[1] A p value of 0.064 means that there are indications of an effect, but that this effect is not strong enough to be able to conclude with the usual statistical certainty that it was not obtained by chance.

Conclusion? Uncertain/Unknown
The effectiveness of messages containing specific information still appears to be uncertain/unknown due to the limited evidence available. A study in the healthcare sector found marginal evidence for encouraging active commuting and another study found a small positive effect on public transport use in general. A review concluded that messages in a social marketing strategy can work to encourage active mobility, but that these types of interventions became more effective if they took place in a cycling and walking friendly environment. It is important to note that many of the promising multi-component interventions discussed previously also included messages as part of their approach, but this means that the effectiveness of this component alone is unknown.

Providing free public transport cards
What is it?
One way of making travelling by public transport more appealing and accessible is to make it more affordable. Providing free public transport cards has the same effect as temporarily leasing e-bikes: once the incentive is stopped, the desired behaviour in a large proportion of the users also stops. It therefore gives a temporary motive and may not change travel behaviour in the long term. Continuing to offer free public transport to travel to work appears to have more potential to encourage commuting by public transport. Research by the Netherlands Institute for Transport Policy Analysis (KiM) (de Haas et al., 2022) showed that lower public transport fares resulted in increased public transport use. This is mainly because existing public transport users make more frequent or longer journeys and less so because new passengers switch to public transport. This effect has not been investigated for commuting.

What did we find?
Two reviews were found outside the healthcare sector (Petrunoff, Rissel, et al., 2016; Zarabi et al., 2024). These reviews found a total of three studies that covered the long-term effects of public transport use. Zarabi et al. found that free public transport cards are particularly effective when combined with support and information.

In addition, we found four other interventions (Andersson et al., 2023; Busch-Geertsema et al., 2021; Kristal & Whillans, 2020; Zeiske et al., 2021). These intervention studies investigated the effect of providing free public transport cards on the use of public transport and other modes of transport. The studies differed in the period over which they provided the cards: from one week to the full employment term at an organisation. A pre- and post-measurement study with a control group found no effect of the free public transport cards on actual public transport use (Andersson et al., 2023). A longitudinal field study in the Netherlands showed that three weeks of free public transport temporarily increased the intention to use public transport more often, but it did not lead to lasting behavioural change at the end of the campaign (Zeiske et al., 2021). A large field experiment among workers of an organisation using objective public transport data showed no difference in public transport use between workers with and without a free 7-day public transport card (Kristal & Whillans, 2020). However, a pre-measurement and post-measurement study on the introduction of

permanent free public transport for civil servants in a German metropolitan region did show an increase in public transport use for commuting (from 64% to 72%) but at the same time there was no decrease in car use. The increase was particularly evident among employees who previously did not have a reduced public transport fare (Busch-Geertsema et al., 2021). Although some interventions with free public transport cards resulted in an increase or temporary increase in public transport use, none of the studies provided convincing evidence that workers permanently switch from car use to public transport; car use remained the same in many cases and the additional public transport journeys appear to be supplementary rather than substitutive.

Conclusion? Uncertain/Unknown
Based on three intervention studies and two reviews, it still seems uncertain/unknown whether the provision or temporary provision of free public transport cards has a positive effect on public transport use. The evidence is mixed: about half of the studies found no effect, while the other half did find positive effects, even in the long term after the intervention period had ended. Car use generally remained the same. More research appears to be needed with a stronger research design, such as randomisation, using a control group and objective measures of travel behaviour.

Other Interventions aimed at encouraging public transport use
What is it?
These are interventions that are specifically aimed at encouraging the use of public transport other than through financial incentives. Examples include improving the provision of information on routes and travel times, increasing convenience and accessibility (such as better connections between public transport and cycling or walking routes), providing travel advice or coaching aimed at public transport use, and using communicative or behavioural interventions to position public transport as an appealing alternative to the car.

What did we find?
Few other studies were found that investigated other interventions to increase public transport use. Most of them tested the effect of providing free public transport cards. One intervention study tested the effect of rewarding the use of public transport (Tsirimpa et al., 2019). See the intervention description under Financial incentives.
A systematic review and meta-analysis looked at intervention functions to facilitate active mobility (Xiao et al., 2022). This means that they looked at the mechanisms by which interventions changed travel behaviour. The meta-analysis found that none of the intervention functions (e.g. financial interventions, improvements to convenience or accessibility) resulted in a significant improvement in public transport use. The review showed that for each additional month of following up encouraging interventions of public transport use, the increase in effectiveness was only small or very small. The meta-analysis showed that encouraging interventions (’carrots’) had a greater effect on public transport use than discouraging interventions (’sticks’) but neither effect was significant.

Conclusion? Uncertain/Unknown
The evidence for other interventions that focus on encouraging public transport use is limited and uncertain; the effects found are small and not statistically significant. Most of the interventions studied focused on financial incentives, such as free public transport cards or rewards, while other types of interventions have hardly been assessed.

Interventions aimed at active mobility of patients and visitors of healthcare organisations
What is it?
These are interventions aimed at encouraging patients and visitors to travel to the healthcare organisation on foot, by bicycle or by public transport. Examples include improving the walking and cycling routes to and from the healthcare organisation, clear signage and information on active and public transport options, good bicycle parking facilities near the entrance and revising the car parking policy for visitors. It also includes communicative interventions, such as actively informing patients about accessibility by bicycle or public transport or integrating travel advice in appointment confirmation messages.

What did we find?
There is currently a lack of healthcare-specific intervention research that focuses on interventions to encourage the active mobility of patients and visitors to healthcare organisations. The available evidence is indirect and comes from studies on active mobility in other contexts, which means that no statements can be made on the effectiveness within a healthcare setting. Targeted intervention studies among patients and visitors are needed to determine which interventions work in this context.

Conclusion? Uncertain/Unknown
There is no healthcare-specific intervention research on active mobility among patients and visitors: the available evidence is indirect (from other contexts or target groups).

Reducing car use through workplace interventions
What is it?
These are interventions aimed at reducing car use at the workplace by actively discouraging the use of cars. Examples include limiting or charging for worker car parking facilities or travel allowances that reward active modes of transport more than car use.

What did we find?
In the article on interventions to reduce car use, interventions that reduce car use emerged as being promising. However, this was only investigated in a general setting, not specifically for commuting or conducted from the workplace, where the focus was mainly on the effects of active mobility interventions and less on the effect on car use. It is however important to measure this because it will then be possible to investigate whether cycling or walking has actually replaced car use.

Conclusion? Uncertain/Unknown
There is limited evidence that workplace interventions not only encourage active mobility but also reduce car use. This is because the effect of interventions on car use is often not explicitly measured.

Social aspects
What is it?
Social aspects include interventions that focus on social norms and social support to encourage active mobility. Examples include coordinating cycling buddies (e.g. connecting colleagues to cycle to work together), making role model behaviour by managers visible and creating a work culture in which active mobility is considered desirable and acceptable.

What did we find?
Limited research has been conducted on social aspects as independent interventions to encourage active mobility. Social components do feature as part of broader workplace interventions, but their separate effect on active mobility is largely unknown. One of the reviews found describes lessons for influencing mobility behaviour based on research on other behaviours (Pan & Ryan, 2025). Social norm interventions influence behaviour by showing people what others do (or what others consider desirable behaviour) but their effectiveness appears to be highly dependent on context and target group. Factors such as how visible and common the desired behaviour is and personal characteristics such as political or environmental preferences, play an important role in this. Some studies show positive effects, while others found no effects or even reported an opposing effect (this is called a boomerang effect). According to the researchers, this emphasises the importance of customisation when using social norm interventions.

Conclusion? Uncertain/Unknown
It is currently unknown whether using social aspects as an intervention strategy is an effective way of encouraging active mobility in the healthcare sector.

What doesn't work? Cycling training

What is it?

Participants are taught how to cycle safely in the cycling training courses. This is sometimes done through instructions and sometimes through practice sessions or demonstrations. No individual intervention studies were found in which cycling training courses were given, but three reviews focused on providing cycling training courses; one at the workplace and two focused on active mobility. A comment that must be made on the Cycling training intervention is that most of the studies were conducted in an international context where cycling skills and bicycle use are much less common than in the Netherlands and where barriers to cycling are often fundamental in nature (such as the lack of infrastructure or cycling culture).

What did we find?

A review of active mobility interventions found that providing cycling training alone does not lead to more cycling, but that supplementing this with individual support for several weeks can be more successful (Roaf et al., 2024).

Another review that focused on encouraging cycling to work found two studies in which cycling training was given and concluded that the evidence was mixed (Stewart et al., 2015).

In their meta-analysis, Doğru et al. found that interventions in which instructions on how to cycle were given or in which cycling was practised, had no significant effect on cycling compared to interventions in which this was not done (Doğru et al., 2021). The conclusion based on four studies in a review with meta-analysis was that no statistically significant effect of the 'skills' intervention function was found on cycling in general (Xiao et al., 2022).

Conclusion? Doesn't work

The review found showed that only focusing on skills and cycling training is not effective in increasing active mobility. In the Dutch context, where cycling is a learned and routinely practised skill for a large part of the population, it is also plausible that cycling training has little added value for the general population. Cycling training can however be effective for specific target groups, particularly when cycling skills are low or absent altogether.

4 Travel behaviour and practical implementation

In addition to literature on interventions to facilitate active mobility, research has also been conducted on the factors that influence transport choices and travel behaviour to and from different destinations. These factors are also referred to as determinants. Little research has been conducted on the travel behaviour of patients, workers and visitors in the healthcare sector. An understanding of the factors that influence travel behaviour to work or other destinations can provide approaches for action in terms of mobility interventions and policies. It can help healthcare organisations comprehend why people travel as they do, what prevents them from making a choice for an active mode of travelling and what could help them to do so.
This chapter therefore discusses a number of important determinants of travel behaviour, broken down into personal, environmental and socio-environmental factors. The literature used for this chapter comes from a previously published RIVM report on active commuting (van der Vliet et al., 2023) and a number of relevant reviews.

4.1 Travel behaviour

This section first discusses personal factors that have an impact on active mobility. These are internal factors that include awareness and knowledge, capability, attitudes and motives, the stage of behavioural change an individual is in and habits. The sections that follow discuss external factors. These are environmental and social factors.

Personal factors

Awareness and knowledge

Sufficient knowledge might include being aware of existing schemes and allowances for bicycle purchase and mileage. However, another important factor is awareness, which includes knowing such things as what the actual travel costs and travel distances are. This is because the actual costs and distances do not always correspond to what people think (van der Vliet et al., 2023). Motorists, for example, underestimate the cost of running a car and they estimate the speed of bicycles to be lower than people who travel the same distance by bicycle.

Capability

Capability refers to the physical ability to travel, i.e. being healthy and fit enough to do so. This is a relevant factor to take into account in interventions and policy for target groups such as patients: not all patients are equally able to actively travel to a healthcare organisation, which therefore calls for a diversified policy. In addition to the actual capability to travel actively, perceived capability also plays a role. This is the degree to which an individual feels that they have the knowledge, resources and conditions to travel actively. In addition, self-efficacy or the confidence in one’s own ability to successfully perform this behaviour, appears to be positively associated with active travel behaviour (Evans et al., 2022). This is also the case for how feasible people consider it to be to use alternatives to the car. This means that if

people feel they are able to walk, cycle or travel by public transport, they are also more likely to do so.

Attitudes and motives
A positive attitude towards cycling and a negative attitude towards car use increases the likelihood that an individual will cycle to work, while a positive attitude towards the car leads to more car use (Hoffmann et al., 2017). Cyclists often cite intrinsic motives for choosing to cycle, such as enjoying being outdoors and the health benefits. To a lesser degree, environmental and cost benefits also play a role (Banerjee et al., 2022; Hoffmann et al., 2017). Financial advantages are also mentioned. Cycling is cheaper. At the same time, weather conditions and risk of arriving at work all sweaty are often cited as barriers. The likelihood of someone actually getting on a bike increases when the beneficial effects such as time savings, comfort and flexibility are clearly experienced and considered important. The main motives for motorists are the privacy, convenience, safety, flexibility and the comfort of the car. Practical reasons also play a role. Car journeys are often part of trip chaining in which several activities are combined, such as picking up children or doing the groceries in addition to commuting. Furthermore, motorists often have a negative perception of public transport and overestimate the time needed to travel by public transport. This reinforces the choice for taking the car. Research has shown that the majority of motorists who live less than 10 kilometres from their work indicated that it took too much time to cycle to work. A smaller proportion felt that it was too far to cycle. Experience with alternative modes of transport could help (familiarity breeds affection).

Stages of behavioural change
It is important to be aware of the fact that when it comes to personal motivation and the willingness to change behaviour not everyone is at the same stage in their willingness to change their travel behaviour (the Stages of Change Model is also referred to as the Transtheoretical Model) (Prochaska & Velicer, 1997). This model outlines the different steps people go through when changing behaviour:

- Pre-contemplation: workers do not or do not yet see any reason to change their current travel behaviour.
- Contemplation: awareness that an alternative may have benefits but there is still some doubt.
- Preparation: there is an intention to change and small steps are being taken, such as gathering information on a bicycle plan or a public transport season ticket.
- Action: the worker goes ahead and actually switches to another transport mode, for example, to a bicycle, electric bicycle or car sharing with colleagues.
- Maintenance: the new travel behaviour is sustained and becomes part of the routine.

Habits
Mobility behaviour is for a large part not the result of a daily, conscious consideration but of habit. It is routine behaviour that is not consciously assessed each time. This certainly applies to commuting, which often take place at the same times several days a week. People do not therefore choose between the car or a more active alternative every

day, but they largely adhere to their ingrained habits (Banerjee et al., 2022; Hoffmann et al., 2017; van der Vliet et al., 2023). New habits are often formed at the start of a new situation; this is when transport choices are more consciously assessed. This makes target groups experiencing a new situation an interesting target group for interventions and policies.

Environmental factors
In addition to individual factors such as knowledge, motives and habits, environmental factors play a crucial role. It is very important that, in addition to knowledge and motivation, the environment facilitates behaviour and makes it appealing. Someone may be keen to cycle, know that it has benefits and also know the best route, but it may still not be practical to cycle or take public transport because of the distance to be covered or a lack of good public transport connections or a safe cycle route, for instance. Important environmental factors include: travel distance, travel time, quality and availability of infrastructure and public transport, parking spaces and facilities for cars and bicycles, and travel costs and allowances.

Distance and travel time
The greater the distance to be travelled, the smaller the number of people who cycle or walk. And the greater the proportion who travel by car (Evans et al., 2022; van der Vliet et al., 2023). Faster travel times by bicycle compared to the car with fewer interruptions (traffic lights, level crossings) and high continuity on the route are positively correlated with bicycle use (van der Vliet et al., 2023).

Infrastructure and safety
People have indicated that a high-quality, safe cycling infrastructure is an important factor for cycling (Banerjee et al., 2022; Pearson et al., 2023). In addition, it is important that people feel safe while cycling, especially when there is also motorised traffic (Banerjee et al., 2022; Ferreira et al., 2022; Pearson et al., 2023). Lighting is also important in this regard. A pleasant cycling route is important for people but at the same time the lack of a direct or fast cycle connection can be a barrier. A shorter distance to facilities and higher density of housing, workplaces and amenities are positively correlated with a choice for walking. The degree to which roads are connected to each other is positively correlated with active mobility.

Good and reliable public transport
A good and reliable public transport connection is an important factor in making the choice for public transport, as is a station close to work (van der Vliet et al., 2023). Poor connections, frequent transfers and waiting times are barriers to taking public transport. A higher frequency of public transport services as well as a greater number of points to board and alight at the start and end points of public transport journeys are positively correlated with active mobility.

Parking and facilities
A very important reason for choosing the car is the availability of sufficient and free parking close to work (van der Vliet et al., 2023). The opposite is also true: paid parking or a lack of suitable parking facilities

discourages car use. A Dutch study showed that about one third of workers who lived within 10 kilometres of their work would be more likely to consider cycling to work if parking became more expensive of more difficult. The availability of enough and high-quality bicycle parking facilities is important for cycling, especially when combined with facilities such as showers, changing rooms or lockers.

Costs and allowances
Active mobility can be encouraged by a financial allowance. An important reason for taking the car is if the employer provides a company car, while the parking fees charged are related to a reduction in car use (van der Vliet et al., 2023). With regard to public transport, people indicated that they would be more likely to travel by public transport if they were to get an allowance for this (however, based on the intervention studies that we found, it is unclear whether an allowance would encourage the use of public transport for commuting) and that excessive public transport costs are a barrier (van der Vliet et al., 2023).

Weather conditions and seasonal influences
Bad weather discourages active mobility, while favourable weather conditions encourage people to cycle or walk (Ferreira et al., 2022; van der Vliet et al., 2023). Facilities for cyclists such as showers and covered bicycle parking could be more important in countries where the weather is more often bad (such as in the Netherlands).

Socio-environmental factors
Fewer studies have been conducted on social factors than on personal or environmental factors. The available research shows that the way in which people travel is influenced by how others travel and how people think that others view their transport choice (social norms) (Banerjee et al., 2022; van der Vliet et al., 2023). People are more likely to travel to work by car, for example, if others in their living environment travel by car a lot, and the work culture also plays a role. If the workplace has a positive attitude towards cycling to work and if people expect others to also cycle to work, this has a positive impact on their cycling behaviour. Social aspects play a greater role for people who live closer to their work: personal aspects play a stronger role if distances are greater. However, there were inconsistent findings on the association between social support or role models and active mobility (Evans et al., 2022). Social norms did appear to be positively and consistently associated with active mobility through the employer’s proactive mobility policy, for instance, or because family and friends expressed support for active mobility (Evans et al., 2022). Other social factors also play a role, such as social safety, social cohesion and social capital. The degree to which someone feels safe (not because of a safe infrastructure but because of no crime or low crime rates or because of a well-lit environment) has an impact on the degree of physical activity (Rees-Punia et al., 2018). This is also the case for social capital (often defined as the support and benefits that individuals or groups derive from their social networks, such as those obtained through social interactions, relationships of trust and community participation) (Gao et al., 2025).

The influences on active commuting in the healthcare sector
Three primary studies in the healthcare sector were found that investigated what healthcare workers reported to be important barriers or facilitating influences on active mobility to work (Kaplan et al., 2016; Larsen et al., 2025; Nieto-Cerezo, 2016). These studies were conducted among workers at American, British and Australian hospitals The factors reported largely correspond to factors from previously cited literature: financial aspects, convenience, habits, infrastructure and public transport, support from the organisation (with strong support for measures to travel more cheaply) and availability of facilities. Shift work and night shifts emerged as barriers that specifically affect the healthcare sector.

Approaches for action based on behavioural knowledge
Put a combination of interventions in place
The development and implementation of mobility plans with multiple interventions is more promising than a single intervention. Multi-component interventions are often more effective in facilitating active mobility. This is partly because travel behaviour is determined by various factors and multi-component interventions are better at responding to those different factors. In addition to raising awareness on the benefits of active mobility, also consider providing allowances, facilities and parking spaces and informing people about the schemes available for bicycle and public transport allowances. To this end, it is important that in addition to encouraging active mobility, there should also be interventions focused on discouraging car use (parking policies, allowances).

Get to know your target group and provide tailored solutions
As described in the first section of this chapter, people will be at different stages of change. The interventions described in Chapter 3 are based on the same approach for everyone. But not everyone requires the same approach. Workers who are not yet convinced of active mobility to work require different support (awareness, others' positive experiences, accessible activities) than workers who are already on the verge of making the switch. Whereas some people benefit from inspiring examples or experiencing the advantages and convenience of active transport options (e.g. a test ride on an e-bike), commuters who are already active need practical tools, such as good parking facilities or a permanent bicycle allowance or support in maintaining their bicycle or the extension of schemes. By taking these different stages into account, it is possible to provide a more tailored solution. This will increase the likelihood that workers will not only make the choice for active transport but will also continue to use it. It is also useful to investigate for which course of action there is support, especially for interventions that focus on discouraging car use. Involving the target group and allowing them to contribute ideas and make decisions on the implementation of alternatives can help to create support.

Furthermore, it is important for policymakers to learn more about the target groups of a specific healthcare organisation: what are the main issues for patients, workers and visitors? It helps to understand exactly what motivates the target group to travel by car, bicycle, public transport or on foot, and what barriers they themselves experience. For

some, health benefits and cost savings are important, while for others fresh air or convenience may play a greater role in their decision to travel by bicycle or car. If the target group believes that they are unable to travel actively (while in reality this is possible), their own effectiveness could potentially be increased by using practical tools such as route planners, test rides or supportive supervision. What are the greatest barriers preventing them from travelling actively and what interventions could help? It is also important to identify subgroups. These need to be taken into account in mobility policies. Subgroups include workers who are dependent on a car because of health conditions.

The surrounding environment must support active mobility and make it appealing
It is very important that the surrounding environment also facilitates active mobility. A campaign telling people that cycling and walking is healthy will often not be enough to get them out of their cars. People are more likely to choose active mobility if the surrounding environment supports this from a practical perspective. This might include safe, well-lit and direct cycle lanes, sufficient bicycle parking facilities, showers or lockers at work, or reliable public transport connections. Financial costs also play a role in the decision-making process. This calls for appealing schemes and allowances for public transport and cycling and less attractive schemes and allowances for cars. The 2025-2027 collective labour agreement (CAO) for hospitals does not include the full reimbursement of public transport costs and the reimbursement for bicycle and car kilometres is the same (Nederlandse Vereniging van Ziekenhuizen, 2025). However, healthcare organisations may include this as a supplement in their own collective labour agreement. Car parking policies can make car use less appealing, whereby it is important to carefully consider the different worker target groups (e.g. distance to work, physical capacity, night shifts). Given the location of some hospitals on the outskirts of cities, schemes such as loaning or purchasing an e-bike at a reduced price may be interesting. E-bikes can take away some of the barriers experienced with a regular bike for longer distances (Banerjee et al., 2022).

If the prerequisites are not in place in the environment, a car often remains the most appealing choice. Combining campaigns with such facilities and interventions therefore significantly increases the likelihood of lasting behavioural change. Not all these environmental factors are in the direct sphere of influence of healthcare organisations, so this calls for cooperation with local authorities and transport companies, for instance.

Ability to act
The ability to act idea is relevant for both the target groups of the policy and the people who develop and implement policy. The ability to act used to be defined as the degree to which an individual could take action and persevere when confronted with setbacks or barriers (WRR, 2017). Nowadays, the ability to act is often seen in broader terms. It now includes the extent to which someone is able to show the behaviour required by policy, taking into account the interaction with both individual and environmental factors.

New interventions and policies must be feasible. This means that interventions must not only draw on 'knowing' or 'wanting', but must also make 'doing' possible. Does policy set realistic requirements for the target group? If a lot of action is expected, or if a lot is asked of someone who is already under a lot of pressure (because of a life event, for example), the ability to act is put under greater strain. In the healthcare sector, where administrative pressure is already high, it is even more important to explicitly include the ability to act in the development of mobility policy. This calls for clear choices, simple schemes, straightforward forms and automatic or standard options, and an environment in which the healthy and sustainable choice is the easy choice. For organisations that develop and implement policy, ability to act means that their capacity, time, resources and implementation power are also essential for the feasibility of interventions. Mobility policy that is too complex, creates additional administrative burden or is inadequately aligned with work processes is therefore less effective.

Make use of social influences
The literature reviewed for this report showed no studies in which the effect of social influences on active mobility had been investigated. It was however a part of some multi-component strategies. Research in other fields does show that the social environment has a significant impact on our behaviour. In workplace programmes, it may be useful to address the role of social norms by highlighting the fact that many colleagues already cycle to work ("80% of your colleagues cycle to work!" or "an increasing number of visitors come by public transport") and by setting a good example, such as managers cycling.

Act upon moments during which people form new habits
Commuting is largely habitual behaviour, which is often deeply ingrained in daily routines. This makes it more difficult to change. It is therefore easier and more promising to capitalise on moments when people are forming new habits than to try to break existing ones (Larouche et al., 2020; van der Vliet et al., 2023). This might include times when major changes occur, such as a relocation or road closures in the city that demand other choices, or a personal life event including moving house or starting a new job. New workers or workers who have moved are particularly susceptible to behavioural change because they have not yet developed a fixed routine. There is evidence to suggest that particularly during the training period of new workers, the introduction of personalised travel plans can help reduce their reliance on cars to commute (Larsen et al., 2024). Dutch research showed that the switch to a bicycle/train journey was not driven by new bicycle parking facilities at stations or environmental concerns, but by practical circumstances such as a new job or moving house (Nello-Deakin & Brömmelstroet, 2021). Interventions can help encourage people to form habits related to active mobility when such events take place. Interventions might include trial schemes in which a free e-bike or a public transport card is provided, for example, so that people can have positive experiences with the new desired behaviour. It is however also important to provide appealing incentives after the 'free travel' or e-bike lease period has come to an end.

Think long term
It became clear from the literature found that little is known about the long-term effects of interventions. Many intervention studies did not include follow-up measurements over a longer period. Intervention studies that did include these measurements present a mixed picture in which the effect of the intervention usually diminishes over time. In the case of interventions with a temporary incentive (free travel, temporary allowances or temporary lease of bicycle or e-bike), it is important to have a plan in place for when the temporary incentive stops. It is advisable to have permanent incentives rather than temporary rewards. This might include higher allowances for kilometres travelled by bicycle instead of by car (or no allowance for kilometres travelled by car). Lasting behavioural change calls for a combination of individual, social and permanent factors. This means that rather than isolated interventions, it is advisable to embed schemes that encourage active mobility and discourage car use in mobility policies.

Dutch research showed that interventions carried out by the 'Zuid-Limburg bereikbaar' programme agency and employers, which made it possible to purchase bicycles and e-bikes at reduced prices (purchase allowance, tax relief on purchase), had a significant effect on reducing the number of car journeys but also saw the greatest drop-off in effect (MuConsult, 2020). This could have been caused by defects in the newly purchased bicycle or e-bike. It may help to take this into consideration by establishing partnerships with bicycle repair shops, for instance.

4.2 Opportunities on implementation of mobility policy in the healthcare sector

When drawing up mobility policy, it is important to select interventions that have been proven to be effective or promising. Successful implementation involves more than this: organisational factors and perquisites also play a significant role. This section first provides an overview of the key insights from the literature, followed by explanatory remarks on each underlying study.

Summary of success factors
We identified one review and two studies with a focus on sustainability or mobility policies in the healthcare sector (Khandokar et al., 2017; Law et al., 2023; Petrunoff et al., 2017). In addition, we found another study that had the first large-scale empirical analysis of major employers worldwide that were implementing policies to reduce emissions produced by commuting (Urueta et al., 2025). We also found a study consisting of 20 employer case studies in the United Kingdom. The employers had implemented mobility plans, which had reduced commuting by an average of 18% (Cairns et al., 2010).

The literature review indicated that successful sustainability and mobility policies in the healthcare sector and beyond depend on a combination of long-term, organisational and cultural prerequisites. Key success factors include strong and clear policies, adequate resources and coordination, collaboration with external parties, and creating good physical facilitating conditions, such as a cycle-friendly infrastructure and good public transport. In addition, organisational culture, leadership and

worker engagement play a crucial role. Building support calls for effective communication, customised education and highlighting shared benefits, such as cost savings or health gains. Parking policy consistently emerges as a powerful incentive for behavioural change in both healthcare and general contexts, provided it is combined with appealing alternatives and an integrated strategy. Monitoring and evaluation are essential to underpin and refine policy, while trust and confidence between employer and worker has proven to be a critical success factor for actual behavioural change.

The studies are discussed in more detail in the following section.

Literature on policy implementation

Success factors for sustainability policy in the healthcare sector

A review of success factors for implementing sustainable initiatives (including sustainable mobility) in the healthcare sector identified four key themes in 13 articles (Law et al., 2023). These themes were policy, external partnerships, various organisational aspects and engaging workers. Policy in this case could mean implementing policy in which sustainability plays an explicit role or is a compulsory component. External partnerships involves collaborating with public transport operators, for instance.

Organisational factors include:

- having an officially dedicated green team
- effective communication (dialogue between management and workers)
- infrastructure, context and organisational governance (e.g. availability of public transport and technology).

Barriers arising from organisational governance included:

- a deeply rooted (non-sustainable) organisational culture
- a lack of vision and strategy
- bureaucracy
- difficulty in integrating environmental issues into existing strategies and structures

Having good data, monitoring and auditing can help in recognising the need for action. Recognising financial co-benefits of sustainable initiatives also helped. These included cost reduction, improvements in air quality or health.

Engaging workers proved to be important because they need to be aware of and recognise the benefits (such as the availability of financial rewards for active mobility). Education on the subject matter also proved to be helpful in raising awareness, knowledge and perception. To achieve this it is important to tailor the approach to the specific groups. Attitudes and beliefs regarding individuals' responsibility to demonstrate sustainable behaviour, for example, had a significant impact on a person's own sustainable behaviour.

Success factors for mobility policy in the healthcare sector

Two studies specifically looked at success factors for mobility policy in the healthcare sector (Khandokar et al., 2017; Petrunoff et al., 2017).

A UK study collected the opinions of 47 coordinators of the National Health Service mobility plans to identify the factors that had an impact on the success of mobility plans in hospitals, particularly in changing the workers' travel behaviour (Khandokar et al., 2017).

Key barriers to behavioural change mentioned were:
- shift work
- personal circumstances
- high car use (dependency on car, car use culture)
- workers' attitude towards car use
- lack of resources to draw up mobility plans

It also became clear that certain factors are in fact important for the success of mobility plans:
- the use of solid evidence and measurable data
- a structured strategy
- a solid and standardised monitoring system makes it possible to assess the actual effects of interventions in mobility plans and to adapt these based on their performance; this is essential to increase the impact of mobility plans.

The researchers also noted that literature demonstrated that parking cost issues can be resolved through clear communication with workers and by coordinating and aligning the parking fees with workers' personal circumstances. Many respondents indicated that support for parking fees could increase if the revenue generated is earmarked for improving facilities that support alternative travel options, such as bicycle parking facilities or better public transport (Khandokar et al., 2017).
Following two previous studies on the effectiveness of workplace mobility plans to encourage active mobility (such as cycling and walking), the researchers investigated how health and transport professionals viewed the implementation of such plans (Petrunoff et al., 2017). A total of 24 Australian professionals were interviewed, 14 of whom worked in the healthcare sector and 10 in the transport sector. The aim was to draw lessons from their experiences.

According to the interviewees, the following components are essential for a good workplace mobility plan:
- Managing parking spaces.
- Strong leadership, organisational commitment and effective coordination.
- Satisfactory skills and knowledge regarding active mobility as well as policy and resources (such as a mobility coordinator and adequate budget for interventions).
- Good supporting infrastructure such as a cycle-friendly environment or good public transport.

Recommendations for facilitating these plans include:
- Clear and supportive government policy.
- Alignment with the organisation's interests (such as cost savings or worker well-being).
- Operating at different levels, for example within a single large organisation or at the level of a business park (and thus seeking collaboration with other organisations in a business park).

It is noteworthy that professionals in the transport sector saw minimising parking options as the key to influencing travel behaviour, while this was mentioned by only a few healthcare professionals.

Mobility plan in a general context
One study provided the first large-scale empirical analysis of major employers worldwide that were implementing policies to reduce emissions produced by commuting (Urueta et al., 2025). Potential effects of COVID-19 were taken into account by analysing emission trends over several years and interpreting these in light of pandemic-related changes in mobility behaviour.

- The analysis showed a clear but limited correlation between the existence of policies and actual emission reductions (Cohen's $d \approx 0.22$).
- The effectiveness of workplace mobility policies appeared to greatly depend on broader organisational and cultural factors, and in particular on the trust and confidence that workers have in their employer. Trust and confidence in the employer was more relevant than formal participation structures.
- This finding poses a challenge to technical or instrumental approaches to mobility management and emphasises the importance of considering the organisational context when designing effective policies.
- Knowledge-intensive sectors (such as professional services, healthcare and the financial sector) show higher adoption of mobility policy and a stronger correlation with emission reduction.
- The researchers found little evidence that formal structures for worker engagement increased the effectiveness of mobility policies. Previous research emphasised the importance of collective negotiating, while these results suggested that the relationship between workers' engagement and environmental outcomes is more complex than previously thought.
- The trust and confidence of workers in their employer appeared to be a key factor in determining how effective the policy ultimately was.

These findings highlight a number of key points for consideration for mobility policies and practice. Policymakers should take into account the opportunities and characteristics of specific sectors when developing initiatives through employers. Organisations that wish to implement mobility policies would be well advised to not only adopt formal policy measures but to also invest in trust and confidence and a supportive organisational culture.

Promising mobility plans aimed at active mobility
Research was conducted on 20 employer case studies in the United Kingdom. The employers had implemented mobility plans and had thereby reduced commuting by an average of 18% (Cairns et al., 2010). It was noteworthy that one of the case studies in this research focused exclusively on awareness campaigns.

The conclusions:

- Significant behavioural change is possible in various situations. To achieve this, employers usually require a broad strategy that also includes parking policy, alongside improving alternative travel options.
- A more comprehensive national policy strategy is required to benefit from the full potential of mobility planning.
- The combination of different interventions is important to reduce the appeal of car use relative to other travel options.
- Interventions targeting specific modes of transport can be reinforced by marketing activities and supplemented by appropriate policies for recruitment and general working practices.
- Supporting interventions such as facilities for other modes of transport, alternatives to the car and appealing options for active mobility are important.
- Organisational commitment: identified success factors include leadership within the organisation, governance and allocation of resources.
- Many initiatives lacked consistent monitoring and evaluation data, which is important for effective testing, comparison and investigating the long-term effects.

Sustainable Mobility Procedure Manual

The Sustainable Mobility Procedure Manual focuses on inpatient healthcare organisations and has been drawn up by the Sustainable Transport working group of MPZ (national network for sustainability in Dutch healthcare). This is an association for and by the healthcare sector. The manual has many practical approaches for action and tips for healthcare organisations when implementing mobility policy. This manual goes beyond active mobility and commuting, and also provides measures and practical examples for business trips, cleaner or fewer trips as well as more economical driving.

Chapter 1 includes information on providers offering advice on making mobility more sustainable, including the regional mobility networks. The latter offer free advice (zowerkthet.nl), but private parties that have previously worked with the healthcare sector are also mentioned.

Chapter 3 covers internal policy and support and provides tips on building support, such as involving the Works Council at an early stage, and provides examples of healthcare organisations' strategies.

Chapter 4 provides information on setting up a baseline assessment and monitoring results to gain an understanding of mobility and CO_2 impact, as well as the effectiveness of the measures taken. This might include an understanding of commuting patterns or parking behaviour.

In addition, Chapter 6 sets out steps that can be taken to reduce CO_2 and environmental impact of traffic, including switching to alternative modes of transport.

The procedure manual uses the Stimular Database of Measures (www.stimular.nl/doe-het-zelf), which contains a wide range of measures and examples of organisations, including healthcare organisations, that have put the measures into practice. The measures are partly based on knowledge and experience that Stimular has gained during projects.

5 Examples from practice

5.1 Three examples from practice

In addition to the literature reviews, seven healthcare organisations were interviewed about the implementation of interventions for active mobility. These are examples from practice of long-term projects or mobility policies in which a combination of interventions was used. In combination with the findings from the literature review, these experiences and success factors can inspire other healthcare institutions to take action themselves.

This chapter first describes three examples from practice. These are examples from practice at healthcare organisations in various contexts that have implemented promising interventions. The organisations were Radboudumc (hospital), Carintreggeland (long-term and outpatient care) and Pro Persona (GGZ – mental healthcare). The second part of this chapter outlines the lessons learnt from practice.

For all seven examples from practice at healthcare organisations working on active mobility, see rivm.nl/duurzamezorg.

5.1.1 Active mobility at and in the area around Radboudumc

Radboudumc in Nijmegen is working towards more sustainable and healthier mobility and a campus that is easily accessible. The hospital is developing policies for their own workers and collaborating with other parties both on and off campus.
The Head of Integrated Mobility Management and the Mobility Adviser play a leading role within the hospital. In addition, many key stakeholders are involved, including the Board of Directors, the Patient Advisory Council, the Nursing Advisory Council, Facilities Management and HR. These parties all play a key role in ensuring the success of the policy and interventions.
The hospital took the following measures to encourage mobility and at the same time discourage car use.

- A bicycle scheme and bicycle helmet allowance to promote the use of bicycles and bicycle helmets.
- A mileage allowance for walking and cycling.
- A 100% public transport allowance (in accordance with the UMC's collective labour agreement).
- Paid parking, to discourage people from travelling by car. A policy on differentiated parking is still being developed: making parking easier or more difficult depending on the type of work and shift times.
- Good facilities to encourage cycling have been provided: good bicycle parking facilities, showers, an area to dry wet rainwear and an on-site bicycle repair service.
- Workers were given the opportunity to try out an e-bike free of charge for two weeks.

In order to also address the area around the hospital, Radboudumc also collaborates with the municipality of Nijmegen and other parties, such

as the provincial council, public transport providers and educational institutions, on the Duurzaam bereikbaar Heijendaal (Sustainable Accessibilty Heijendaal) project. The objective of the project is to reduce CO_2 emissions from transport on campus by 30 per cent by 2030 compared to 2018. The parties in the project use the STOMP method to encourage active mobility. STOMP is the Dutch acronym for: *Stappen* (walking), *Trappen* (cycling), *OV* (public transport), *Mobility as a service* (such as shared mobility and combining multiple modes of transport in a single journey) and *Private car*. This method prioritises more sustainable forms of mobility on campus, such as walking, cycling and public transport.

A number of success factors for successful collaboration both within and outside the hospital, according to Radboudumc:

- Work together with your local environment by joining existing or new discussion groups. Alternatively, ensure that your healthcare organisation is represented through the network. Listen to all parties. Help seek solutions to challenges, such as raising awareness of parking policies and alternative modes of travel.
- By engaging everyone, you also shape the organisation's vision: what do we consider acceptable? What can we expect of our workers? And then ensure that the necessary conditions are in place: such as a good drying rack for drying cycling gear, safe and secure bicycle parking, etc.
- Look into grant and funding opportunities. This might include an on-site bicycle repair service or organising a car sharing pilot scheme.
- Seek advice from mobility advisers. They are appointed by the provincial council to help encourage businesses and organisations to adopt sustainable travel behaviour.

5.1.2 Encouraging bicycle use at Carintreggeland

Carintreggeland provides care in nursing homes, community nursing, and day and home support services in Twente (a region in the eastern part of the Netherlands). As part of its 'Sustainable and Healthy Mobility' policy, the organisation focuses on encouraging workers to cycle. Carintreggeland is affiliated with the Sustainable Healthcare Green Deal (Carintreggeland, 2024). The organisation is particularly committed to reducing CO_2 emissions through more sustainable mobility. Because the organisation employs 4,200, it can make a significant contribution to this reduction.

The Board of Carintreggeland considers it vital that sustainability is an integrated part of day-to-day work. This is why a Sustainability Adviser has been appointed. A Sustainability Committee has been established to ensure that there is support for the policy. Participants in the committee include representatives from HR, purchasing department, property department, communications and clinical practice. The Board of Directors also endorses this.

The province of Overijssel helped identify opportunities and provide examples of other organisations that are actively promoting cycling. Requirements set by the MTZ (*Milieuthermometer Zorg*, 'environmental

thermometer of the healthcare sector') have also been incorporated into the policy (Milieu Platform Zorg, 2026).

Cycling in particular is being encouraged by Carintreggeland. As not all Carintreggeland locations are easily accessible by public transport, cycling proved, in may cases, to be a feasible and plausible alternative to the car. This is certainly true for community nursing. About 1,500 workers work in the community. Journey data showed that 80% of the clients live within 2 km of one another, a distance that can be easily covered by bicycle or an e-bike.

Examples of interventions introduced by Carintreggeland to encourage cycling include:

- An electric bicycle trial: in collaboration with the province of Overijssel, workers were given the opportunity to try out an e-bike free of charge for three months. Workers can purchase a bicycle of up to €1,500 at a discount or opt for a bicycle lease scheme. Arrangements were also made, with provincial council support, to improve the bicycle parking facilities. This means that the bicycle parking facilities now have locks and are equipped with charging points.
- A total of 90 company bicycles are available for community nurses at various locations of the organisation.
- Annual campaigns are run to promote cycling, such as free bicycle MOTs at several locations and sharing bicycle photos on the intranet. The 'Groen met Koen' campaign conveys information on sustainability in a relatable and easily accessible manner. One of the ways in which this is done is in conversations with 'Koen'. Koen is an animated character based on one of the managers at Carintreggeland.

Carintreggeland highlights the following successes and success factors for encouraging workers to cycle:

- Despite the fact that the electric bicycle trial took place in the winter, there was a great deal of interest in the trial. It resulted in almost all participants subsequently purchasing a bicycle. In addition, Carintreggeland reported that there was also considerable interest in the bicycle lease scheme.
- Support by the Board. They allocated budget and staff.
- Engaging various departments (such as HR, purchasing, clinical practice) ensures broad support and practical feasibility.
- Simply making schemes available is not enough; positive communication is what really encourages workers to cycle.

5.1.3 Earning points through active mobility at Pro Persona

Pro Persona is a large mental healthcare organisation with locations across the Netherlands. It is a challenge to ensure that all sites and workers are included in the sustainable mobility policy. Pro Persona aims to reduce CO_2 emissions by 30% in 2026, as set out in the Sustainable Healthcare Green Deal. Furthermore, the organisation aims to meet the requirements of the MTZ (environmental thermometer of the healthcare sector) (Milieu Platform Zorg, 2026).

In 2019, Pro Persona started developing a long-term strategy for mobility. The organisation wanted to make sustainability an integrated part of its policy, rather than addressing it through separate working groups and initiatives.

In collaboration with a mobility broker, Pro Persona conducted surveys among workers and carried out research on where people lived and travel distances. Based on this input, and in consultation with various works councils, a joint policy for workers was drawn up. This policy was approved in 2024 and will be further rolled out over the coming five years.

Pro Persona promotes sustainable mobility using various activities, such as:

- A loyalty points scheme: workers collect points by cycling. They can spend their points at on-site shops and the restaurant. The system works with tags on bicycles and has been implemented at a few locations. The locations were selected based on the number of workers within a 12.5 km radius and the available budget.
- The loyalty points scheme is actively promoted by offering extra points in spring, for example, to encourage workers to start cycling again after the winter. There is also a communication plan in which this has been included and interviews are sometimes shared on the intranet so that workers can share their enthusiasm for cycling to inspire others.
- Free e-bike trial schemes.
- Participating in the nationwide 'cycle to work' day and a central calendar listing all mobility initiatives, which is shared regularly with workers through the communication channels.
- Between 40 and 50 e-bikes are available at various locations, particularly at outpatient care centres. Workers can use these bicycles to cycle from one client to the next. At the end of their journey, workers return the bicycle to the care centre.

Key successes and success factors, according to Pro Persona:

- Workers were enthusiastic about the cycling scheme with its loyalty points and it generated positive feedback and a pleasant atmosphere at the workplace.
- Build support among the senior management and Board of Directors. Role models are important to achieve this. Actively involve nursing wards. Policy initiated solely by senior staff is not enough; it must be aligned with practice. Ensure there is clear communication to the workplace about the objective and the rationale behind it.
- Ensure a tailor-made approach for each location, depending on the environment, travel distances and facilities. Gathering detailed information takes time and local involvement is valuable in this regard.
- Visit different locations in person to engage in dialogue and to gain an understanding of the situation and possible solutions for the locations.

5.2 Overall insights from practice

A number of overall insights gained from the seven interviews conducted with healthcare organisations to gather examples from practice are discussed in this section. Three of these examples were briefly outlined above.

Development and implementation
Most of the interviewed healthcare organisations began by working on a broadly supported vision with the Board and workers. They focused on reducing CO_2 emissions through their mobility policies, for instance, and they addressed active mobility within sustainability projects. Projects aiming to develop a new mobility policy will put emphasis on both the health and sustainability aspects of active mobility. The new mobility policy is now in the implementation phase at a number of the organisations interviewed.

Measurable results
The availability of data on the use of bicycles, public transport or cars by workers varies by organisation. Many different methods were used by the interviewed organisations to track travel patterns. These included barriers or smart cards at the entrance to car parks or bicycle parking facilities to register car and bicycle use and HR systems that register public transport use. Organisations also indicated that developments in e-health and working from home have an impact on figures relating to workers' active travel. The effect of various measures on encouraging active mobility is therefore often difficult to measure. Nevertheless, healthcare organisations are already seeing a number of positive results. A number of organisations have recorded an increase in the use of bicycle schemes, for instance, and workers appear to be more aware of the possibilities and benefits of active travel. Workers and management are conducting more discussions on sustainable and healthy mobility and workers are sharing the positive effects of active mobility on mental well-being with one another.

Challenges
The organisations indicated that they also experienced challenges, such as frequently having to energise and inform workers, having to gather location-specific and other data, and mentioned financial aspects such as allowances. Furthermore, several organisations reported that improving the environment and collaboration with parties outside the healthcare organisation is a challenge. This might include prerequisites such as good cycle routes, adequate public transport options and road safety.

Lessons learnt
The interviews with practitioners also highlighted a number of aspects that were considered important in relation to the implementation of mobility policy. The healthcare organisations provided the followed recommendations:

- Support by the Board: ensure support and exemplary behaviour by the Board. They are the ones who allocate budget and resources.

- Broad involvement: involve various departments (such as Works Councils, HR, purchasing and healthcare workers). This ensures broad support.
- Good communication: do not just offer appealing schemes but also focus on positive communication. This also encourages workers to cycle.
- Focus on benefits: emphasise the positive aspects of cycling and public transport (health, relaxing, convenient) in your communication.
- Customise policy to location: be aware of the fact that challenges and opportunities may vary by location (for organisations with multiple sites). Engage in dialogue with workers at the various locations to identify the challenges and opportunities and to tailor the policy to each location.
- Behaviour change takes time: be patient, continue to engage in dialogue and make sustainable alternatives appealing.
- Collaboration with external parties: engage in dialogue with public transport organisations and/or the municipality and other organisations addressing mobility in the region. Collaborate as much as possible.

6 Discussion

This chapter reflects on the findings from the literature review and the interviews with healthcare practitioners. It examines what the results mean for encouraging active mobility in the healthcare sector and identifies relevant knowledge gaps and points for consideration. Specific emphasis is put on the limited amount of healthcare-related research, the suitability for use of findings from other sectors and the lack of studies focusing on patients and visitors. In addition, this chapter describes the main methodological limitations of the available research and the conducted literature review.

6.1 Reflection on findings

Limited healthcare-specific evidence and suitability for use in the healthcare sector

What Works in practice primarily identified promising interventions. Because of the very limited number of studies conducted specifically in the healthcare sector, this overview draws on the broader academic literature on active mobility. This has resulted in an overview of measures that, based on existing evidence, are promising and are potentially suitable for use in the healthcare sector. However, applying these interventions in the healthcare sector calls for careful adaptation to the healthcare context. Shown below are a number of aspects that may have to taken into account because they could have an impact on both the feasibility and effectiveness of interventions.

Working hours, safety and maximum workload

- Night shifts and irregular working hours make travelling by public transport more difficult due to limited timetables. This results in longer journey times and higher costs. Differentiated parking policies could be an option in such cases. But a strong focus on collaboration with public transport providers to establish timetables outside regular working hours is also essential.
- Cycling is less appealing for workers in night shifts. Feeling unsafe weighs more heavily when cycling at night than during the day.
- Cycling in the dark calls for well-lit infrastructure as well as well-lit, secure, monitored cycle parking facilities with 24/7 access, and the option for e-bikes.
- On-call shifts require workers to get to work quickly in which case the car usually wins in terms of speed. This calls for tailored parking policies. Time pressure due to staff shortages also means that people want to travel in the way that they believe is fastest.
- Hygiene is arguably even more important for healthcare workers, so being able to have a shower and change easily after cycling to work is crucial.
- Long and intensive shifts by healthcare workers may reduce the willingness to engage in active mobility at the end of their day.

Different working practices and multiple locations

- These aspects will apply to a lesser extent for office workers and commuting studies from sectors outside the healthcare sector will be more applicable to this group. It is therefore important to distinguish between situations where restrictive parking policies will be introduced, giving priority to on-call and night shifts.
- There are also employees who work at different locations on different days. Furthermore, the number of healthcare locations within a single organisation can make it difficult to draw up a single policy that applies to every location and every worker.
- Many healthcare organisations (other than hospitals) also provide outpatient care in the community and, in addition to commuting, the workers then also travel from the healthcare organisation to clients during work hours. Policy should also take this into account. Clients could, for example, be grouped based on the care provider's home address or workplace. This would make it easier for the care provider to travel by bicycle rather than by car.

Accessibility and location

- The 2025 Mobility Outlook Survey showed that, on average, the accessibility of hospitals in the Netherlands declined between 2018 and 2024 for cars, bicycles and public transport. This is partly due to the reduction in the number of hospitals. Furthermore, in many areas in the north and south-west of the Netherlands, hospitals cannot be reached by bicycle within a reasonable cycling time. This also applies to a number of regions near the border. The accessibility of hospitals in Groningen, Drenthe, Friesland and Zeeland by public transport is poorer than in the rest of the country. Given the importance of good infrastructure for active mobility, this needs to be addressed (Kennisinstituut voor Mobiliteitsbeleid, 2025).
- Hospitals are often located on the outskirts of cities and sometimes even in city centres. Hospitals in or near larger cities are often close to a train station, but a bus transfer is usually required. Hospitals in the region do not always have train stations nearby, but they will always have a bus stop near the entrance. This calls for 'last mile' solutions, such as frequent bus services that also run outside regular rush hour times and providing enough shared bikes at stations. It is therefore important to take into account the location of the healthcare organisation in question (whether it is on the outskirts of a city or closer to the city centre).
- Certain healthcare organisations are located on a campus, which calls for collaboration, given the shared infrastructure and public transport connections.

Evaluating interventions in healthcare practice

Because the effectiveness of many of the promising interventions has often not yet been studied within the healthcare sector, it is important to assess when implementing them whether and how these interventions actually work in healthcare practice. It is precisely the combination of implementation, monitoring and evaluation in practice that is vital in gaining an understanding of what works in practice, for

whom and under what circumstances. Implementing and evaluating promising interventions in the healthcare sector makes it possible to work towards a mobility policy that benefits both health and environment. However, the interviews conducted to gather examples from practice revealed that impact evaluation is hardly carried out. Without reliable effect measurements (at least pre- and post-measurements), it is difficult to determine whether interventions are effective and to improve or scale up policy in a targeted manner. Making impact evaluation a mandatory part of grant schemes for sustainability of mobility in the healthcare sector could potentially help to gain an understanding of what actually works. An inspiring example of effect assessment in practice is the evaluation carried out by UMC Utrecht, where quantitative and qualitative data were collected over a six-month period as part of the Sustainable Transport Living Lab (e.g. public transport cards, parking data, surveys and focus groups) (UMC Utrecht 2025).

Knowledge gap: interventions for patients and visitors
Initially, this literature review focused on the target groups of workers, patients and visitors. No interventions were found that investigated the active mobility among visitor or patients travelling to and from healthcare organisations. This resulted in a primary focus on active mobility, specifically active commuting by workers of healthcare organisations. However, the mobility of patients and visitors is also relevant to both CO_2 reduction in the healthcare sector and health effects. Interventions that have been proven to be promising in other contexts could also be applied within the healthcare sector for visitors. A number of examples are briefly summarised under 'Visitors of healthcare organisations'.

Encouraging active mobility among patients may be more challenging as the feasibility varies greatly depending on the patient and type of care. For some patients, such as in the case of patients requiring acute care, those with limited mobility or those who are vulnerable, independent active travel is not always possible and the car remains the most practical option. At the same time, many healthcare visits are planned, outpatient appointments or check-ups, where active mobility may well be feasible and in some cases could even be instrumental in achieving health goals, such as improving fitness before surgery or preventing obesity. Evaluation studies under patients is challenging because of the diversity of the target group and the often unplanned or unexpected nature of visits. A development that is particularly relevant in the context of sustainability and CO_2 norm-setting is digital healthcare applications (e-health). Providing digital healthcare will reduce the number of physical journeys to healthcare organisations.

Visitors to healthcare organisations
Many intervention studies examined the effect of interventions on active mobility (rather than specifically on commuting). This report focused on active commuting among workers of healthcare organisations. However, some of the promising interventions are also suitable for use by other travellers to and from healthcare organisations, such as visitors. This might include:

- Good, safe cycling and walking infrastructure to healthcare organisations.
- Frequent public transport with covered stops close to the main entrance.
- Facilities. Good bicycle facilities can also reduce the barrier to cycling for visitors. This might include Sheffield stands (U-shaped metal stands fixed to the ground to which you can secure your bike), covered well-lit bicycle parking facilities close to the main entrance of the healthcare organisation and e-bike charging points.
- Financial incentives such as parking policies (differentiated parking fees with exceptions for emergencies or informal carers, for instance).
- Personalised travel plans for visitors: sending a link with the appointment reminder message to a suggested route using active mobility (information on door-to-door travel time, travel costs and CO_2 emissions).
- Gamification with rewards (visit sustainably, challenges with rewards such as a free cup of coffee after three visits using active modes of transport).
- Adequate number of shared bicycles for the 'last mile' when travelling by public transport. These shared bicycles could be public transport bikes (*OV fietsen*) or shared bikes provided by other operators.

It is also important to take healthcare-specific aspects into account when drawing up mobility policy for visitors. Visitors often come for short visits and during the standard visiting hours, which can lead to peaks in parking demand. Furthermore, people may be less inclined to travel long distances for a short visit, particularly if the visiting hours are during office hours. This may make them more likely to prefer travelling by car.

Interviews with practitioners
The interviews with practitioners revealed that the focus was primarily on active mobility of workers and, to a lesser extent, of visitors and patients. Policies and interventions for these groups are mainly aimed at ensuring that the healthcare organisations remain accessible. High parking fees were sometimes reported, which affects people in all target groups who travel to the healthcare organisations by car. The literature showed that financial incentives and measures to discourage car use were promising. Some healthcare organisations focused on e-health (remote healthcare) for visitors and on communicating alternative modes of transport. They did this by placing cycle routes at the top of their webpage on accessibility (instead of the route by car), for instance, or by providing information on active mobility options in outpatient appointment letters. Literature does not show much promising evidence for this type of information provision, at least not as an isolated intervention, but it could be promising as part of a multi-component strategy.

Long-term effects largely unknown
Relatively little is known about the long-term effects of the interventions because most of the studies do not carry out long-term follow-up

assessments. This is certainly an important point to consider in the case of interventions involving a temporary reward, such as an e-bike lease period or temporary free travel by public transport. With a view to sustaining behavioural change, permanently embedding policy is more effective than temporary interventions.

Small effect sizes
Many of the included reviews and meta-analyses concluded that interventions had small effect sizes. This means that the average change per person is limited, but such effects can still have a significant impact on public health when applied on a large scale at population level. Although the annual increase in active mobility often remains limited, behavioural research has shown that small, consistent changes can accumulate to create cumulative effects and possible shifts in social norms with long-term and widespread implementation. In line with insights on social tipping points (Judge et al., 2024), this suggests that long-term encouragement of active mobility in combination with discouragement of car use and systematic monitoring is necessary to achieve and bring to light potential changes in norms and culture.

Less and cleaner travel
This study focuses specifically on active mobility because of the distinctive win-win situation for both health and sustainability. At the same time, a broader mobility policy than simply promoting cycling, walking and the use of public transport will be required to reduce CO_2 emissions in the healthcare sector. This should also include measures to reduce the number of journeys (e.g. through digital healthcare applications and working from home policies) and measures that make travelling cleaner in both commuting and business travel, such as electrification of the vehicle fleet and car sharing. Although technological measures such as electrification of the vehicle fleet are expected to achieve significant CO_2 reductions, this study focuses on active mobility as a result of the combination of reducing CO_2 emissions and the health gains through behaviour change. The contribution of active mobility should be seen as supplementary to, and not as a replacement of, measures aimed at making motorised transport cleaner. These measures are beyond the scope of this report, but are also essential in an integrated mobility and climate policy for the healthcare sector. The interviews revealed that various healthcare organisations are already working on this. Examples include making their vehicle fleets more sustainable, installing charging points, providing shared mobility and car sharing apps, and investing in e-health and remote care.

6.2 Methodological limitations of the literature

Quality and study design
Although the quality of the included studies was not systematically assessed, a qualitative assessment showed that relatively little research of high methodological quality was available. Only a limited number of studies are randomised controlled trials (RCTs) and several reviews indicated that many of the interventions studied were of poor quality and had an increased risk of bias (even if RCT designed). This could mean that there are possibly systematic biases that could compromise the reliability of the findings (Okraszewska et al., 2024; Petrunoff,

Rissel, et al., 2016; Stewart et al., 2015; Xiao et al., 2022). An umbrella review also concluded that some of the reviews themselves showed methodological shortcomings (Cleland et al., 2023).

Furthermore, many studies used self-reporting instruments while objective measurement methods such as pedometers or bicycle counters could provide more reliable data. In addition, several studies lacked a control group, which makes it difficult to interpret effectiveness. An additional methodological challenge is the seasonality of cycling. Cycling campaigns are often carried out in periods of favourable weather, which means that some of the observed effects may be seasonal rather than attributable to the intervention. Without a control group or a comparison period, it is difficult to determine the true effect of the intervention.

It is important to note that RCTs are not always feasible or appropriate for behavioural interventions in real-life settings (Pearson et al., 2025). Many external factors that cannot be controlled are at play in daily practice, which means that quasi-experimental or natural experiment research is often more realistic. Ogilvie et al. argued that it is more appropriate to adopt a more mechanism-oriented approach and focus on why and where something works. This requires evidence from various sources and different types of evidence collection (Ogilvie et al., 2020).

More evidence does not automatically mean greater impact
It is important to emphasise that the volume of research on an intervention does not directly indicate its effectiveness. The use of e-bikes, for example, has been studied relatively frequently in recent years, but this does not automatically mean that this approach is more effective than other interventions that have been investigated less or not at all. Little research has recently been conducted on parking policy or other types of discouraging car policies, for instance, while the available evidence suggested that these types of interventions could have a powerful effect when combined with interventions that encourage active mobility. This underlines the importance of a broad interpretation of the evidence, which also includes interventions that have been studied less but could potentially be impactful.

Variations in the classification of interventions and outcome measures
The included reviews did not always use the same classification as used in this study, which makes comparison difficult. Workplace interventions in some reviews were interpreted very broadly (all interventions at the workplace), for example, while other reviews only included specific types of workplace interventions, such as group training sessions or one-day campaigns. This makes the comparability of their conclusions less straightforward.
Furthermore, some reviews failed to distinguish between interventions aimed at active mobility in the broad sense and active commuting in particular. Although active commuting is part of active mobility, the determinants of travel behaviour in commuting differ from those of other journeys (e.g. leisure trips). These differences could also affect the effectiveness of interventions, which can vary between different types of journeys.

This variation in quality, research design and classification of interventions emphasises the importance of not relying solely on the summary of conclusions of this report when putting the findings into practice, but to also consult the original studies.

The impact of the COVID-19 pandemic on study results
Some of the primary interventions studies were published pre- or post-COVID, with data collection having taken place outside the COVID-19 pandemic. However, parts of the studies were most likely conducted during the COVID-19 pandemic (2020-2021) or in its immediate aftermath. COVID-19 is not explicitly mentioned as a explanatory factor in these studies. Most of the included reviews do not explicitly address the role played by the COVID-19 pandemic in the underlying studies. Reviews based on pre-2020 literature have not, by definition, been influenced by COVID-19. More recent reviews sometimes acknowledged that some of the included studies were conducted during the pandemic, but COVID-19 was not considered as an analytical factor and no separate analyses were conducted by time period.

However, the effects measured could well have been influenced by the exceptional circumstances of the pandemic, such as working from home and mobility restrictions. Mobility behaviour changed as a result of the COVID-19 pandemic. There is no evidence that interventions after the pandemic are less effective or effective in a different way than they were before the pandemic. However, the changed situation may require a different approach to and communication of behavioural change interventions. There are reviews that specifically address changes in mobility behaviour during the COVID-19 pandemic. However, they primarily focused on descriptive analyses of behavioural changes resulting from lockdown measures and working from home and not on the effectiveness of structural interventions to encourage active mobility. They were therefore beyond the scope of the literature review. Clear, permanent changes in commuting have become evident in the Netherlands since the pandemic, particularly as a result of working from home, as described under *Trends in passenger mobility and the impact of COVID-19.* However, it is uncertain to what extent these permanent changes also apply to the healthcare sector, where physical presence remains a necessity for many professional groups and the opportunities to work from home are more limited. There has been an increase in e-health, such as online consultations, but it is not known what impact this has on commuting or visitor traffic to and from healthcare organisations.

6.3 Limitations of the current study

This letter report presents a comprehensive literature review of both primary intervention studies and reviews. Although the available research provided valuable insights, it also had significant limitations.

Quality assessment
When selecting studies, explicit consideration was given to whether they met pre-defined inclusion criteria, such as an adequate methodological description. Studies that did not meet these criteria were not included in the document. However, an exhaustive, systematic quality assessment was not conducted on all included studies and reviews. As indicated by

previous literature and concluded by a number of reviews in this report, the quality of the available research on active mobility interventions is generally poor to adequate. This means that the effects found were not always high-quality and may vary significantly depending on the context and study design. Caution when interpreting the results means that the findings in this report should not be adopted wholesale (in their entirety), but when applying them in practice always refer to the chapter with background information, Appendix 1, or the underlying study itself on which the conclusions were based. In doing so, it is important to determine for each intervention in which context it was studied, for which target group and with what outcome measures. Furthermore, it is recommended that when organisations implement interventions, they monitor and evaluate for themselves whether and how the interventions facilitate active mobility within their own context.

Representativeness and generalisability to the Netherlands
Although the included literature provided valuable insights, there are limitations regarding its representativeness and generalisability to the Dutch healthcare context. Some reviews also included studies from before 2015, which means that the results are less relevant to the current mobility and infrastructure situation. Individual studies published since 2015 therefore provide relevant and up-to-date additions.

One of the inclusion criteria for the individual intervention studies was that the context must be comparable to that of the Netherlands. However, some reviews worked with very broad inclusion criteria, which meant that intervention studies from countries that differ significantly from the Dutch context were included. This applies to countries that do not have a strong cycling culture, have limited public transport infrastructure or longer journey distances, for instance. In contrast, most parts of the Netherlands have good cycling and public transport infrastructure, short journey distances and a strong cycling culture. Consequently, interventions that are effective in other countries, such as infrastructure improvements in countries with few cycle lanes, are not directly applicable or equally relevant to the Netherlands, where the base level is already high. Although countries comparable to the Netherlands were selected for the primary intervention studies, differences in context between countries remain apparent. This calls for caution when directly adapting international results to the Dutch situation.

Excluding grey literature and Dutch pilot schemes
Only academic literature has been included in this literature review. As a result, pilot schemes, practical experiments and other initiatives described in reports, policy documents or websites (grey literature) may have been overlooked. However, various practice-oriented pilot schemes are underway in the Netherlands that provide relevant insights on encouraging more sustainable mobility, particularly within large organisations. An example is the *OV-Privé* pilot scheme within the central government, which is being carried out as part of the *duurzame CAO Rijk* pilot programme (Sustainable Collective Labour Agreement for the Central Government pilot) (Rijksoverheid, 2025). About 2,000 civil servants were permitted to use their public transport business travel card for personal use for a period of six weeks during this pilot scheme.

The results showed that such interventions can lead to a clear shift in travel behaviour: a large proportion of the participants used public transport more frequently, looked upon the measure highly and replaced car journeys with travel by public transport. When extrapolated this could result in a substantial CO_2 reduction for the central government. In addition, a pilot scheme for shared mobility will be launched within the central government in 2026, in which shared bicycles, scooters and cars will be made available by using a mobility card to encourage the use of public transport and reduce car use.

Another example of pilot schemes in practice are the experiments within the Travelling Differently Coalition that have been carried out since 2015 (Anders Reizen, 2025). In this scheme, 70 major employers have been experimenting with testing grounds, including a sustainable annual budget for employees to accelerate the transition to sustainable business mobility and commuting and to reduce CO_2 emissions. The results and key recommendations following ten years of experimentation were recently presented to the House of Representatives. Some of the shortcomings that they identified are that last-mile connections were often inadequate, that cycling and public transport infrastructure often failed to connect with work and home locations, which hinders the switch from cars to sustainable transport. With regard to active mobility, their recommendations included making active mobility and other more sustainable travel choices more tax-friendly than non-sustainable options, and improving the connections to public transport, bicycle and last-mile solutions at work and home locations (to encourage trip chaining, such as shared bicycles at a train station). This might include targeted investment in cycling infrastructure and facilities around public transport hubs. If these solutions are consolidated, switching to other modes of transport will become more appealing. They also recommended involving employers in location-specific solutions.

Overlap of primary studies in reviews
It was examined to what extent the included reviews drew on the same primary studies, to ensure that findings did not unintentionally carry more weight due to multiple reporting of the same evidence. The overlap between primary studies proved to be limited. This does not mean that the evidence is stronger, but it does mean that the reviews largely describe different interventions. This is why all the reviews were included as supplementary sources of information, and interventions and results were not counted twice.

7 Conclusions and recommendations

Despite the limited amount of healthcare-specific evidence, this letter report provides clear approaches for action for healthcare organisations on how to encourage active mobility among workers. Promising interventions were identified that are also suitable for use in the healthcare sector. By implementing these interventions, healthcare organisations can achieve a double benefit, in gains for both public health and the environment. The effects of interventions on travel behaviour are usually small per person, but even small effects can have a substantial social impact when implemented on a large scale and over a long period of time.
What Works in practice helps in defining a suitable package of interventions by showing which interventions are promising and for which interventions the evidence is still uncertain or unknown. The report also provides an understanding of travel behaviour and practical implementation aspects of mobility policy. Furthermore, the various examples from practice offer inspiration for healthcare organisations.

Based on the literature review, the interviews, and the literature on travel behaviour and implementation, a number of recommendations for application in the healthcare sector can be given:

- Lasting behavioural change calls for **an integrated strategy. Use a combination of interventions** that address different aspects. This can include individual, social and environmental aspects.
- **Combine encouraging active mobility with discouraging car use.** Combine the promotion of cycling, walking and public transport with, for instance, differentiated parking policies.
- **Introduce structural interventions** to sustain behavioural change in the long term. It is better to focus on permanent schemes that are embedded in policy, rather than short-term, isolated interventions. This might include allowances and provisions in collective labour agreements within the healthcare sector.
- **Collaborate with local authorities, government and transport providers.** Infrastructure, such as suitable bicycle lanes and good public transport, has an significant impact on active mobility. This is beyond the direct sphere of influence of a healthcare organisation and calls for collaboration.
- **Understand the target group** and what motivates or deters them from choosing active mobility. Incorporate these insights into the mobility policy.
- **Actively engage workers**, as without engagement and support they may develop reluctance, particularly when discouraging car policies are involved. Provide opportunities for workers to become involved in the proposed mobility policy. Trust and confidence between employer and worker has been shown to be a critical success factor in this type of policy.
- **Ensure a customised approach** in both strategy and communication. Carefully consider the healthcare-specific context, particularly when implementing interventions that have

not yet been evaluated in the healthcare sector. The healthcare sector has specific characteristics such as shift work or night shifts, multiple work locations and the nature of the work itself. These aspects make it a distinctive sector.
- **Be responsive to times at which workers form new travel behaviour**, such as when workers start employment or when workers move house. These are the moments at which you should implement interventions to encourage active travel behaviour.
- **New interventions and policies must be feasible.** This means that interventions must not only draw on 'knowing' or 'wanting', but must also make 'doing' possible. This applies to both the implementation capacity of organisations themselves and to workers, patients and visitors.

In addition, there are a number of recommendations regarding the evaluation of interventions and policies aimed at active mobility:
- **Investigate whether it works in the healthcare sector and carry out impact evaluations.** Promising interventions from other sectors should also be investigated in the healthcare context. It is therefore important to set up impact evaluations when implementing mobility policies.
- **Monitor and assess systematically.** Healthcare organisations should systematically monitor and assess interventions and policies aimed at active mobility. Measure the impact of interventions using pre- and post-measurements of travel behaviour. It is also advisable to measure over long periods. This enables adjustments to be made and increases the understanding of what works in practice in the healthcare context. Monitoring can also be linked to future grant schemes.
- **Measure effects on car use.** Do not only measure the effects on active mobility but also on car use. This makes it possible to investigate whether active mobility actually replaces car use.
- **Examine active mobility interventions for visitors and patients.** These groups constitute a substantial proportion of the traffic to and from healthcare organisations, but interventions aimed at these target groups have scarcely been investigated.

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Appendix 1 Details of the literature for each intervention

B1.1 Promising interventions

Workplace programmes and policies

Reviews outside the healthcare sector

A systematic review was identified that examined experiments and pre- and post-measurements aimed at promoting active mobility and reducing car use to and from the workplace (Petrunoff, Rissel, et al., 2016). The interventions that were included were broadly divided into four categories: (1) targeted behaviour change programmes, (2) workplace transport plans, (3) financial incentives and (4) the introduction of new transport infrastructure. The majority of the studies (seven out of 12) pertained to targeted behaviour change programmes (by providing information in individual or group sessions at work). In these cases, no further adjustments to policy or the environment were made. Two of these interventions primarily focused on encouraging cycling to work, two were aimed at promoting walking among workers and three were aimed at encouraging all forms of active and sustainable commuting. These programmes generally targeted individual workers and tried to replace car use by more active modes of transport by providing information through individual sessions, group meetings or a combination of both, followed by less close supervision. Additional tools were used in some studies, such as providing a bicycle or the use of pedometers.

The results showed that these behaviour change programmes had predominantly positive effects on active commuting. Two studies that focused on walking reported that participants in the intervention group walked to work significantly more often in the short term than participants in the control group, with a 1.93 to 2.21 times higher likelihood of still walking after two months. However, these effects proved not to be enduring and were no longer significant after six to twelve months. The two cycling studies showed greater effects: in one study, participants in the intervention group were 7.8 times more likely to cycle to work than control group participants, while another study reported a significant improvement in cardiorespiratory fitness (VO_2max) among workers who cycled. With regard to car use, the effects varied. In most of the behaviour change programmes, the number of participants that travelled to work by car remained stable or decreased slightly in the intervention groups, while an increase was observed in the control groups. In one study, the proportion of car users in the intervention group remained virtually unchanged, while it increased in the control group; in another study, car use decreased in the intervention group while it increased in the control group.

Although these findings are evidence for the potential of targeted behaviour change programmes to encourage active commuting, the authors classify the evidence as limited. The included studies were characterised by a high risk of bias and the positive effects often proved to be short-lived. Consequently, caution is advised when drawing

conclusions on the effectiveness of behavioural interventions without additional structural or policy-related interventions.

A systematic review identified three pre- and post-measurement studies which examined the effect of a workplace intervention on cycling to work (Stewart et al., 2015). The results of the three studies showed a mixed picture. A repeated pre- and post-measurement study among workers at the University of Bristol showed that a workplace transport plan that primarily focused on restricting parking facilities was associated with a statistically significant increase in walking to work, while the increase in cycling was not statistically significant. Another study examined a 'Ride to Work Day', an annual large-scale event in the Australian state of Victoria designed to encourage cycling to and from work. The study reported evidence that participating in 'Ride to Work Day' was associated with sustained cycling among some of the participants, but statistical significance of these changes was not assessed. About 20% of the participants cycled to work for the first time during the event, 27% of whom were still doing this five months later. The effect on behavioural change was greater among women than among men. The third pre- and post-measurement study examined the 'Bike Now' project, a workplace intervention in which several initiatives to promote cycling were tested. Although the programme raised awareness and encouraged some participants to cycle, no specific interventions were identified as being a deciding factor.

Two reviews of reviews (Cleland et al., 2023; Winters et al., 2017) described two older reviews (from before 2015). These older reviews concluded that although small effects were identified, there is insufficient evidence that workplace programmes (organisational travel plans) are sufficient to bring about a population-level increase in active mobility. These findings were based on secondary synthesis of older literature and are therefore mentioned for the sake of completeness but were not used as evidence.

A review from 2024 concluded that this type of multi-component workplace interventions only make a small difference in encouraging active commuting if no supporting infrastructure improvements are made, particularly when considering the longer term (Roaf et al., 2024). The researchers drew this conclusion based in part on the four intervention studies that are discussed separately below and have been included as evidence. Because these four studies have been included separately, this review does not add any independent additional evidence to this summary.

Intervention studies in the healthcare sector
During a three-year intervention in which travel behaviour was surveyed at four points in time (2011, 2012, 2013, 2014), a workplace programme was introduced at a hospital (Petrunoff, Wen, et al., 2016). The intervention was aimed exclusively at encouraging active mobility and not at discouraging car use. Both behavioural theories (such as stages of change) and organisational change theory were used to develop the activities within the travel plans. Intervention components included mobility policies such as schemes offering tax benefits for public transport through payroll deduction, facilities such as good bicycle

parking facilities for cyclists and the designation of parking spaces for car sharers. There were also programmes aimed at encouraging cycling and walking, such as cycling and walking-to-work-day events, cycling skill courses and lunchtime cycle rides. The proportion of workers who actively travelled to work increased by 4%-6% in the intervention years compared to the base year (after adjusting for how far workers lived from their workplace, a factor that has a significant impact on active travel behaviour). These increases were statistically significant in 2012 (p=0.04) and 2013 (p=0.003) compared to the baseline measurement.

The other study compared the changes in travel behaviour between two Australian hospitals where travel plans had been introduced (Petrunoff et al., 2015). The interventions at one hospital focused solely on encouraging active mobility, while the other hospital had interventions aimed at active mobility as well as those aimed at discouraging car use through parking policies. The results showed that the proportion of workers only travelling to work by car decreased by 5% at the hospital where only active mobility was encouraged, compared to a 42% decrease at the hospital where a comprehensive parking policy was also introduced. The 37 percentage point difference in the reduction in car-only travel between the two hospitals was statistically significant (χ^2= 87.5; p<0.001). The parking policy involved reducing the number of parking spaces for staff by half, as well as introducing paid parking. Park and ride facilities, bus services, car sharing incentives and e-bikes were made available as alternatives to driving.

Intervention studies outside the healthcare sector
Walsh et al. (2021) investigated "Commuter Choices". This was a six-week, multi-component intervention based on a behavioural theory known as the social cognitive theory (SCT) (Walsh et al., 2021). Participants attended four interactive lunch seminars that covered topics such as the benefits of active mobility, problem-solving, setting goals using the SMART method, safe cycling, personal travel planning and practical skills such as bicycle repair and injury prevention. They set personal long-term and short-term goals, devised strategies to overcome barriers and chose rewards for themselves. They also received a personal travel plan (with alternative routes and information on travel time, costs and environmental impacts). They were paired with a peer buddy to achieve goals together and they were encouraged to seek additional social support from their personal network. Results showed that participants in the intervention group travelled actively for an average of 8.9 minutes more per day (p<0.05, CI95% 4.1-13.7), met physical activity guidelines through travel more frequently and also reported having more social support and self-regulation than the control group.

One study examined the Cycle Nation Project, a multi-component programme to boost cycling at a British multinational (Connell et al., 2022). Intervention components were developed based on behavioural change theories. Specific elements of the intervention included deploying trained 'Cycle Champions' at the workplace, organising information sessions, setting clear personal cycling goals, group activities such as cycling trips or challenges, practical support (such as helping with bicycle repairs or equipment) and a special focus on safety.

In addition to making cycling easier in practice, the intervention was also focused on boosting motivation, self-confidence and a sense of safety. The programme in the pilot scheme led to a statistically significant increase in the number of workers that cycled more (particularly in their free time, but also to commute), with an average increase in cycling of 43.1 minutes per week (p=0.02) and three trips per week (p<0.001). Positive effects were also reported in terms of wellness and motivation and the approach was perceived as being feasible and easy to implement by workers and the organisation.

One study examined the effect of the 'Active Lions' campaign on active mobility (Bopp et al., 2018). This was a university-wide, multi-component intervention at a large university in the US, designed to promote active mobility (walking and cycling) to and from the campus among both students and staff. The campaign was based on behavioural theory and used behaviour change techniques. Key components of the intervention included a specially developed smartphone app featuring route planning, logbooks, goal setting, rewards (overviews of cost savings, calories and CO_2), reminders for planned trips and information on where to park bicycles. In addition, there was an extensive promotional campaign via social marketing and a recognisable house style campaign (logo, slogan, university colours), communication via news media, campus events and an active deployment of social media. Furthermore, specific channels for students were also tapped into, such as student news, student health services and student accommodation. The share of active travel among students increased significantly at the end of the campaign (from 49.2% to 64.2 %; p=0.001), but this was not the case for staff; students and staff who were aware of the campaign also made relatively more frequent use of active mobility.

A study investigated the effect on active mobility and car use of a 30-day 'cycle to work' campaign for which multiple messages were used as recruitment mechanism (Olsson et al., 2021). Three different messages were disseminated to the target group (including hospital workers): a financial message ("Take part and win a bike"), a moral message ("Let's do this for the environment") and a social message ("It's fun so let's do this together"). The nudges were made available via the intranet and leaflets. The campaign was easy to access: staff signed up voluntarily. During the cycle days they were rewarded with prizes through raffles. Participants recorded the days on which they cycled themselves. Results showed that car use fell during the campaign (from an average 26% to 11%) and the use of bicycles increased (from 57% to 74%); three months after the campaign had ended this effect had been partially maintained (car use at 20% and bicycle use at 59%) (all results had a statistical significance of p<0.001). The type of nudge made no significant difference to the effectiveness: success was primarily attributed to the overall campaign with rewards and visibility, and not to the specific type of message.

A large-scale randomised controlled trial investigated whether a 10-week behavioural intervention (Walk to Work) could encourage workers to walk to work regularly (Audrey et al., 2019). The intervention consisted of providing information on the benefits of walking and overcoming barriers, as well as focusing on intention formation and goal

setting, self-monitoring, social support and relapse prevention. Physical activity and travel behaviour were measured using accelerometers and GPS devices at the start of the intervention and after 12 months. The results showed that the intervention did not generate a statistically significant increase in the number of minutes of moderate to vigorous activity per day, nor did it lead to a shift from driving to walking as mode of transport.

Free loan scheme and purchase subsidies for e-bikes

Reviews outside the healthcare sector

A systematic review and meta-analysis examined experimental and quasi-experimental studies that investigated the effect of e-bike ownership on active mobility (Chevance et al., 2025). The authors concluded that access to an e-bike encourages active mobility (e.g. through free loans or purchase). The meta-analysis showed a statistically significant difference of an average of 5 kilometres (95%CI 4.1-6.4) extra per day compared with control groups. This is in line with a 26% increase in the proportion of e-bike use. The meta-analysis showed a non-significant difference of an average of 2.4 kilometres less car use per day, which corresponds to a 10% decrease in car use. Functional journeys, such as commuting, are more frequently replaced by e-bike use than combined trips (e.g. dropping children off and doing grocery shopping).

A review with meta-analysis on the effectiveness of interventions aimed at promoting active mobility (Pearson et al., 2025) concluded that loaning e-bikes can effectively promote active mobility (OR = 1.13, 95%CI 1.02–1.22). This finding was based on a single intervention study in 2009 (Bjørnarå et al., 2019). This was a randomised controlled trial with a small sample size, in which the participants were parents with young children (n=36). After having had access to an e-bike with trailer, a cargo bike or a bicycle with trailer for three months, Bjørnarå et al. (2019) reported a 4.6% increase in the proportion of bicycle trips to childcare among participants who had previously mainly used cars. The greatest effect was shown by e-bikes. After the intervention, 38.9% of the participants in the intervention group were classified as cyclists for commuting, compared to 5.9% in the control group (p=0.04).
A review of active mobility interventions concluded that loaning e-bikes and access to an e-bike hire scheme are more effective than providing regular bicycles (Roaf et al., 2024). In addition, they concluded that loaning or subsidising e-bikes, particularly when linked to a workplace, had a positive effect on cycling levels and a negative effect on car use. They based this on two studies already discussed above and therefore not included in this analysis (Cairns et al., 2017; Ton & Duives, 2021). Furthermore, they identified one additional small-scale study that demonstrated that subsidies for e-bikes can be effective for people who were previously inactive and had recently been diagnosed with diabetes (Cooper et al., 2018). Given the highly specific target group, this review was not included.

Intervention studies outside the healthcare sector

Questionnaire data from a pre- and post-measurement study conducted among Dutch staff and students of a university showed that loaning free e-bikes for a period of eight weeks had a positive effect on both e-bike

and regular bike use (Ton & Duives, 2021). Prior to the pilot scheme, participants reported using cars on 88% of the days, and after the pilot scheme there was a significant decrease in car use to 63% ($p<0.01$). The proportion of e-bike use had risen significantly from 2% before the pilot scheme to 18% after the pilot scheme ($p<0.01$). It is interesting to note that the proportion of bicycle use had also statistically significantly increased three months after the pilot scheme ended ($p<0.01$), from 5% to 12%. A total of 75.6% of the participants do not use an e-bike after the pilot scheme, primarily because they do not own an e-bike (e.g. due to the high costs or because they do not know which e-bike to buy).

A randomised controlled trial involving Swedish participants (Söderberg Andersson et al., 2021) examined the substitution effect in active mobility: to what extent can e-bikes replace car use? GPS data showed that participants who had been given access to an e-bike increased their daily e-bike use by an average of one trip and 6.5 km per day per person ($p<0.001$) (this is a large to very large effect size), which resulted in a 25% increase in total bicycle use. At the same time, car use decreased by an average of one trip and 14 km per person per day ($p<0.05$), a 37% reduction in car kilometres (moderate effect size).

The effect on travel behaviour of commuters of loaning e-bikes for a period of six to eight weeks was investigated using bicycle sensors, pre- and post-measurement questionnaires, focus groups and semi-structured interviews (Cairns et al., 2017). Three-quarters of the participants indicated that they cycled more during the loan period and that they cycled to work on an e-bike an average of two days a week. They expressed the intention to cycle more frequently, but a year after having participated only a very small proportion had purchased an e-bike. Participants were asked in a post-measurement questionnaire whether their travel behaviour had changed compared to the period before the loan scheme. A total of 43% of the participants indicated that their car use had decreased. No assessments for statistical significance were carried out.

E-bike purchase subsidies

Intervention studies outside the healthcare sector

Another type of intervention is a subsidy that makes it cheaper to purchase an e-bike. Two intervention studies on the same scheme showed this to be an effective way of increasing the share of e-bike use in the overall mix of transport modes used. A pre- and post-measurement study on an e-bike subsidy scheme run by the City of Oslo (Sundfør & Fyhri, 2022) showed that participants who had received a subsidy (€500 for the purchase of a new e-bike) cycled statistically significantly more on their e-bikes (17 to 22% higher share of e-bikes in the total transport mode dataset) than the usual seasonal increase observed in the control groups ($p<0.001$). The subsidy led to a shift in mode of transport (more e-bike use) and to more physical activity related to cycling. In a later round of the subsidy scheme, another pre- and post-measurement study found that subsidies for e-bikes can result in a higher share of bicycles (12.6%; 95%CI 7.2–18.0; $p<0.001$), mainly at the expense of car use (-10.1%; 95%CI -15.9 to -2.5; $p=0.036$) and public transport (-7.1%; 95%CI -11.8 to -2.4; $p<0.05$) (Sundfør et al., 2024).

Financial incentives

Reviews outside the healthcare sector

A systematic review and meta-analysis focused on intervention functions rather than specific interventions (Xiao et al., 2022). The review examined interventions that can be implemented at population level to promote various types of active mobility and reduce car use. The review included 24 financial interventions, of which nine focused on car use, eight on public transport, two on active mobility and five on cycling. The meta-analysis showed that financial interventions aimed at reducing car use (small effect: SMD=-0.23; 95%CI -0.39 to -0.08) and promoting cycling (small to moderate effect: SMD=0.35; 95%CI 0.03 to 0.68) were effective, while active mobility (where walking and cycling were considered as one) was not significantly facilitated by financial interventions (SMD= 0.05; 95%CI -0.19 to 0.29). Financial interventions also did not show a statistically significant effect on public transport use (SMD=0.05; 95%CI -0.03 to 0.13). Examples of included interventions are the provision of free bicycles and e-bikes and subsidising car sharing.

The umbrella review by Winters et al. was not included in the conclusion for *What Works in practice*, as it presents the results of an older review. It is described here for the sake of completeness. An umbrella review (review of reviews) (Winters et al., 2017) identified one review from 2012 that examined the effect of financial rewards on active mobility (Martin et al., 2012). The five studies included in the older review showed that financial interventions were generally associated with an increase in active mobility, although the effect size varied. Ogilvie et al. (2004) and Yang et al. (2010), for instance, reported that monetary incentives, such as travel allowances or cash rewards for avoiding car use, led to measurable behavioural change, with increases in active mobility ranging from 5% to 20% depending on context and design. Pucher et al. (2010) identified financial measures as part of broader policy programmes, where the largest effects were shown in combination with infrastructure improvements. Although Mackett and Brown (2011) were unable to provide hard figures, they emphasised that both positive (e.g. rewards) and negative financial incentives (e.g. taxes or parking fees) can encourage behavioural change in the desired direction. Bases on these reviews and studies, Martin et al. (2012) concluded that although these studies showed an increase in active mobility, additional high-quality research was necessary to be able to draw more precise conclusions.

One review (Petrunoff, Rissel, et al., 2016) described an older intervention study in which a cash-out programme was tested. Eight case studies in California were evaluated in this study by Shoup (1997). Due to the absence of significance tests and because the review contained only one older intervention study, this review was not taken into consideration in the conclusion for *What Works in practice*. It is described here for the sake of completeness. Employers in California with fifty or more workers who paid for a parking space for their staff, were legally required to offer a cash-out programme from 1992 onwards. This meant that workers who did not use their parking space (because they commuted to work using another mode of transport) were offered a cash payment equivalent to the value of the parking

space. The result of the intervention was that the number of people who only drove to work fell (from 76% to 63%), the number of people car sharing rose (14% to 23%), public transport use increased (from 6% to 9%) and the combined share of walking and cycling increased slightly (3% to 4%).

Intervention studies outside the healthcare sector
A Dutch study examined the effect of an e-bike incentive programme in the province of Noord-Brabant (de Kruijf et al., 2018). Under the programme, commuters could earn a financial reward by using an e-bike (€0.15 per kilometre during peak hours and €0.08 per kilometre outside peak hours). This increased the proportion of commutes by e-bike. Compared to the base measurement before the intervention was introduced, the proportion of commutes by e-bike rose from 0% to 68% one month after the start of the intervention, rising to 73% after six months. About one half of the e-bike trips replaced car journeys, while the other half replaced journeys on regular bicycles. Distance had only a slight negative effect on e-bike use and the share of e-bikes in total transport modes used remained substantial (57%) in the category with the longest distances. The study did not examine travel behaviour after the rewards were stopped, so the long-term effects are unknown. No assessments for statistical significance were carried out.

A randomised controlled trial (in the Czech Republic) using a mobile application showed that a fixed financial reward (€0.40 up to a maximum of €20) for each kilometre cycled, combined with game elements (gamification), almost doubled commuting by bicycle compared to the group who did not receive rewards (Máca et al., 2020). This effect was statistically significant ($p<0.05$). A fixed reward without gamification also statistically significantly increased the number of journeys by about two-thirds ($p<0.05$). For this intervention, gamification meant that points and badges could be earned and there were leaderboards, challenges and personalised push notifications. Gamification without financial incentives had no significant effect.

A Dutch intervention study examined the effect of the SMART app on cycling in general, outside the context of commuting. The study also specifically looked at the effect of participating in challenges (Huang et al., 2021), which is why the study is also described under Gamification. In addition to the automatic tracking of trips, the SMART app uses various persuasive strategies, such as self-monitoring and feedback (e.g. allowing users to see their daily CO_2 emissions), setting challenges and goals, rewards and encouragement, traffic information and suggestions, and a reliable system. Users could voluntarily participate in monthly challenges, such as cycling a certain distance, making a certain number of trips or cycling to specific locations. On completing a challenge, participants did not receive a financial reward, but points that could be exchanged for discounts in a webshop.
The results showed that participating in challenges was associated with statistically significant short-term effects on travel behaviour. During the challenge periods, the proportion of bicycle journeys was higher and the proportion of car journeys lower than outside the challenge periods. On average, people also cycled more per day during the challenge periods. These differences were statistically significant ($p<0.05$). The average

distance travelled by car did decrease, but this change was not statistically significant (p>0.05), which suggests that the behavioural change was primarily shown in the mode of transport choice rather than the overall car use. In the longer term, the authors found evidence for lasting behavioural change in a subgroup of users with a high degree of engagement with the app. Over a period of several months, this group showed a higher proportion of journeys by bicycle and a lower proportion of car journeys compared to less active users. Not all long-term effects reached statistical significance.

An intervention study investigated the effect of a reward system on the use of public transport. This was carried out using a transport smartphone app. Travel points could be collected when using multiple modes of transport (Tsirimpa et al., 2019). The study consisted of two phases. First, a personalised behaviour model was developed based on an online questionnaire survey. The reward programmes were then tested using a route planning mobile app, in which participants could earn points or rewards for using sustainable transport such as walking, cycling and public transport. These points could be exchanged for monetary rewards, public transport tickets or shopping vouchers, depending on the location of the experiment (Vienna or Birmingham). Actual travel behaviour was measured before and during the intervention using a mobile application. The intervention resulted in an increase of about 21 minutes per day in travel time by public transport and 14 minutes per day in walking time. The observed increase in travel time suggested a positive effect of rewards, although these findings were primarily descriptive and not based on formal significance tests. It was particularly users who already frequently used public transport or active modes of transport that showed the greatest increase. It appeared that car users were therefore encouraged to walk or take public transport more often, but scarcely encouraged to cycle more. The reward programme in Birmingham was more successful than the one in Vienna, probably because there was a greater variety in the rewards there. The study showed that rewards can have a positive impact on the choice of sustainable modes of transport, although the effects depend on personal preferences and the rewards being offered.

Gamification

Reviews outside the healthcare sector

Another review found that 11 of the 14 studies included reported an effect from interventions using gamification, including an increase in sustainable commuting (Bassanelli et al., 2025). Although positive effects were reported in 11 of the 14 studies, these findings are primarily outlined in descriptive terms. Because of the heterogeneity in research designs and outcome measures, the review did not make any overarching statements regarding statistical significance or the magnitude of the effects. The researchers concluded that performance-oriented game-based systems when combined with rewards could be effective in promoting active mobility, particularly in the short to medium term. Social game elements, such as competition, comparison and collaboration, were also frequently engaged and appeared to facilitate behavioural change. The authors noted that many studies primarily used external rewards, while personal, context-specific game elements and strategies such as feedback and social impact were

employed less often. They suggested that this could limit the likelihood of long-term behavioural change as intrinsic motivation plays an important role in sustaining sustainable mobility behaviour. Furthermore, not all studies showed a decrease in car use, which is important in achieving sustainability gains. In many cases, the studies also lacked a clear baseline assessment, making it difficult to determine to what extent the intervention actually resulted in behavioural change. The researchers concluded that better research designs are needed to provide more solid evidence.

A review focused on commuting concluded that the use of gamification elements had a positive effect on various outcome measures (Reindl et al., 2023). Examples included an increased use of shared bicycles, behavioural change towards more environmentally friendly transport choices, more environmentally friendly driving behaviour or an improvement in the quality of interaction with the mobility service used. Although none of the included studies reported negative effects of gamification, the review did not make any overarching statements on statistical significance or the magnitude of effects. As a result, conclusions regarding effectiveness of gamification on actual commuting behaviour remain indicative for the time being. The researchers also concluded that measurable data were scant, with only a few studies presenting specific measurable results on the impact of gamification on the mobility behaviour of commuters.

Intervention studies outside the healthcare sector
Kazhamiakin et al. (2015) used gamification via the ViaggiaRovereto app, which allowed commuters to earn points, badges and a place on the leaderboard by choosing sustainable modes of transport, such as cycling, walking or using Park&Ride (Kazhamiakin et al., 2015). The experiment consisted of three phases: first, participants registered their normal travel behaviour (baseline); they then received sustainable travel route recommendations for two weeks via the app; and finally in the last phase, gamification was introduced for another two weeks. This meant that participants could earn points and badges for sustainable travel behaviour and at the end of the experiment they received a certificate showing their results. The three highest scoring participants received a month’s free use of the shared bikes as a reward. App usage increased statistically significantly during the gamification phase: participants consulted and used the app demonstrably more frequently in those weeks than in the preceding weeks. The percentage of sustainable transport routes chosen rose statistically significantly from 42.7% in the recommendation phase to 60.6% during the gamification phase. Car use also fell sharply: the proportion of car journeys dropped from 34.8% (baseline) to 27.2 % (recommendations) and then to 16.9% in the gamification phase ($p<0.01$). The use of shared bicycles rose from 11.3% (baseline) to 20.7% (recommendations) and 21.6% (gamification), with the introduction of recommendations being the primary driver of this increase. The researchers concluded that the experiment showed that gamification facilitated the participants to use the app more frequently and to opt for sustainable transport options more often, particularly by less car use.

A randomised control trial investigated the effect of gamification on cycling to and from work (Máca et al., 2020). This experiment was also included under the Financial incentives section as it also examined the effects of rewards. The focus here is primarily on the effects of gamification. The intervention took place in the Cyclers app, an application with points, badges, leaderboards and challenges, supplemented by personalised push notifications and messages. The study examined the effect of gamification with and without financial rewards. The study showed that gamification without rewards had no statistically significant effect on the number of cycle journeys. Gamification with rewards proved to be the most effective approach; the number of cycle journeys almost doubled compared with the control group *(p*<0.05). In the other groups, a fixed reward without gamification led to an increase of about two-thirds in the number of journeys compared to the control group *(p*<0.05). Gamification alone proved to be ineffective in this study in encouraging cycling to commute. This suggests that gamification is particularly powerful when combined with a specific, extrinsic incentive.

A Dutch intervention study discussed under the Financial incentives section is also relevant here. This study examined not only the effect of financial incentives, but also gamification, specifically the participation in challenges (Huang et al., 2021). In addition to the automatic tracking of trips, the SMART app also uses various persuasive strategies, such as self-monitoring and feedback (e.g. allowing users to see their daily CO_2 emissions), setting challenges and goals, rewards and encouragement, traffic information and suggestions, and a reliable system. Users were able to voluntarily take part in challenges, such as cycling a certain distance or travelling to specific locations. In this case, the reward for completing a challenge was not money but discounts to spend in a webshop. The study found positive effects of the challenges with rewards on bicycle use (p<0.05). The distance travelled by car did not decrease statistically significantly.

A quasi-experimental field trial examined the effect on public transport use among commuters of incorporating certain behaviour change techniques, including gamification (in addition to nudging and health framing) compared with only providing a free public transport card (Lieberoth et al., 2018). The intervention was not conducted by an employer, but this could, in practice, have been the case. The active control group received a free public transport card, along with an introductory letter of encouragement and access to a webpage with personalised feedback on the distance travelled. In addition to the bus pass, participants in the gamification group were also given access to an online platform where they could keep track of their progress. On this platform, they were rewarded with bonus points for certain behaviour (such as travelling more frequently) and they could see at a glance how many kilometres they had travelled and how much CO_2 they had saved. The trial showed that behaviour change techniques had no additional effect compared with the active control group. Although the actual bus use (measured by the number of times the pass was scanned) in the gamification group was not statistically significantly higher than in the control group, this group did show a greater intention to continue using the bus. Participants in the gamification group indicated significantly

more often that they were likely to renew their bus pass after the experiment ended. Furthermore, they logged in to their personal page more than twice as often to track their progress.

Personalised interventions

Reviews on personalisation in general

A review with meta-analysis concluded that individually tailored behavioural programmes were effective in encouraging cycling, with an average effect size of OR=1.33 (95%CI 1.23–1.43) (Pearson et al., 2025).

A review of behaviour change techniques to encourage sustainable modes of transport reported that personalised interventions were effective. Based on a qualitative synthesis of the literature, the authors concluded that personalised interventions were promising for encouraging sustainable transport choices. However, the review did not report any quantitative effect sizes or statistical significance, meaning that the conclusions are primarily conceptual in nature. They argue that by taking users' previous behaviour and contextual factors into account, the link to the consequences of actions can be enhanced, with smartphone apps offering opportunities for personalised messages (Pan & Ryan, 2024).

Reviews on personalised travel plans

One meta-analysis was focused specifically on personalised travel planning as a type of intervention to change travel behaviour (Bamberg & Rees, 2017). They defined this type of intervention as directly approaching individuals and providing them with information, assistance, incentives and motivation, so that they can voluntarily modify their travel choices. The key message of the meta-analysis was that all intervention studies with solid experimental designs showed that personalised travel plans can lead to a significant reduction of approximately five per cent in the proportion of car use in the intervention group's transport choices, compared with the control group.

A review of behaviour change techniques to encourage sustainable modes of transport, which also drew on interventions targeting other forms of sustainable behaviour to support its findings, concluded that providing feedback and personalised information could help in facilitating sustainable travel behaviour. The researchers also concluded that it is effective to integrate feedback with goal-setting strategies (Pan & Ryan, 2024). However, the review did not report any quantitative effect sizes or statistical significance, meaning that the conclusions are primarily conceptual in nature.

A systematic review and meta-analysis that examined interventions to reduce car use (Okraszewska et al., 2024) concluded, based on three studies, that there was a small statistically significant positive effect of campaigns involving personalised travel plans on reducing car use. One of the studies used was by Bamberg & Rees (2017) and has not again been included here. The study by Hsieh et al. (2017) found that the combination of action and coping plans was particularly effective, while Ma et al. (2017) demonstrated that an individualised marketing programme coincided with a significant reduction in car use.

A systematic review of various behaviour interventions to encourage cycling for commuting identified six studies, two of which were RCTs (Larsen et al., 2024). One of the RCTs was the study by Ahmed et al. (2020), which will be discussed as a separate intervention study and is not included here. Three of the included studies had embedded individual travel advice in a workplace group programme designed to encourage more active mobility (such as cycling or walking). Another intervention combined personalised travel plans with a programme that also included information, awareness raising and motivational components. One of the studies focused specifically on how cycling could be used in such a personalised travel plan. The studies often had a small sample size. This review does not describe the individual results of all the studies, only those of the RCTs. Based on the six studies, the researchers concluded that there was a small positive effect of personalised travel plans on cycling for commuting.

A review that examined which 'soft' inventions (as opposed to 'hard' inventions such as infrastructure-related changes) encourage the use of public transport identified two intervention studies that tested travel feedback programmes (Zarabi et al., 2024). These studies reported small but measurable changes in travel behaviour, such as a 28% reduction in journey time, a 12% decrease in car days (Fujii & Taniguchi, 2005), a 5% decrease in car journeys and a 4% increase in public transport journeys (Taniguchi et al., 2003). However, these findings are based on pre-post comparisons without a control group and were reported descriptively; statistical significance or p-values were not specified.

Intervention study on personalised travel plans
One individual intervention study was found that examined the effect of personalised travel plans on active mobility (Ahmed et al., 2020). The intervention was developed based on a behavioural change theory. Based on the participants' travel diary data, tailored eco-friendly travel plans were drawn up and information on the positive effects on health and the environment was provided. The impact was assessed by comparing the travel behaviour before and after the intervention. Significant differences in individual travel behaviour were observed in terms of car use and active mobility, with an effect size (Cohen's *d*) of 0.28 and 0.45. On average, the change in travel behaviour led to a 4.25% reduction in CO_2 emissions and a 6.10% increase in the level of physical activity per individual.

Self-monitoring
Review outside the healthcare sector
One systematic review with meta-analysis looked at the effect of specific behaviour change techniques in interventions to encourage cycling (Doğru et al., 2021). Based on four studies, this review concluded that interventions that used self-monitoring of behaviour (e.g. asking participants to use a smartphone app to track the cycling distance or frequency) were significantly more effective in facilitating cycling (Hedges' $g+ = 0.48$) than interventions that did not encourage self-monitoring ($Q=8.50$, $p=0.0004$). This is a medium-sized effect.

Interventions to reduce car use

Reviews outside the healthcare sector

A systematic review with meta-analysis concluded that restrictive, deterrence interventions for car use have been studied less frequently in the literature, while the accompanying meta-analysis showed that, on average, discouragement had the greatest effect on reducing car use, although this effect was not statistically significant (SMD=-0.17; 95%CI -0.36 to 0.02)(Xiao et al., 2022). They also reported that interventions focused on improving access showed a small but insignificant decrease in car use (SMD=-0.11; 95%CI -0.24 to 0.02). Financial interventions were associated with a larger, statistically significant decrease (SMD=-0.23; 95%CI -0.39 to -0.08). Spatial interventions also showed a statistically significant reduction (SMD=-0.18; 95%CI -0.36 to 0.00). Interventions focused on convenience resulted in a small, statistically significant decrease (SMD=-0.11; 95%CI -0.26 to 0.05).

One systematic review and meta-analysis was specifically designed to investigate whether intervention studies with a solid research design provided evidence for the common assumption that 'soft' interventions (in which no 'hard' restrictions or changes are made to infrastructure) in transport are effective in reducing car use (Semenescu et al., 2020). The primary outcome of the meta-analysis was that, based on the 41 interventions that were examined, a statistically significant but small effect was found on reducing car use (equivalent to a decrease of about 7% in the share of cars used in the total transport choices). This small effect size had also previously been observed in other studies. The meta-analysis by (Semenescu et al., 2020) also examined this type of intervention. The most effective interventions were those that focused on social, cultural and moral norms, with a decrease of about 32% in the share of car use in transport choices. These were followed by interventions that focused on knowledge and awareness of one's own car use behaviour, with a moderate effect (a reduction of about 14%). Interventions that focused on skills and self-confidence had, on average, a smaller effect (a reduction of about 5%).

Another systematic review examined the effect of intervention studies that investigated soft, hard and mixed interventions on car use (Okraszewska et al., 2024). This review was an update of an earlier review (Scheepers et al., 2014). A reduction in car use was confirmed in 74% of the studies examined (although a majority of these found no statistically significant evidence or did not test for significance), while only one study found the opposite effect and five studies were unable to draw a clear conclusion. This overall effect was statistically significant but small in magnitude. With regard to the type of intervention, the results suggested that hard, mixed and soft transport interventions all significantly reduce car use; no statistically significant difference was found between these different types of interventions. The statistically significant effects came from intervention studies on parking restrictions (from the study by Knott et al., 2019 discussed below), personalised travel plans, a toll system and the development of pedestrian infrastructure. The authors suggested that interventions that focused directly on car owners may potentially be more effective, but they also highlight the need for additional evidence.

A review of reviews concluded that interventions that increased the cost and inconvenience of car use, such as restricting parking capacity, higher parking fees and lower driving speeds, were consistently associated with a reduction in the appeal of car use. The researchers did not make clear-cut statements about the effect sizes or statistical significance (Winters et al., 2017).

Intervention study outside the healthcare sector
A natural experiment examined the effect of introducing free or paid parking spaces at the workplace on the share of car journeys (Knott et al., 2019). Thus, the researchers made use of changes that were already taking place. In this case, it concerned the introduction of parking facilities (free or paid). This turned out to be associated with a higher share of car journeys (11.4%; 95%CI 6.4 to 16.3) and a lower share of journeys on foot or by bicycle (-13.3%; 95%CI -20.2 to -6.4) and by public transport (-5.8%; 95%CI -10.6 to -0.9), in comparison to situations without parking facilities at the workplace. Shifts from car use to alternatives were observed when restrictive parking measures were implemented, but these negative effects on car use were not statistically significant. As this was a natural experiment, other contextual factors, such as location or organisational choices, may also play a role here.

Integrated approach and the combination of encouragement and discouragement
Reviews on the combination of multiple components in an intervention
A review of reviews concluded that effective interventions to change travel behaviour often consist of multiple components. The combination of elements such as personalised travel plans, providing information and employing behaviour change techniques, for example, was effective. According to the authors, this emphasises the importance of an integrated and combined strategy (Cleland et al., 2023).

A systematic review with meta-analysis that focused on encouraging cycling showed that the number of behaviour change techniques used in an intervention was not statistically significantly associated with the intervention's effect on cycling (Doğru et al., 2021). It may not simply be a matter of how many techniques are used, but rather a combination of the right techniques. This is in line with the conclusion of another review on active mobility, which observed that interventions must address various aspects, involving not only behavioural interventions but also a combination with infrastructural changes, for instance. The authors also concluded that multi-component interventions had the greatest impact, particularly when policy measures were included to support active mobility (Roaf et al., 2024).

A review with meta-analysis found that for every additional intervention function (mechanism within an intervention that brings about behaviour change) that was added to an intervention, there was a further increase in cycling (SMD=1.57; 95%CI 0.63 to 2.51). This was tested in interventions that combined both encouragement of active mobility ('carrot') and discouragement of car use ('stick'), with a medium effect size (Xiao et al., 2022).

Reviews on the combination of encouraging active mobility and discouraging car use
A review that investigated which interventions reduce car use concluded that interventions combining both discouraging car use and encouraging active mobility were the most effective (Piatkowski et al., 2019).

A review and meta-analysis concluded that, in particular, a combination of both encouraging interventions for active mobility and discouraging interventions for car use was effective in facilitating active mobility; however, this effect was not statistically significant (SMD=0.33; 95%CI -0.01 to 0.68) (Xiao et al., 2022). This might include investing in cycling infrastructure at the expense of a motorway. They also found that combined interventions had a greater effect on reducing car use if they were implemented by the workplace rather than at city level. However, Xiao et al. expressed important reservations: conclusions regarding discouraging and combined interventions should be integrated with caution, given that relatively little research has been conducted on such interventions.

Improving cycling and walking infrastructure and public transport
Reviews
A systematic review and meta-analysis focused on intervention functions rather than specific interventions, which meant that they examined the mechanisms within an intervention that bring about behavioural change (Xiao et al., 2022). They examined intervention functions related to infrastructure, for instance. Interventions that focused on improving accessibility showed a positive effect on active mobility (SMD=0.20; 95%CI 0.02 to 0.38) and cycling (SMD=0.48; 95%CI 0.09 to 0.87). Spatial interventions were also associated with positive effects on active mobility (SMD=0.21; 95%CI 0.02 to 0.41) and cycling (SMD=0.56; 95%CI 0.04 to 1.08). Interventions that focused on physical safety also had a positive effect on active mobility (SMD=0.24; 95%CI 0.01 to 0.46) and cycling (SMD=0.54; 95%CI 0.00 to 1.07). For walking, positive effects were found for spatial interventions (SMD=0.23; 95%CI 0.02 to 0.44) and safety interventions (SMD=0.23; 95%CI 0.02 to 0.44).

A review with meta-analysis on the effectiveness of interventions that focused on promoting active mobility concluded that interventions that modify the physical environment, such as segregated cycle lanes and traffic calming interventions, were associated with longer cycling times than control interventions (OR=1.70; 95%CI 1.20–2.22) (Pearson et al., 2025).

Another review examined different experiments and pre- and post-measurements aimed at encouraging cycling for commuting. Although the review reported different quantitative outcomes for each study, such as percentage changes in bicycle use, the authors did not present a summary of the effect sizes or statistical significance for environmental interventions. The reported effects were context-dependent and were therefore only described in narrative terms. Interventions aimed at the environment were shown to have small but consistently positive effects on cycling for commuting. These were mainly large-scale infrastructural

and policy-related changes at city or local authority level (Stewart et al., 2015).

One review examined the effect of infrastructural interventions on cycling. The authors concluded that the introduction of cycling infrastructure in urban areas is correlated with an increase in the use of this infrastructure and was shown in several studies to be accompanied by an increase in cycling (Mölenberg et al., 2019). The authors emphasised that most findings were based on observational and quasi-experimental studies, which meant that the results were summarised in narrative terms and no pooled effect sizes were calculated; statistical significance was not systematically synthesised.

One review concluded that social and behavioural interventions appear to be more effective in encouraging active mobility if the environment facilitates and enables walking and cycling (Roaf et al., 2024). The authors reported that interventions involving physical modifications to the environment generally showed greater and more consistent effects than interventions that only included social or behavioural elements. The greatest effects were found in multi-component interventions combining infrastructure changes with social or behavioural programmes.

A systematic review with meta-analysis concluded that the 18 interventions targeting the physical environment (Hedges' g+=-0.01) were less effective in encouraging cycling than the 30 interventions that did not do this (Q=18.16, p<0.001) (Doğru et al., 2021). They suggested that this may be due to methodological limitations or that interventions aimed at psychosocial aspects are genuinely more effective. They recommended incorporating psychosocial components in interventions that involve infrastructure modifications.

A systematic review examined experiments and RCTs or pre-post studies aimed at encouraging active mobility and reducing car use for commuting (Petrunoff, Rissel, et al., 2016). They reported having found one study that examined what the effect was of introducing a new bus route on commuting patterns. Proximity to the bus lane increased the likelihood of a significant increase of more than 30% in the proportion of journeys involving active mobility. It is important to note that this pertained to a combined infrastructure intervention. In addition to the bus route, a cycle lane and footpath were also constructed along virtually the entire length of the bus route. The increase can therefore not be attributed solely to the new bus route.

A review of reviews concluded that providing convenient, safe and well-connected cycling and walking infrastructure is important for supporting active mobility (Winters et al., 2017). Their conclusion was based on various reviews (including (Buehler & Dill, 2016; Fraser & Lock, 2011)). These reviews included not only experimental but also observational studies, which means that there is a correlation between high-quality infrastructure and more cycling, but not a causal link. However, the researchers also concluded that this should be part of a broader package of interventions at different levels (society, city, routes and individuals). The researchers reported that various urban policy measures, such as

improving street connectivity and good access to public transport, both have positive effects on cycling.

Facilities
Review
A review with meta-analysis describes the positive association between facilities at the end of a journey and cycling in general (Doğru et al., 2021). The conclusion was that the seven intervention studies that added objects to an environment, such as bicycle storage racks or shared bicycles, were more effective in encouraging cycling (Hedges' g+ = 0.45) than the 41 intervention studies found in which these facilities were not made available (Q=14.72, p<0.001) (Doğru et al., 2021).

B1.2 Uncertain/Unknown

For some interventions, it is not or still not clear whether they work, are promising or do not work. These interventions have not been adequately researched yet to be able to draw a conclusion or the existing evidence sometimes shows effects on active mobility and sometimes does not. Some of the intervention studies or reviews listed below did indeed report effects of a specific intervention on active mobility, while others reported no effect for the same type of intervention, which is why the conclusion for *What Works in practice* for that type of intervention has been classified under the category Uncertain/Unknown. Future research is needed to draw a conclusion on their effectiveness in encouraging active mobility.

Messages and providing information
Reviews
Xiao et al. investigated the effect of raising awareness in their meta-analysis (Xiao et al., 2022). They defined this as informing individuals about the benefits of active mobility or the disadvantages of driving, as well as providing information on routes. For all the outcome measures that they examined (cycling, walking, active mobility, public transport use, driving), awareness was not found to improve to a statistically significant degree. No reviews or primary intervention studies were found that examined the effect of broader information campaigns on active commuting. The information aspect is sometimes mentioned as part of a multi-component strategy to raise awareness, but the stand-alone effect has not been investigated.

One review concluded, based on five studies, that the use of messages (via a social marketing strategy) on the benefits of active mobility can have a positive impact on active mobility (including commuting) (Roaf et al., 2024), provided that the messages are tailored to the target group and are widely disseminated so that people are aware of them. If the messages are not effectively positioned or not sufficiently brought to notice, its impact will remain limited. Furthermore, they concluded that these types of behaviour interventions were more effective if they took place in walking and cycling friendly environments. This aligns with the findings included in *What Works in practice* that a multi-component strategy is promising.

Intervention study in the healthcare sector
A randomised controlled trial (RCT) investigated whether an intervention with brief messages sent as text messages or emails could facilitate an increase in active mobility among healthcare workers (Blake et al., 2017). There were two interventions groups (one group was sent text messages, the other group received email messages) and no control group. The content of the messages was based on the Theory of Planned Behaviour, which meant that there were three different messages that addressed attitude, social norms and the perceived personal control over one's own behaviour. The intervention was carried out among hospital staff. They were asked to complete questionnaires on their travel behaviour on four occasions (baseline, 6 weeks, 12 weeks and a follow-up meeting at 16 weeks). The average number of hours per day spent on active mobility increased with a moderate effect, but this increase was only marginally significant (p=0.064) from baseline to the 16-week measurement, in both the email and text message intervention groups. Both channels proved to be effective, but the increase was slightly larger in the email group than in the text message group. The type of message sent also made a difference: all messages sent by email proved to be effective while only the social norm message via text message was effective.

Intervention study outside the healthcare sector
In a large-scale field experiment in Rotterdam, free public transport card holders were distributed (Franssens et al., 2021). The card holders provided to the intervention group had a social message on it that read: "Of course I use public transport. Whether you travel on weekdays or weekends, it's always sustainable". The control group received the same card holder, but without a message. An analysis of the number of journeys per hour showed that bus use on the routes with the message increased more significantly than on the control routes. On average, this represented a small but statistically significant effect of 1.18 additional journeys per day in the period following the intervention (176 days) compared to the period before the intervention (619 days) (p<0.001).

Providing free public transport cards
Reviews
A systematic review of experiments or pre- and post-measurement studies aimed at promoting active mobility and reducing car use to and from the workplace (Petrunoff, Rissel, et al., 2016) showed one intervention in which participants were provided with a free public transport pass for one month (Thøgersen, 2009). This resulted in a doubling of the share of commuting journeys made by public transport from 5% to 10% during the trial month (t=−3.97, p=0.0001). Five months after the intervention had ended, usage remained elevated at 7%, an increase that was just on the border of statistical significance (t=−1.971, p=0.05). This could be evidence for the fact that a free public transport trial has not only a temporary effect but could also support behavioural change in the longer term.

A systematic review examined 'soft pull' interventions for public transport use (Zarabi et al., 2024). 'Soft pull' and 'soft push' interventions are soft interventions within mobility management that focus on behavioural change without physical interventions such as

infrastructural changes. The review included two studies on free public transport cards: a Swedish study among workers (Friman et al., 2019) and a French study among car users (Castel et al., 2019). In the French study, a proportion (56%) of the participants was still using public transport three months after the intervention. Participants already had a more positive attitude towards public transport use than non-participants. The studies showed indications that free public transport cards are particularly effective when combined with support and information, which help alleviate uncertainties about using public transport and boost motivation. However, the study did not report any statistical significance of these behavioural changes and pointed to possible selection effects. The Swedish study found that four weeks after the intervention ended only the use of public transport had increased significantly (p<0.001), while changes in car use and active modes of transport were not statistically significant.

Intervention studies
A pre-and post-measurement study with a control group, in which travel behaviour was measured using questionnaires, found that having free public transport passes (for a period of 30 or 14 days) had no effect on public transport use (Andersson et al., 2023).

A longitudinal field study in the Netherlands with three rounds found that three weeks of free public transport cards encouraged commuters in their intentions to use public transport more often, but this did not have a lasting effect once the cards were no longer available (Zeiske et al., 2021). It is important to note that this pertains to intentions rather than actual behavioural change.

A large field experiment among workers of a large organisation investigated the effect of providing a free 7-day public transport card on public transport use (Kristal & Whillans, 2020). One group received a free public transport card, while the control group did not. Rather than self-monitoring, a more objective measure was used, i.e. the actual use of the card. No significant difference was found between the two groups.

A pre- and post-measurement study in a metropolitan region in Germany used the introduction of free public transport travel for all civil servants in the region (Busch-Geertsema et al., 2021). Travel data was examined for the period before (2015) and after the scheme was introduced (2019) among staff at a university where the scheme was also in place. This showed that the use of public transport for commuting rose from 64% to 72% (p<0.01). There was also an increase from 13% to 21% (p<0.01) in walking. However, car use did not decrease in this period. Many staff members were already able to travel at a reduced rate during the pre-measurement period. It was the staff members who were not yet able to travel at a reduced rate, in particular, who showed an increase in public transport use.

Other interventions aimed at encouraging public transport use
Reviews
A systematic review and meta-analysis looked at intervention functions designed to promote active mobility (Xiao et al., 2022). This means that they looked at the mechanisms by which interventions changed travel

behaviour. The meta-analysis showed that none of the intervention functions (e.g. financial interventions, improvements to convenience or accessibility) led to a significant increase in public transport use. The review showed that for each additional month of following up encouraging interventions of public transport use, the increase in effectiveness was only small or very small (SMD=0.02; 95%CI 0.00-0.04). The meta-analysis showed that encouraging interventions ('carrots') had a greater effect on public transport use than discouraging interventions ('sticks') but neither effect was significant.

Intervention studies
Few other studies were found that investigated other interventions to increase public transport use. Most of them tested the effect of providing free public transport cards. Another intervention study tested the effect of rewards on public transport use (Tsirimpa et al., 2019). For further details, see the intervention description under the Financial incentives section.

Interventions aimed at active mobility of patients and visitors to healthcare organisations
There is currently a lack of healthcare-specific intervention research that focuses on interventions to encourage the active mobility of patients and visitors to healthcare organisations. The available evidence is indirect and was derived from studies on active mobility in other contexts, which means that no conclusions can be drawn regarding effectiveness in the healthcare sector. Targeted intervention studies among patients and visitors are needed to determine which interventions work in this context.

Reducing car use through workplace interventions
In the article on interventions to reduce car use, interventions that reduce car use emerged as being promising. However, this has only been examined in a general context rather than specifically in relation to commuting or having been organised by the workplace. The focus was mainly on the effects of interventions on active mobility and less on the effect on car use. It is, however, important to measure this because it will then be possible to investigate whether cycling or walking has actually replaced car use.

Social aspects
Limited research has been conducted on social aspects as independent interventions to encourage active mobility. Social components do feature as part of broader workplace interventions, but their separate effect on active mobility is largely unknown. One of the reviews found described lessons for influencing mobility behaviour based on research about other behaviours (Pan & Ryan, 2024). Social norm interventions influence behaviour by showing people what others do (or what others consider desirable behaviour) but their effectiveness appears to be highly dependent on context and target group. Factors such as how visible and common the desired behaviour is and personal characteristics such as political or environmental preferences, play an important role in this. Some studies show positive effects, while others found no effects or even reported an opposing effect (this is called a

boomerang effect). According to the researchers, this emphasises the importance of customisation when using social norm interventions.

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