



Do information-based measures affect active travel, and if so, for whom, when and under what circumstances? Evidence from a longitudinal case-control study

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ABSTRACT

Soft, information-based measures to encourage walking and cycling for travel are increasingly being recommended alongside infrastructure investments. Using principles of realist evaluation, we evaluate measures implemented as part of the European Physical Activity Through Sustainable Approaches (PASTA) study in Vienna (Austria), Örebro (Sweden), Rome (Italy), and Antwerp (Belgium) over a 3-year cohort study, and a further follow-up 2.5 years later in Vienna and Örebro. Increases in active modes of travel due to the interventions were most significant for walking, one year after the intervention, and for people in full-time employment. Increases in e-bike use were associated with changes in perceptions of cycling, while increases in walking were not associated with any changes in perceptions of walking. We find evidence supporting previous findings that information provision is unlikely to work as a standalone intervention in the longer run, but may be effective when combined with other policies.

1. Introduction

The health benefits of exercise are widely recognised. These include reduced risk of cognitive impairment and dementia (Loprinzi et al., 2018), hypertension (Liu et al., 2017), type 2 diabetes (Smith et al., 2016), cardiovascular disease, almost halving the risk of depression (Catalan-Matamoros et al., 2016), several types of cancer, and others (Davies et al., 2019). This is true even for exercise carried out in areas with elevated pollution levels (Tainio et al., 2016). Walking and cycling for travel has been recognised as an easy and feasible way of achieving the minimum daily recommended amounts of exercise (Gibson-Moore, 2019). A shift towards active travel (AT) can also reduce congestion, emissions, air pollution, and traffic accidents (Woodcock et al., 2007).

A significant body of empirical research on built-environment (hard) and psychosocial (soft) interventions aimed at increasing active travel exists (Bird et al., 2013; Ogilvie et al., 2011, 2007; Pucher et al., 2010; Yang et al., 2010 for reviews), but reports mixed, and sometimes conflicting, results regarding effectiveness (Panter et al., 2017). Organisational travel plans (OTPs) belong to the category of “soft measures”, an umbrella term that includes personalised travel plans, information provision, car clubs and sharing facilities, or promotional activities (May et al., 2018), undertaken in order to encourage public and active transport use in the trip to work and study. Kelly et al. (2020) identified 129 studies describing cycling promotion initiatives, and classified 93 unique action types. A meta-analysis of 141 travel plan single-group evaluations found a statistically significant, 11% decrease in car-based trips (Möser and Bamberg, 2008). Other meta-analyses and systematic reviews of personalised marketing found smaller but consistent changes (Fell and Kivinen, 2016; Yang et al., 2010), about 4% (Cairns et al., 2008) to 6% (Fujii et al., 2009). Others

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conclude there is not enough evidence to support their effectiveness (Hosking et al., 2010; Macmillan et al., 2013; Stewart et al., 2015; Winters et al., 2017). However, workplace travel plans have been found to be effective in some cases, and both Winters et al. (2017) and Fell and Kivinen (2016) argue that a mix of measures is most likely to be most effective.

In addition, many of these studies rely on self-reported travel, small sample sizes (Panter et al., 2016), short follow-up periods (Goodman et al., 2014; Kearns et al., 2019; Song et al., 2017) or lack a control group (Fujii et al., 2009; Yang et al., 2010), which undermines the conclusions that can be drawn about long-term behavioural outcomes, or may be insufficiently long for substantial behaviour change to have taken place. Studies with sufficient pre-treatment data and multi-year follow-up periods are rare, and do not always find consistent patterns of behaviour change (Heinen et al., 2017).

Even fewer studies examine the causal pathways through which an intervention has worked (examples for the built environment include the studies by Ogilvie et al. (2011) and Sahlqvist et al. (2015)). Richter et al. (2011) identify gaps in knowledge surrounding personalised travel plans and call for more research into the mechanisms explaining why customising information, goal setting, and plan formation are effective.

This study aims to fill these two gaps in the literature and evaluates whether the interventions implemented as part of the Physical Activity Through Sustainable Transport Approaches (PASTA) study shift travel behaviour towards active modes, and whether this change is sustained more than 3 years after the intervention has ended. The PASTA study is a multi-centre cohort study of people's physical activity and travel behaviours in seven different cities in Europe during 2014–2016. Of the seven cities, four implemented interventions that split respondents into treatment and control groups, enabling a comparison between groups that experienced the intervention and those that did not. The interventions were both soft measures (information-based) and hard measures (infrastructure), specifically promotion, creating personalised travel plans, or opening a cycle lane, bicycle storage, or bicycle rack building. We also conduct subgroup analysis in order to explore the relationships between the context (setting), mechanisms (putative causal pathways), and outcomes using the principles of realist evaluation (Pawson et al., 1997). This approach is particularly useful in evaluating transport interventions, which are context-dependent by design (Craig et al., 2012). This study tracks the behaviour of people in two-week intervals for up to a year after the intervention, and again two and a half years later. The case-control study design allows us to control for city-wide campaigns and efforts to increase active travel, as well as control for wider trends.

The next section explains realist evaluation principles and our hypotheses of how behaviour change happens more closely; the Methods section describes the PASTA study, the study sites, interventions, sample characteristics, and statistical methods in more detail. This is followed by the results which include subgroup analyses, a discussion where we compare our results to previous studies and provide policy recommendations, and the conclusion.

2. Realist evaluation principles

Pawson and Tilley propose (Pawson et al., 1997) that evaluation of interventions should be context-specific and theory-driven, rather than aggregate. We follow the simple agenda set out by them, and ask “what works, how, in which conditions and for whom?” By applying realist evaluation, it is possible to identify levers that either mediate or moderate the effects of interventions aimed at increasing active mobility. We formulate a set of contexts, mechanisms, and outcomes which we then statistically test, in order to be able to draw conclusions about causal inferences on behaviour change in our dataset. Context may refer to the institutional, social, or physical setting in which an intervention was implemented, while mechanisms can be defined as the processes and structures that operate in particular contexts to inhibit or generate outcomes (Panter et al., 2017).

The contexts and mechanisms considered in this paper are described in brief in Table 1. We consider employment status, income, and education as primary mediating factors in information-based campaigns, as these factors have been found to influence travel behaviour; perceptions related to travel (Anable, 2005; Goodman et al., 2014) are classified as moderating factors. First, conscious behaviour change may occur as the result of a change in the meaning, and competency (or usefulness) of that activity. Second, information-based measures (related to the health or general transport benefits of active travel) may reduce the influence of social norms on a behaviour. Here, social norms are defined as expectations of society or a specific group regarding what behaviour is appropriate, and how one should feel about it. For example, the use of scooters instead of bicycles (Rome), or stereotypes of cyclists being young, fit, and male. Third, we are interested in finding out whether the influence of social norms, and the influence of the intervention, attenuate over time, or become stronger.

Specifically, considering Bamberg and Möser (2007), Stern (2000) and Whitmarsh and O'Neill (2010), we ask whether two statements reflecting own environmental beliefs and own moral responsibility beliefs, are influenced by the intervention and link to changes in active travel behaviour. Changing the strength of descriptive subjective norms, the visibility and prevalence of walking and cycling in one's surroundings, are also an important mechanism through which behaviour change might be accomplished (Ball et al., 2010); hence we also include how common it is to walk or cycle in the neighbourhood as a moderating variable. Similarly, the influence of injunctive subjective norms (Bird et al., 2018), whether other people important to a person believe that person should walk or cycle, may change as a result of the intervention, and was included as a moderating variable. As motorcycling is associated with a particular image, we also hypothesise that regular motorcyclists will be less affected by any of the interventions. We did not consider built environment changes in our analysis, as these are presumed to have been the same for both groups.

Table 1
Realist evaluation hypothesised context–mechanism–outcome configurations.

Context	Mechanism	Possible outcome
Having a family/dependants	Less flexibility around transport mode choice and timing of travel	Greater reliance on car as a mode of transport
Economic status	Having a part time job increases flexibility of time use; having a higher income increases flexibility with regards to financial outlays for travel purposes	Higher multi-modal travel patterns; more cycling/e-biking
Access to a vehicle	Having access never/only sometimes encourages trying out different modes of travel	Higher multi-modal and variable travel patterns
Health info. treatment	Perceived greater personal health benefit	Lower significance of health-related problems in determining mode choice
Travel info. treatment	Greater understanding of the other (environmental, congestion) benefits of switching to active travel	Higher self-rated beliefs for walking/cycling, and higher rated environmental reasons for walking/cycling
Travel info. treatment	Greater awareness of decision-making in transport	Higher self-rated intent to walk/cycle
Info. treatment	Decrease in influence of what other people think/do	Higher intention to walk/cycle and frequency of mode use, regardless of social norms
Social norms	A behaviour being common or important to people will influence a person's choice (injunctive norm)	Higher rates of the common or socially desirable activity
Cultural meaning of transport mode	Owning a motorbike is associated with a culture and an image that travel plan provision and the intervention are unlikely to change	Maintenance of motorbike use

3. Methods

3.1. Interventions

The Physical Activity Through Sustainable Transport Approaches (PASTA) study¹ is a multi-level longitudinal study of people's physical activity patterns and travel behaviours in seven different cities in Europe (Antwerp, Barcelona, London, Örebro, Rome, Vienna, Zürich), covering different geographical regions, as well as varying city sizes, transport provisions, mobility cultures, and built environments. They also vary from the inexperienced in active travel promotion (Rome) to “mature” cycling cities (Antwerp, Örebro), to cities with a strong political focus on public transport (Vienna, Zürich). Fig. 1 shows their location in Europe. Details of the study design and protocol are provided elsewhere (Dons et al., 2015; Gaupp-Berghausen et al., 2019; Gerike et al., 2016).

All seven cities had overarching mobility plans and comprehensive city-wide policies to increase active mobility. In addition, there was a further specific measure implemented in every city, described in Table 2 and in more detail later. This measure was called the top measure in order to distinguish it from the general, city-wide interventions. There were several criteria for choosing the top measure: innovation, scalability and possibility that it could become a mainstream policy, transferability potential, added value in terms of health and environment, and ability of the measure to meet new challenges. In addition, there was an effort to have a mix of different policies evaluated as a top measure. The top measure also had a specific treatment and control group, whereas the general measures affected the population of the entire city. This experimental design also influenced the choice of statistical analysis, described in more detail in Section 3.4.3.

This study focuses on four of the seven cities. In the remaining three cities, either a separate study exists (e.g. Barcelona, Mueller et al. (2020)), or the design made it difficult to define a control and treatment group and would necessitate a different kind of analysis. Two cities with built-environment based measures with designated treatment and control groups (where treatment was either defined as attending the specific school, or distance from the infrastructure) were chosen. Two cities where soft (information-based) interventions were implemented were also chosen. Rome, in Italy, and Antwerp, in Belgium, were chosen as the built-environment cities, with data collected between 2014–2016. Vienna, in Austria, and Örebro, in Sweden, implemented the soft measure with clear treatment and control groups. Additional surveys were conducted in 2019 in Vienna and Örebro. Further details of the four cities are in Appendix A.

The interventions are described in Table 2. Rome and Antwerp, where only one phase of follow-up surveys was collected between end 2015 and end 2016, both planned mostly built environment measures. In Rome, the intervention was a mixture of bicycle rack provision and safety improvements to the road infrastructure around schools, but not new cycle lanes, as well as information provision aimed specifically at high school students, teachers, parents, and public office employees. This was part of a larger effort

¹ The study was funded by the EC under FP7-HEALTH-2013-INNOVATION-1.

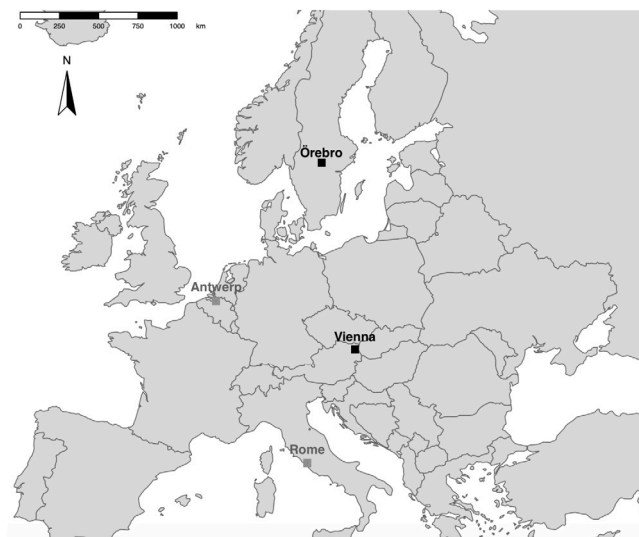


Fig. 1. Map of the four case study cities. Cities in grey were part of the study 2014–2017, cities in black 2014–2019.

Table 2

Details of the interventions in the four cities studied in more detail in PASTA.

City	Measure	Mode	Details
Antwerp	Infrastructure	Cycling	Completion of a cycling highway, to eliminate ‘missing links’ between cycle lanes
Rome	Infrastructure	Cycling	Installing 4000 bicycle racks, and active travel safety improvements around high schools and in public
Örebro	Social environment	Walking, cycling, public transport	Workplace mobility management programme, including information about health, promotion of active travel, 3-month leasing of e-bikes, upgrades to cycle racks, provision of bicycle pumps at work
Vienna	Social environment	Walking, cycling, public transport	Personalised mobility consultancy aimed at people in a period of life change, provision of general information and the use of mobile apps and GPS trackers to provide motivation and advice on switching to active travel

to change the transport culture in Rome, which is heavily reliant on motorised vehicles. In Rome, respondents were automatically assigned to the treatment or control groups/general population group depending on whether they were somehow involved with the schools, or worked at the public office.

In Antwerp, large-scale bicycle storage for more than 2000 bicycles opened at the Antwerpen-Berchem train station in late 2014, in conjunction with a cycle highway (called Antwerpen-Melechen) leading towards the city. This was coupled with a media campaign to increase awareness of the new infrastructure. The aim of the infrastructure was to save time and reduce missing links between parts of infrastructure in the city. In Antwerp, proximity to infrastructure, or having a work/study/home location within the catchment area of the train station or cycle lane led to automatic assignment to the treatment group.

In Vienna, Mobility Agency Vienna and the University of Natural Resources and Life Sciences (BOKU) worked in close cooperation with the city and the walking and cycling commissioner as part of a Europe-wide project called SWITCH (SWITCH, 2016). Part of this cooperation was the implementation of a personalised mobility consultancy for people in life-changing circumstances, namely health problems for which they were recommended to undertake more exercise, or moving home (CORDIS, 2018). This consisted of information provision and mobile apps, which served as reminders and motivators for behaviour change in the top measure affected group. The top measure therefore took a pro-active approach targeting about 2500 people, using novel instruments and combined both travel and public health arguments to achieve behaviour change. In Vienna, respondents could decline to use the services if asked. Coinciding with this the city implemented extensive improvements to the speed and frequency of public transport services. Festivals and initiatives encouraging children and mothers to cycle, people to cycle to work, walk, initiatives to let people submit feedback about the cycling environment in Vienna were all part of the active mobility plan (Klimaaktiv) in Vienna. It is therefore

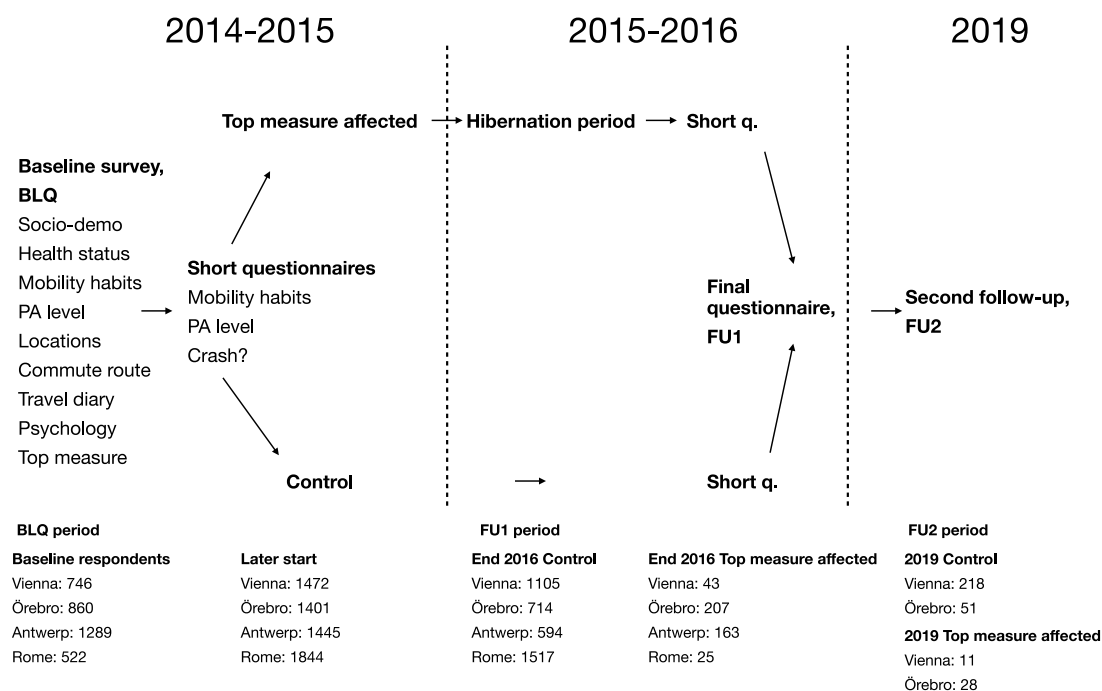


Fig. 2. Survey respondent numbers include respondents recruited after the beginning of the study in 2014. In the baseline questionnaire, Socio-demo refers to socio-demographic variables; PA level to physical activity levels; Psychology to the questionnaire asking about people's attitudes, social environment, and perceptions; In the short questionnaires, Crash? refers to a pedestrian and cyclists' crash questionnaire which they were asked to fill in if they suffered/experienced a collision, or were in a near-miss situation.

expected that travel patterns have changed in Vienna overall, as both the control and top measure affected groups were exposed to the city-wide initiatives.

In Örebro, several companies and public institutions participated in the intervention. The top measure consisted of workplace information campaigns and infrastructure upgrades (leasing of electric-assist bicycles, installation of bicycle racks, bicycle pumps and other low-cost measures) (Gerike et al., 2016) for the top measure affected group, with a specific focus on car driving employees. All components of the intervention had to be implemented for at least 3 months in order to obtain comparable results across companies. All respondents in Örebro who worked at the selected companies were assigned into the treatment group, regardless of whether they made use of the equipment, or read the health information provided. Many other city-wide initiatives were also implemented, affecting both the top measure, and control groups. A free safety "call a friend" number was set up that pedestrians can use at night if they feel unsafe, public transport became free, and a healthy cyclist campaign and a cycling map were published (PASTA, 2016).

3.2. Sample

Respondents were asked to answer a web-based survey on a bi-weekly basis between November 2014 and January 2017.² The baseline questionnaire included questions about sociodemographic, individual, and household characteristics, and respondents' attitudes toward travel. Attitudinal questions were developed in line with the theory of planned behaviour (Ajzen et al., 1991), and the transtheoretical model of behaviour change (Prochaska et al., 1998).

The survey followed a baseline pre-treatment (BLQ), post-treatment (FU1) and follow-up (FU2) case-control design most typically used for randomised controlled trials (also known as PPF). Participants were recruited continuously throughout 2014–2016, and as a result some respondents filled in a baseline questionnaire after the intervention was implemented (632 in Vienna, 1158 in Rome, 397 in Örebro, and 89 in Antwerp). Fig. 2 details the flow of survey sampling during the study. None of the interventions had been implemented at baseline, and all participants were divided into general, control, and top measure affected groups after the baseline questionnaire. Respondents who joined later were added to the general population group, in order to observe the general city-wide transportation trends. Assignment to the top measure group happened after the baseline questionnaire was answered in 2014, and was based on (a) living in the catchment area of a hard measure (infrastructure) top measure, or (b) working for an employer who administered the scheme. All top-measure affected respondents in the second follow-up in 2019 had been a part of the study since 2014, and all members of the control group in 2019 had completed at least two questionnaires during the 2014–2016 study period.

² http://pastaproject.eu/fileadmin/editor-upload/sitecontent/City_survey/PASTA-questionnaires.pdf.

Table 3

Baseline characteristics for all four cities, 2014–2016, 2016 includes people recruited during the study. At baseline, treatment and control groups were not statistically different in Antwerp, Rome, or Örebro. In Vienna, treatment was partly based on doctors' recommendations to move more actively, hence groups are slightly different. In Antwerp, the treatment group lived in one region of the city, where they could be plausibly influenced by the infrastructure.

Variable	Level	N (%) Baseline, 2014 N = 3417	N (%) End of follow-up 1, 2016 N = 4373
City	Antwerp	1289 (37.7%)	757 (17.3%)
	Rome	522 (15.3%)	1546 (35.2%)
	Vienna	746 (21.8%)	1148 (26.3%)
	Örebro	860 (25.2%)	922 (21.1%)
Top measure affected	Yes	–	442 (10%)
	No	–	3931 (90%)
Sex	Female	1837 (53.8%)	2140 (48.9%)
	Male	1580 (46.2%)	2233 (51.1%)
Age (range) in years		41.5 (18.1–91.4)	41.8 (18.1–87.7)
Household, children <17	Yes	1130 (33.1%)	1381 (31.6%)
	No	2287 (66.9%)	2992 (68.5%)
Education level	Tertiary or equivalent	2233 (65.3%)	2577 (58.9%)
	Secondary school	722 (21.1%)	1077 (24.6%)
	Primary or other	461 (13.5%)	719 (16.5%)
Employment status	Employed	2768 (85.5%)	3288 (75.2%)
	Student	353 (10.3%)	568 (13%)
	Retired or other	296 (8.7%)	517 (11.8%)
Access to a car	Always	2042 (59.8%)	2480 (56.7%)
	Sometimes	884 (25.9%)	1176 (26.9%)
	Never	491 (14.4%)	717 (16.4%)
Access to a bicycle	Yes	3098 (90.7%)	3685 (84.3%)
	No	319 (9.3%)	688 (15.7%)
Self-rated health	Excellent/good	2634 (77.1%)	3346 (76.5%)
	Fair/poor/other	782 (22.9%)	1027 (23.5%)
Self-rated frequency of walking	Less than once a month	217 (6.4%)	273 (6.2%)
	1–3 days per month	296 (8.7%)	388 (8.9%)
	1–3 days per week	702 (20.5%)	981 (22.4%)
	Daily or almost daily	2202 (64.4%)	2661 (60.9%)
Self-rated frequency of cycling	Less than once a month	795 (23.3%)	1483 (33.9%)
	1–3 days per month	330 (9.7%)	501 (11.5%)
	1–3 days per week	587 (17.2%)	782 (17.9%)
	Daily or almost daily	1705 (49.9%)	1607 (36.7%)

Post-treatment questionnaires were administered only after an approximately 6-month hibernation period had ended, during which the top measure was implemented (Gerike et al., 2016). For each city, permission to collect, store, and process data was obtained from local ethics committees. On enrolment, participants registered on the PASTA website and gave informed consent.³

1447 adults in Antwerp, 1849 adults in Rome, 1477 adults in Vienna, and 1404 adults in Örebro completed questionnaires between November 2014 and January 2017 (BLQ or FU1) about their travel patterns, preferences, motivations, and filled in travel diaries. 286 people in Vienna and 96 people in Örebro completed a follow-up survey and travel diary in June 2019, with 308 valid responses overall.

3.3. Baseline characteristics

Table 3 presents the characteristics of the respondents examined as predictors of behaviour change towards active mobility. We included respondents for whom information on sex, age, employment status, city of residence, access to a car, access to a bicycle, and top measure affected/control group assignment were available. C presents the baseline characteristics for Vienna and Örebro only, and includes the second round of follow-ups conducted in 2019. Information on the frequency of walking and cycling was based on self-reported frequency over the past week. All other values were also self-reported, apart from whether a respondent belonged to a top-measure affected, or control group.

³ Available at http://pastaproject.eu/fileadmin/editor-upload/sitecontent/City_survey/PASTA-questionnaires.pdf.

3.4. Statistical analyses

3.4.1. Exposure

The exposure was membership in the top measure affected (1) or control (0) group. Both groups were also exposed to the wider initiatives coordinated by both cities aimed at reducing car-based travel described in Section 3.1.

3.4.2. Outcome

Individual travel behaviour was measured bi-weekly through self-reported frequencies of walking, cycling, e-bike use, public transport use, driving, and motorcycling. Respondents were asked to summarise the frequency of different mode for the past seven days approximately every two weeks during the baseline period (BLQ), re-entry period (for top-measure affected respondents) and final 2016 period of questionnaires (FU1), and follow-up 2019 (FU2) questionnaires. Respondents only had to fill in one questionnaire in 2019.

3.4.3. Analysis

First, using the outcome variables described above, we calculate the average mode use frequency (days per week) for each city as a descriptive statistic. We then conduct statistical analysis (details in Appendix B) that allows us to evaluate the change in transport mode use frequency at baseline and follow-up 1, or baseline, follow-up 1 and follow-up 2 using a differences-in-differences regression. This effectively splits the dataset into four groups: baseline treatment and control groups, and post-intervention treatment and control group. This is possible because of the hibernation period respondents entered when the intervention was being implemented, which creates a clean break for the before- and after-datasets. Using a differences-in-differences regression design allowed us to control for any city-wide trends in travel, as it separates out the total change in the treatment group, less the total change in the control group. As the groups were statistically very similar at baseline, any differences in trends were then attributed to the specific top measure intervention. Next, we conducted subgroup analyses to evaluate the role of contexts and mechanisms we hypothesised could influence the strength of the interventions. All coefficients reported are standardised β coefficients (mean 0, SD 1) and standard errors, and can be interpreted the following way: for every one point (standard deviation) increase in the values of the independent variable, the dependent variable of interest increases by the β coefficient multiplied by the dependent variable's standard deviation. For example, a standard deviation increase in age might increase the frequency of walking by 0.2 (the reported β coefficient) standard deviations of walking. With standardisation, beta coefficients describe the relative strength of independent variables. The statistical analysis was carried out using the *plm* package in Rv3.6.2 (Croissant and Millo, 2008).

4. Results

4.1. Study population characteristics

3239 respondents filled in the baseline questionnaire in the 2014–2015 period. Due to the continuous recruitment of participants in PASTA, 4366 respondents filled in questionnaires during the post-treatment phase of PASTA. We included these to track general travel trends in all four cities. At the end of the 2014–2017 PASTA survey, 716 respondents (28 top measure affected and 454 control group respondents in Vienna, and 81 top measure affected and 153 control group respondents in Örebro) gave consent to being contacted for further research in the future. 373 respondents filled in the follow-up questionnaire sent in 2019; 308 were valid. A more detailed overview of the differences between cyclists and non-cyclists specifically in the PASTA dataset has been done by Raser et al. (2018).

Our sample was evenly split between Rome, Vienna, and Örebro during the first two waves of questionnaires, with a slight over-representation of Antwerp. Most respondents in the first follow-up came from Rome and Vienna. Vienna is significantly over-represented at the second follow-up in 2019, comprising 76.6% of the sample. As expected, the average age rose from 42 to 46 throughout the study. More females (53%) than males (46%) filled in the questionnaires during the first two waves. Overall, respondents were highly educated, with 70% having attained higher education degrees. Around half of the respondents always had access to a car, and over 80% had access to a bicycle. More than 80% of respondents rated their health as good, very good, or excellent. Comparisons with local authority and national data suggest that our respondents are representative in terms of age distribution, and particularly in the final wave of questionnaires in terms of gender, but are significantly over-educated for Austrian standards.⁴

4.2. Aggregate mode choice change

4.2.1. Mode use frequency

Mode use frequency for Rome and Antwerp, where data for 2014–2016 is available, are presented in Table 4. Mode use frequency for Vienna and Örebro, where we conducted a follow-up in 2019 as well, are presented in Table 5. The number of observations in each group is shown in Fig. 2.

⁴ This may be due to the popularity of vocational training in Austria, which respondents may have classified as tertiary or equivalent education.

Table 4

Frequency of mode use expressed in days per week, Rome and Antwerp, baseline to follow-up one, 2014–2016, \pm shows standard deviation, by top-measure vs. control.

Rome	Top measure	Walk	Bike	E-bike	Public t.	Driving	Motorbike
BLQ	Yes	2.1 \pm 1.2	1.4 \pm 1.2	0.5 \pm 0.7	2.2 \pm 1.2	2.1 \pm 1.1	0.9 \pm 1.1
	No	2.5 \pm 1.1	1.6 \pm 1.1	0.8 \pm 0.6	2.3 \pm 1.1	2.1 \pm 0.9	1.1 \pm 0.9
FU1	Yes	3.1 \pm 1.1	1.4 \pm 0.7	1.0 \pm 0.2	2.6 \pm 1.3	2.1 \pm 0.8	1.4 \pm 0.9
	No	2.5 \pm 1.1	1.7 \pm 1.0	0.9 \pm 0.5	2.1 \pm 1.0	2.1 \pm 1.0	1.2 \pm 0.9
Antwerp							
BLQ	Yes	2.2 \pm 1.0	2.4 \pm 1.2	0.8 \pm 0.6	2.0 \pm 1.0	2.1 \pm 0.8	0.8 \pm 0.6
	No	2.1 \pm 0.9	2.6 \pm 1.1	1.0 \pm 0.6	1.7 \pm 0.9	2.1 \pm 0.8	0.9 \pm 0.4
FU1	Yes	2.4 \pm 0.9	3.0 \pm 1.0	1.0 \pm 0.3	1.6 \pm 0.8	2.0 \pm 0.7	1.0 \pm 0.2
	No	2.0 \pm 0.9	2.6 \pm 1.1	1.1 \pm 0.6	1.6 \pm 0.9	2.1 \pm 0.8	0.9 \pm 0.4

Table 5

Frequency of mode use expressed in days per week, Vienna and Örebro, baseline to follow-up one to follow-up two, 2014–2016–2019, \pm shows standard deviation, by top-measure vs. control.

Örebro	Top measure	Walk	Bike	E-bike	Public t.	Driving	Motorbike
BLQ	Yes	2.0 \pm 1.0	2.0 \pm 1.2	0.6 \pm 0.7	2.0 \pm 1.4	2.2 \pm 1.0	0.6 \pm 0.7
	No	2.2 \pm 1.1	1.9 \pm 1.1	0.7 \pm 0.5	1.7 \pm 1.2	2.2 \pm 1	0.8 \pm 0.6
FU1	Yes	2.3 \pm 0.9	2.5 \pm 1.1	1.1 \pm 0.4	1.3 \pm 0.8	2.3 \pm 0.9	1.0 \pm 0.4
	No	2.1 \pm 1.0	1.9 \pm 1.1	0.8 \pm 0.5	1.7 \pm 1.1	2.2 \pm 1.0	0.8 \pm 0.5
FU2	Yes	3.2 \pm 0.9	2.4 \pm 1.7	0.9 \pm 1.6	1.6 \pm 1.1	2.5 \pm 1.1	0.2 \pm 0.7
	No	3.2 \pm 1.2	2.7 \pm 1.6	0.3 \pm 0.9	1.3 \pm 1.1	2.6 \pm 1.1	0.1 \pm 0.3
Vienna							
BLQ	Yes	2.4 \pm 1.3	1.9 \pm 1.1	0.6 \pm 0.6	2.4 \pm 1.2	2.1 \pm 1.1	0.7 \pm 0.8
	No	2.6 \pm 1.2	2.0 \pm 1.2	0.8 \pm 0.5	2.4 \pm 1.1	1.9 \pm 1.0	0.8 \pm 0.6
FU1	Yes	3.3 \pm 0.8	1.5 \pm 0.8	1.0 \pm 0.2	3.1 \pm 0.8	1.8 \pm 0.7	1.1 \pm 0.4
	No	2.8 \pm 1.1	1.9 \pm 1.1	0.9 \pm 0.4	2.4 \pm 1.0	1.9 \pm 0.9	1.0 \pm 0.5
FU2	Yes	3.9 \pm 0.3	1.9 \pm 1.6	0.3 \pm 0.6	3.3 \pm 0.9	2.0 \pm 0.9	0.4 \pm 0.8
	No	3.7 \pm 0.7	2.6 \pm 1.5	0.2 \pm 0.7	3.2 \pm 1.0	1.6 \pm 1.1	0.1 \pm 0.5

In Antwerp, large increases for walking and cycling frequency in the top measure affected group can be observed (increase in cycling by 0.6 days/week vs. no change for the control group). This was, however, accompanied by decreases in public transport use (0.4 days/week less transit use in the top measure vs. a 0.1 day/week decrease in the control group). In Rome, similar increases in walking can be observed, but there is a marked increase in e-bike and public transit use in the top measure affected group as well (by 0.5 days/week for e-biking, and 0.4 days/week for public transit use). In both cities, the overall frequency of driving did not change.

In Örebro, changes in walking frequency were similar for both the top measure and control groups, with a marked increase in walking during the 2019 questionnaire (an increase of more than 1 day/week for both groups). Cycling frequency increase for the top measure group between the baseline and first follow-up in 2016 by 0.5 days/week and remained unchanged for the control group. However, this trend was reversed in the second follow-up in 2019, when cycling in the top measure affected group remained stable and cycling in the control group increased by 0.8 days/week. However, e-bike use increased in the top measure affected group between baseline and the first follow-up, and remained high even in the second-follow-up in 2019. In the second follow-up, driving frequency increased for both groups.

In Vienna, the top measure affected group increased walking slightly more than the control group in the first follow-up. The increase in walking frequency was much more pronounced, and present for both groups, when a comparison between the baseline and second follow-up is made, with an increase of 1.5 days/week, and 1.1 days/week for the top measure and control groups, respectively. The top measure affected group reduced reported frequency of bicycle use, but increased the use of e-bikes from baseline to follow-up one. However, this effect was lost by the second follow-up in 2019. Large increases in public transit use in the second follow-up can be observed for both groups, though no consistent pattern for driving exists.

Overall, it appears that walking is easier to influence and keep up after an intervention has finished than cycling. In Antwerp and Örebro, cycling, e-biking, and public transport use appear to be competing modes that people substitute for one another. Finally, driving patterns have not changed consistently in any of the cities.

4.2.2. Minimally adjusted model, all four cities

In order to determine whether these changes are significant, we conducted panel data analysis for each city. We control for sex (female 1/male 0), age (continuous variable), car access, and top measure/control group membership (control group being the reference category). The dependent variable is the self-reported frequency of mode use over the past seven days, and we conducted separate regressions for each of the six modes. Respondents were assigned into a pre-intervention (0) and a post-intervention (1) time-period, depending on when they filled out the questionnaires. The results are presented in the left-most column labelled “Full results” in Fig. 4, and the full regression results are in Appendix D. As expected, the increase in walking is significant for all four

cities (0.23, 95% CI 0.15–0.31 for Antwerp; 0.70 95% CI 0.43–0.97 for Rome; 0.31, 95% CI 0.20–0.42 for Örebro; and 0.77, 95% CI 0.58–0.96 for Vienna), as is the increase for e-biking (0.22, 95% CI 0.17–0.27 for Antwerp; 0.36 95% CI 0.23–0.49 for Rome; 0.31, 95% CI 0.26–0.36 for Örebro; and 0.26, 95% CI 0.17–0.34 for Vienna). The two northern cities, Antwerp and Örebro, both show a statistically significant increase in cycling (0.52, 95% CI 0.43–0.62 for Antwerp; 0.58, 95% CI 0.47–0.69 for Örebro), and decrease in public transit use (−0.33, 95% CI −0.41–0.24 for Antwerp; −0.57, 95% CI −0.69–0.46 for Örebro). In contrast, the increase in public transit use in Rome and Vienna (0.26, 95% CI 0.00–0.52 for Rome; 0.63, 95% CI 0.44–0.82 for Vienna) is counterbalanced by a decrease in cycling in those two cities (significant for Vienna only, −0.30, 95% CI −0.49–0.12), relative to their control groups. Furthermore, Vienna, which exhibits the largest increase in public transit use, is also the only city that shows a significant decrease in driving (−0.46, 95% CI −0.62–0.29). Likewise, it appears that regular cycling frequency fell due to a comparable increase in e-bike use. Motorcycle use was low in the sample overall, but increased for the top measure affected groups in all four cities.

4.3. Long-term influences in Örebro and Vienna

Follow-up questionnaires sent to respondents in Örebro and Vienna in 2019 were used to find the long-term effect of the soft-measure interventions. Fig. 3 shows the treatment effects separately for the follow-up 1 and follow-up 2 periods for 308 people who were sampled for the entire 2014–2019 period. Treatment is shown relative to the baseline, minus changes in the control group. For some modes, the intervention effect decreased over time (walking, public transit, driving in Vienna; cycling and driving in Örebro), but for others, the effect became stronger in the second follow-up (notably e-bike use in Örebro, 0.11, 95% CI −0.08–0.30 in FU1, and 0.43, 95% CI 0.13–0.73 in FU2). This shows that while in many cases, an intervention may appear to be successful in the first year after implementation, the effectiveness of the intervention may fade after a longer period of time. Full regression results are in Appendix E.

4.4. Contexts

In line with the contexts and mechanisms proposed in Section 2, we conducted subgroup analyses in order to determine the relative influence of different socio-economic, demographic, and personal factors on the effectiveness of the interventions.

4.4.1. Socio-economic groups

In order to evaluate the influence of socio-economic groups, we split the dataset into university educated and fully employed; university educated with other types of occupation; university educated and high income; non-university educated and fully employed; non-university educated with other types of occupation; and full sample results. Fig. 4 shows coefficient results for socio-economic subgroup analysis for all modes of transport. Appendix D includes regression results for each transport mode and socio-economic group.

Fig. 4 shows the change in mode use frequency over time for the top measure affected group, relative to the control group. The top measure was most effective at influencing the behaviour of people with a degree in full-time employment, specifically for walking (0.20, 95% CI 0.10–0.30 for Antwerp; 0.67 95% CI 0.36–0.99 for Rome; 0.14, 95% CI −0.00–0.29 for Örebro; and 0.51, 95% CI 0.18–0.85 for Vienna) and e-bike use (0.13, 95% CI 0.07–0.18 for Antwerp; 0.38 95% CI 0.15–0.61 for Rome; 0.24, 95% CI 0.16–0.31 for Örebro; and 0.37, 95% CI 0.23–0.51 for Vienna). Driving showed the least change overall, though people with tertiary education and in full-time employment exhibited slight decreases in driving relative to the control group across all four cities. Curiously, motorcycling frequency also increased consistently across most socio-economic groups and cities. Effects for other transport modes vary both by city, and socio-economic grouping. Relatively few people identified themselves as high income in Rome and Vienna, or as people not in full-time employment in Rome. This increased the standard errors for these groups, though variable influences were mostly in the same direction as all other socio-economic groups.

Respondents without a university degree in other occupations than full time employment were the least uniform, and often reacted to the interventions differently from city to city. For example, they increased public transit use in Vienna (1.01, 95% CI 0.60–1.43), but showed no consistent change in Rome or Örebro, and even decreased transit use in Antwerp (−0.82, 95% CI −1.23–0.41). Rome is the only city where the behaviour of fully employed individuals differed quite widely by the level of education attained. Public transit use increased (0.59, 95% CI 0.28–0.91) slightly for the tertiary-educated fully employed group, but the opposite change (−0.60, 95% CI −1.10–0.09) was observed for non-university educated fully employed individuals in Rome. Smaller, but still opposing, effects were observed for driving and cycling, as well.

4.4.2. Family and dependants

Having under-age or elderly family members is proposed as a context in which respondents have less flexibility with regards to their use of time and mode choice. Instead, they may be reliant on cars for escorting purposes, thus reducing the effect of the top measures on modal shift. Respondents were asked to list the number of household members under the age of 6, aged 6–17, 18+, and 65+. We estimated whether the top measure had significantly different effects over time, depending on household size and type.

Overall, living with children or with elderly did not change the effect of the intervention significantly, implying that behaviour change within the top measure affected group happened irrespective of household size or membership. Marginal effects were detected for some subgroups. E-bike (−0.19, 95% CI −0.38–0.00) and motorcycle use (−0.39, 95% CI −0.67–0.12) over time was significantly lower for top measure affected respondents with a child under 6 in Rome. Conversely, for the same group, e-bike use was increased (0.14, 95% CI −0.01–0.29) in Vienna. Not enough people reported living with elderly members of the household to enable comparison across cities or control vs. top measure affected groups. Regression results are presented in Appendix F.

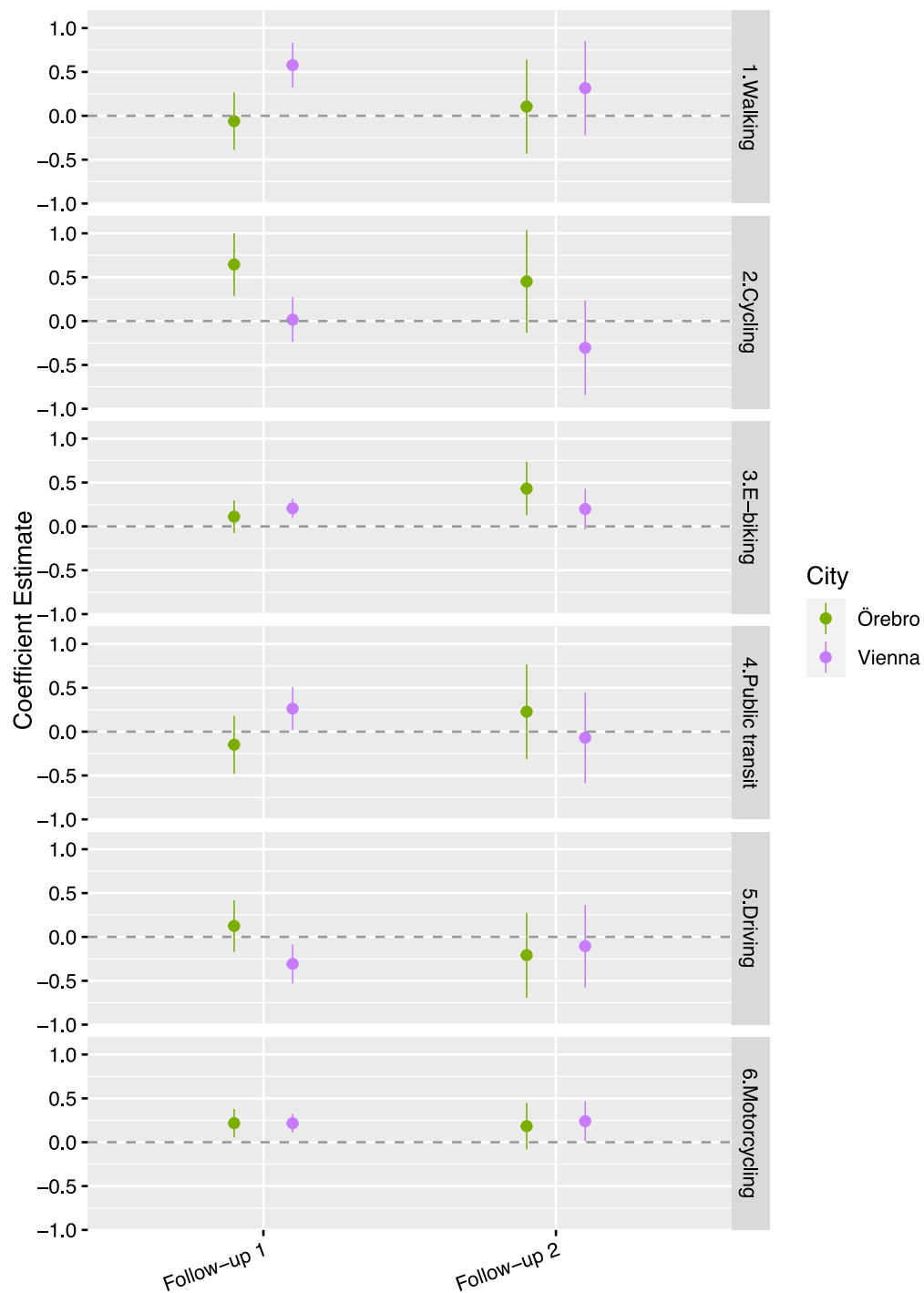


Fig. 3. Treatment effect over time in selected cities.

4.5. Mechanisms

Following Section 2, where we proposed that some of the mechanisms through which travel behaviour can change is through a change in the relative strength of social and personal influences on travel, we analyse people's responses regarding their subjective views of walking and cycling. Respondents were asked: how common it is to walk/cycle in their neighbourhood; how strongly their sense of moral responsibility requires them to walk/cycle; how strong their own intent to walk/cycle is; how strongly their own

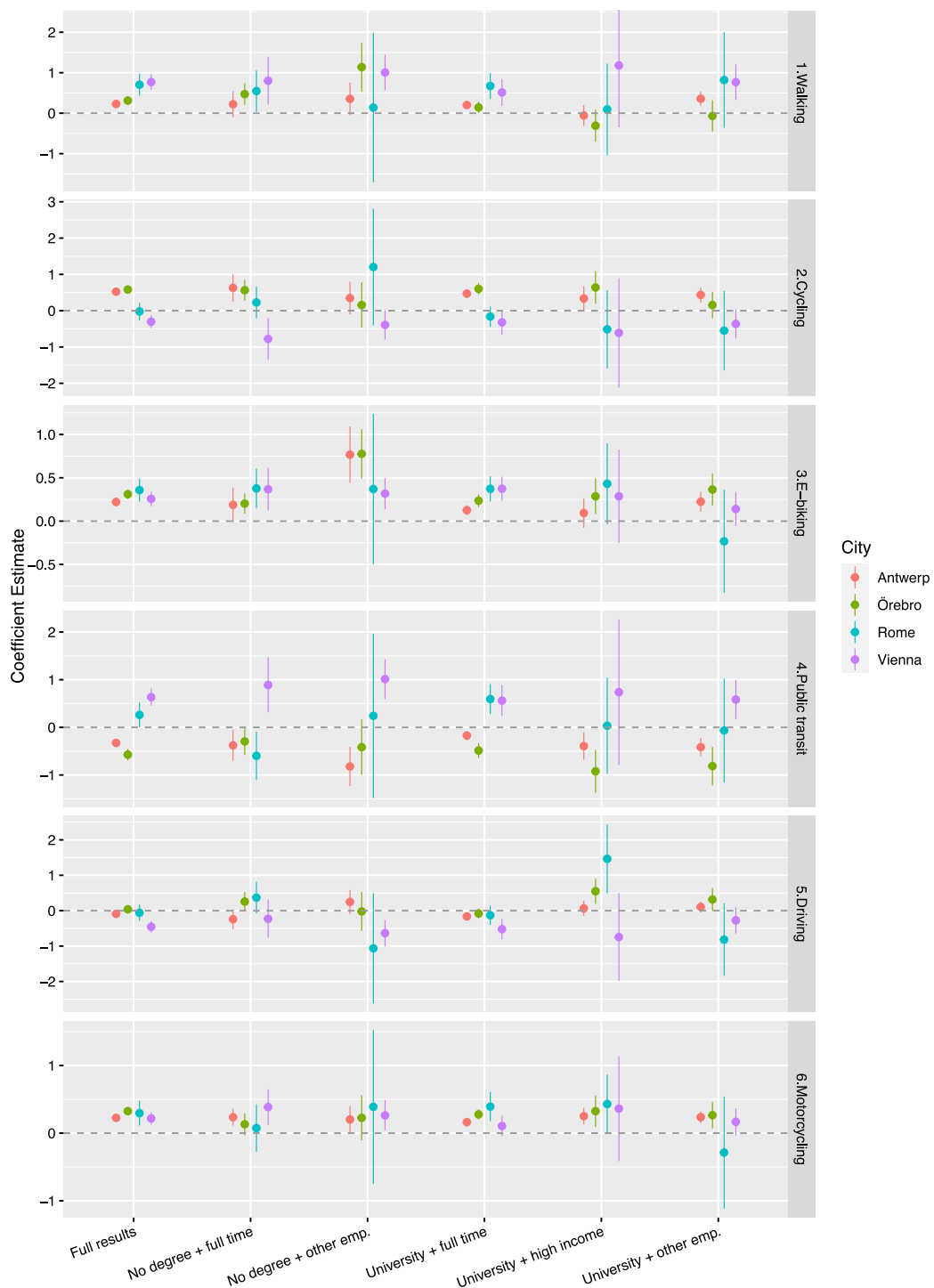


Fig. 4. Top measure effect on transport mode use frequency by socio-economic group.

values, regardless of what other people think, require them to walk/cycle; and how strongly people important to them think they should walk/cycle. In order to find whether changes in psychological indicators regarding active travel persisted through time, we focus only on Vienna and Örebro, where both the first and the second follow up questionnaires were conducted. Due to the small sample size in the second follow-up wave, we pooled both cities together.

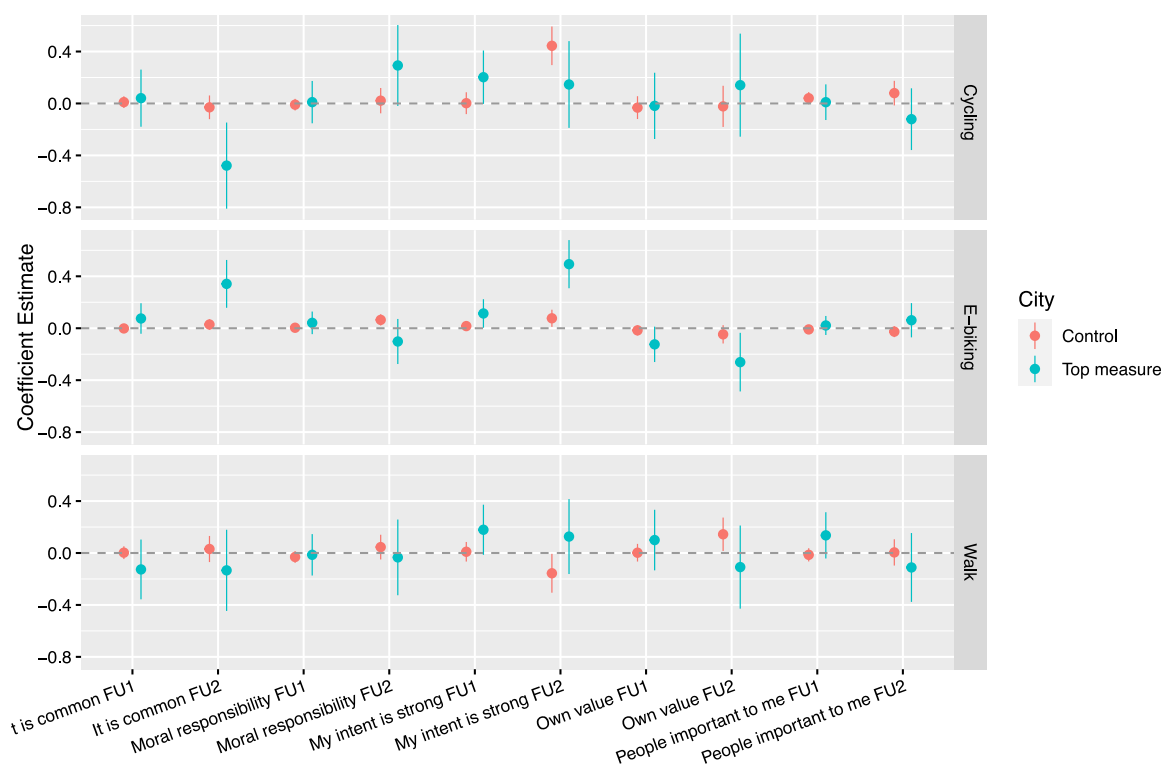


Fig. 5. Influence of cycling-related perceptions on behaviour.

4.5.1. Influences of walking perceptions

Influences of walking perceptions on walking were minimal, and did not differ by time, or by top measure affected vs. control groups. The regression results are presented in Appendix G. The influences of cycling perceptions on walking were also insignificant, and are shown in Fig. 5.

Although walking frequency did increase significantly for the top measure affected group (see Fig. 4), perceptions of walking, or their influences on walking, did not change as a result of the intervention. This implies that increasing the frequency of walking, a more mundane and ordinary activity among society, requires less conscious decision-making and careful deliberation than increasing cycling or e-biking use do. The increases in walking, when they occurred, also persisted through to the second follow-up wave of questionnaires in 2019.

4.5.2. Influences of cycling perceptions

The influences of cycling perceptions on mode use for both top measure affected and control group are presented in Fig. 5. While mode use change was significantly different in the top measure group already in the first follow-up in 2016, a significant change in perceptions relative to the control group is only detectable three years after the intervention was implemented, during the second follow-up wave. The relative influence of the perception of social norms, specifically whether it is common to cycle, did not change for the control group. However, the top measure affected group was significantly more likely to e-bike when the respondent considered it common to cycle (0.08, 95% CI -0.04 – 0.19 in FU1; 0.34 , 95% CI 0.16 – 0.53 in FU2). The intervention helped change perceptions of how common it is to cycle, and this change helped alter behaviour towards greater e-bike use over bicycle use, over the longer run. Similarly, the influence of one's own sense of moral responsibility towards travelling more sustainably increased significantly for the top measure affected group for cycling for the second follow-up period (0.29 , 95% CI -0.02 – 0.60). This effect was not present for e-bike use, potentially because their consumption of electricity may be perceived as less sustainable. In fact, for e-biking a stronger sense of own values that would require a person to walk or cycle where possible, was negatively associated with e-bike use, and grew stronger in the second follow-up survey (-0.12 , 95% CI -0.26 – 0.01 in FU1; -0.26 , 95% CI -0.49 – 0.04 in FU2).

The strength of one's own intent to cycle in the future led to significantly higher cycling for the control than top measure affected group (0.44 , 95% CI 0.30 – 0.59 in FU2 as opposed to 0.15 , 95% CI -0.19 – 0.48 in FU2). Conversely, strong intent led to significantly higher e-biking for the top measure affected than control groups (0.49 , 95% CI 0.31 – 0.68 in FU2). It is possible that for the top measure affected group, cycling had become a normalised activity and e-biking was a new mode the respondents had to challenge themselves to choose. In contrast, the control group perceived the bicycle as their challenge. In both cases, these effects became stronger in the second follow-up wave.

The influence of the variable representing injunctive social norm, whether other people think a person *should* cycle, did not reduce significantly as a result of the intervention, contrary to what was hypothesised. Although not tested in this study, this could be because other people's opinions consistently matter to one's own decision-making process and in promoting behaviour change (Heath et al., 2012).

5. Discussion

5.1. Summary of results and comparison with previous research

The case-control cohort study design of the PASTA study allowed us to determine the effectiveness of largely information-based travel-to-work plan interventions in promoting walking and cycling. We conducted regression analyses to estimate the differences in transport mode use frequency over time between control and top-measure affected groups for four cities for 5460 participants, and conducted subgroup analyses to test specific contexts and mechanisms that may influence the effectiveness of the interventions. We tested different household size and socio-economic group membership as influencing contexts, and individual perceptions as moderating mechanisms of the interventions. In order to establish the duration and time over which the interventions work, we conducted additional follow-up surveys in two of the four cities 2.5 years after the initial study was completed, resulting in data spanning five years for 308 individuals.

The interventions were effective in increasing active travel in the 2014–2016 period, but this was not associated with equally large shifts away from car transport, but rather from public transport to walking, or from cycling to e-biking. Broadly in line with previous research (Brand et al., 2014; Goodman et al., 2014), our results highlight society's overall dependence on cars for transport. At an aggregate level, changing the outcome variable of interest to individual trips (obtained from trip diary data), or adding additional control variables, did not change the general trends. However, considerable variability in travel patterns between cities and groups indicates that the interventions were indeed highly dependent on local contexts, and provides support for the use of realist evaluation, in order to understand “what works, when, and for whom” (Pawson et al., 1997).

Regardless of socio-economic group membership, certain city-specific (and therefore intervention-specific) effects are evident. In Vienna, driving and cycling frequency fell slightly for most socio-economic groups; public transit, e-biking, and walking increased. In Antwerp and Örebro, more similar culturally, walking, cycling, and e-bike use increased for most socio-economic groups, while public transit use fell across all groups. In Rome, socio-economic group effects dominated city-wide effects. Rome is both larger, and so unequal in terms of social, income, and employment distribution, that it has been called “two cities” instead of one (Lelo et al., 2019). This may help explain why different socio-economic groups behave differently in Rome but not in the other three cities.

Our study is consistent with findings that high income/highly educated people may have higher senses of environmental moral responsibility, but may continue having less sustainable travel behaviour (Anable, 2005). We do not find a consistently different pattern of intervention effect among university educated and non-university educated respondents, contrasting the findings of Goodman et al. (2014). As interventions in all four cities included variants of travel-to-work plans, full-time employees were the most likely to benefit most from the interventions. Indeed, the results of regressions divided by socio-economic grouping confirm this hypothesis. On the other hand, the results could also imply that switching to active modes is not a viable alternative for non-university educated, flexibly employed people (Groth, 2019). We suggest that different policies need to be designed to suit the accessibility needs of every socio-economic group.

In Vienna, no consistent change in travel patterns across modes in the top measure affected group was observed over both follow-up periods. This may be due to the type of people the intervention targeted, namely people with health problems, and people who recently moved homes. However, *individualised* travel plans were found more likely to be effective (Yang et al., 2010), and large life changes were found to be critical enablers of travel-related behaviour change (Christensen et al., 2012; Marsden et al., 2020) in other studies. Finally, many studies cite lack of access to a bicycle as the main barrier to the adoption of cycling (Kelly et al., 2020; Savan et al., 2017), and in Örebro, part of the intervention included renting e-bikes to employees for free. It is thus perhaps not surprising that the largest relative increase in e-biking was observed in Örebro.

5.2. Policy recommendations

Policymakers need to identify whether their active mobility plans aim to increase the health of citizens, or reduce carbon emissions. The interventions were successful at increasing frequency of active travel, in particular walking. The effect on cycling and e-biking decreased over time. Provided walking can be encouraged effectively and is the most resilient form of active mobility once established, concepts such as the 15-minute city, superblocks in Barcelona, or pedestrian zones, would have a higher potential of achieving regular active mobility and mode shift. If, however, the effects of a costly policy may be lost several years after the intervention has ended, it may be desirable to design repeated interventions, where people receive information to reinforcing their new behaviours for longer, or develop commitment mechanisms, as suggested in the review of ICT-based transport interventions by Andersson et al. (2018) and Abrahamse et al. (2005).

Mobility advice in Vienna and Örebro was personalised, but the interventions did not include a separate group with generic active mobility advice, so it is not possible to evaluate the relative benefits of personalisation, even though Andersson et al. (2018) recommend interventions are personalised. Alternatively, it may be beneficial to phase in policies that target walking first (where behaviour can change without changes in perceptions), then followed by cycling, and followed finally by e-biking (which may be an option only for people who are comfortable cycling already).

None of the interventions studied reduced the frequency of driving significantly for both waves of the survey, and would thus not reduce carbon emissions from transport significantly. Furthermore, apart from Rome, increases in active travel were mostly accompanied by decreases in public transit use, not driving. Policymakers thus need to weigh whether it is worth using public funds for policies that may not achieve their desired goals, particularly if the goal is reducing vehicle-based traffic.

Finally, as the examples from Vienna and Örebro show, we recognise that information-based measures are unlikely to work on their own. In Vienna, where driving did fall during the first follow-up wave, the city also conducted a large-scale expansion of public transport services and frequency, making the switch away from cars more attainable. Örebro was the only city in which free renting out of e-bicycles for longer periods was part of the intervention. As a result, it is the only city where e-bike use had significantly increased for the top measure group for both the first, and the second follow-up waves of questionnaires. In their review of personalised travel planning measures, Cairns et al. (2008) conclude that standalone interventions have the potential to reduce car travel by only around 4%–5%. However, when coupled with other interventions, effectiveness can increase up to 20%. Similarly, Song et al. (2017) argue that infrastructure investments alone may be necessary, but are not sufficient, in order to increase walking and cycling. Keall et al. (2015) argue that joining behaviour and infrastructure-focused policies can almost double the impact on reducing carbon emissions. Combining interventions was also suggested by Abrahamse et al. (2005) in the context of energy saving within households. We support these findings and conclude that more integrated measures are needed in order to achieve a substantial shift away from car-based travel in urbanised areas in the future.

5.3. Limitations of this study

The original PASTA study used opportunistic recruitment methods to sample respondents. The sample is therefore not representative of the general population and oversampled regular cyclists, younger people, and more highly educated members of the public (Gaupp-Berghausen et al., 2019). The findings of this study can nonetheless be applied to tailor measures to particular subgroups within the general population. A sensitivity analysis using propensity score matching (matching respondents in the treatment and control groups as closely as possible based on sociodemographic and location variables) was carried out for the BLQ-FU1 part of the study, which showed similar, but less significant results. This is likely due to the lower power of the resulting smaller sample.

This study also assumed that city-wide initiatives had an equal effect on both the treatment and control groups throughout the study period. Exposure to soft measures, such as active travel campaigns and transport education for children, deployed in some form in all four cities, could not be controlled for. Exposure to hard measures was measured by comparing work/study and home locations of people in the treatment and control groups, finding no statistical difference in Örebro, Vienna, and Rome. In Antwerp, treatment group was based on proximity to a specific piece of infrastructure, so the treatment and control groups did differ in terms of their home and work/study locations. However, most of the hard measures were implemented throughout the city (creating low-speed streets near schools), which suggests that both the control and treatment groups should have been affected by these policies.

Due to the focus of the study on transport and active mobility in particular, the long-term nature of the study and time-consuming survey, people interested in walking and cycling may be more likely to remain in the study. This introduces the risk of selection bias. Attrition of survey participants was severe in the 2019 wave, with only 11 top-measure-affected respondents in Vienna participating. The study did not ask people specific questions about the top measure, and whether it influenced their opinions on active travel and hence only proxy measures for perception changes could be used, potentially not capturing the full effect of the interventions. However, in order to fully understand processes of behaviour change, full ethnographic studies may be necessary (Panter et al., 2017). Finally, the rise of shared mobility schemes such as Uber and Lyft were not considered in the design of this study, even though their rise could have changed mobility patterns (Graehler et al., 2019).

6. Conclusion

We analysed mode use change following the implementation of four different interventions in four cities in Europe in 2014–2016 as part of the PASTA longitudinal study. We conducted a further follow-up in 2019 in two of the cities to evaluate the long-term effects of the interventions. In the one-year follow-up, the interventions were effective at increasing walking and cycling. At the three year follow-up, levels of walking remained elevated among the top measure affected group, returned to previous levels for cycling, and increased significantly for e-biking. Driving frequency did not change. We used realist evaluation and subgroup analysis to analyse differences in modal shift within groups, based on socio-economic, demographic, and perception variables. Respondents in full-time employment were the most responsive to the interventions, with most inconsistent results for people in the high income group. Policies that take different approaches to people with different kinds of employment and time management requirements should be adopted. The findings also support the development of policies that combine built environment, accessibility, and information-based measures, rather than taking a siloed approach. In the future, more research on ways to reduce driving, not only increase active travel, should be conducted.

Research data

Due to the sensitive nature of the questions asked in this study survey respondents were assured raw data would remain confidential and would not be shared.

CRediT authorship contribution statement

Simona Sulikova: Conceptualisation, Software, Formal analysis, Writing – original draft. **Christian Brand:** Supervision, Conceptualisation, Writing – review & editing.

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Appendix A. Supplementary data

Supplementary material, including further data and regression results related to this article, can be found online at <https://doi.org/10.1016/j.tra.2022.03.021>.

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